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Contact Address:
Prof. Dr. Aytekin İŞMAN
TOJET, Editor in Chief
Sakarya-Turkey

Message from the Editor-in-Chief

Dear Colleagues,

TOJET welcomes you. TOJET looks for academic articles on the issues of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should discuss the perspectives of students, teachers, school administrators and communities. TOJET contributes to the development of both theory and practice in the field of educational technology. TOJET accepts academically robust papers, topical articles and case studies that contribute to the area of research in educational technology.

The aim of TOJET is to help students, teachers, school administrators and communities better understand how to use technology for learning and teaching activities. The submitted articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. It provides perspectives on topics relevant to the study, implementation and management of learning with technology.

This journal was initiated in October 2002 to share knowledge with researchers, innovators, practitioners and administrators of education. We are delighted that more than 500000 researchers, practitioners, administrators, educators, teachers, parents, and students from around the world had visited it's web page. TOJET has diffused successfully innovation on educational technology around the world. We hope that this v15i4 will also successfully accomplish our global educational goal.

TOJET, Sakarya University, Governor State University, Vienna Technology University will organize the International Educational Technology Conference (IETC 2017) in August 2017 in Harvard University, Boston – USA.

The guest editor of this issue is Prof. Dr. Servet BAYRAM and Assist. Prof. Dr. Alper Beyazıt from Yeditepe University, Turkey. TOJET thanks the guest editor and the editorial board of this issue.

Editors,
Prof. Dr. Aytekin İŞMAN
Sakarya University
Prof. Dr. Jerry WILLIS
Manhattanville College

Hello from Guest Editor

TOJET welcomes you. Many persons have given their valuable contributions TOJET since October 2002. Please continue to give your helpful contributions to TOJET. I am honored to be the guest editor of TOJET. I am always proud of TOJET for its valuable contributions to the field of educational technology.

TOJET is interested in academic articles on the issues of educational technology. The articles should talk about using educational technology in classroom, how educational technology impacts learning, and the perspectives of students, teachers, school administrators and communities on educational technology. These articles will help researchers to increase the quality of both theory and practice in the field of educational technology.

October 01, 2016

Prof. Dr. Servet BAYRAM

Editorial Board

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#Beyond140: Helping Pre-Service Teachers Construct a Community of Inquiry on Twitter

Osman Solmaz, Ph.D.
Department of Foreign Languages (ELT), Dicle University, Diyarbakır, Turkey
osolmaz@dicle.edu.tr

ABSTRACT
The development of socio-interactive web technologies such as social media necessitates the exploration of how they can be effectively appropriated and implemented in educational contexts. In an effort to respond the need, the present study examines the use of a synchronous multimodal tool in higher education context. By applying the Community of Inquiry (CoI) framework by Garrison, Anderson and Archer (2000) on Twitter, the study investigates the social and teaching presence elements of the CoI and pre-service language teachers' perspectives pertaining to the integration of a microblogging tool into a college-level course. For this purpose, the participants and the instructor's tweets posted during the course were collected, and students' opinions regarding the implementation of Twitter were gathered through a survey. Quantitative and qualitative analyses of the data revealed that the participation of pre-service language teachers and the instructor highly indicated social and teaching presences, respectively. It was also documented that students who took the designed hybrid course often reported positive experience in regards to the implementation of Twitter, including a perceived increase in social network literacies. Informed by the scholarship, the results of the study illustrated that social networking sites could provide spaces to establish and maintain a participatory community of inquiry in post-secondary settings.

Keywords: Community of Inquiry, Social Networking Sites, Social Presence, Teaching Presence, Higher Education

INTRODUCTION
The use of social media and the development of online, hybrid, and collaborative models of educational delivery are among the key trends accelerating educational technology adoption in higher education space (The NMC Horizon Report, 2016). It is generally acknowledged that the shifting paradigms in education and the growing popularity of Social Networking Sites (SNSs) play a part in the pedagogical employment of online technologies. Such gravitation towards providing more learning and teaching experiences online in higher education requires teachers and learners to be prepared for their new roles (Redmond, 2011). Despite technology being embedded in the lives of higher education students, it is highlighted that academic use of these technologies is not efficiently harnessed and widespread presence of them do not necessarily translate into meaningful and intuitive academic uses (ECAR, 2015). This necessitates the exploration how a wide array of interactive technologies can be effectively appropriated in post-secondary settings. Being one of those widely used media, SNSs may provide opportunities for educators to make learning more interactive and collaborative.

Informed by the Community of Inquiry (CoI), a framework designed to guide the research and practice in online learning by Garrison, Anderson, and Archer (2000), the present paper examines the use of Twitter in an undergraduate course at a public university in Turkey, in which English language teacher candidates engaged collaboratively in face-to-face and online environments. The introductory section of the paper provides an explanation of the nature of Twitter as a social networking tool and proceeds with the theoretical framework of the study. In order to contextualize the current research appropriately, the relevant scholarship on the use of Twitter in education and social and teaching presence-emphasized CoI research is presented. This is followed by a description of the methods employed, and the findings section in which, analyses of the collected data are made. The paper concludes with the discussion of key findings, limitations, and implications of the study.

Twitter as a Social Networking and Microblogging Tool

Twitter is a popular online social networking site and microblogging service that allows its users to post and read entries known as "tweets". Individuals participate in the site by sharing tweets that are composed of 140 characters or less, responding to tweets, exchanging direct messages (DM), following and being followed by other users. Tweets often contain "hashtags", the use of hash (#) symbol with a word or phrase, which allows

users to identify or categorize their tweets and enable other members to find tweets that share a common theme. User profiles are indicated by a username designated with the "@" symbol and they include profile photo and background photos of choice, composed tweets and redirected tweets from other users which are known as "retweets" (RT). When individuals sign up for Twitter, their accounts are public by default; however, they can "protect" their tweets by requiring manual approval of each and every person who wants to follow them. Incorporated in 2007, Twitter has more than 310 million monthly active users as of August 2016 (Twitter, 2016). The consensus view among social media scholars seems to be that a number of the features of Twitter (e.g., mobility, the frequency of update) are more prominent compared to other SNSs. Mobility is "perhaps the most powerful aspect of microblog platforms" (Ebner, Lienhardt, Rohs, & Meyer, 2010, p. 93), as users can participate by means of web interfaces, free applications for mobile phones and tablets, and texting services without any time and place restriction. The fact that 80% of active users are on mobile (Twitter, 2016) shows that people exploit the potential of the mobility feature. Another distinct feature of the platform is the possibility of sending several tweets in a single day with a less amount of time invest thanks to the 140-character limitation. However, all the users do not utilize the medium in the same way, resulting in the emergence of various styles and cultures-of-use (Thorne, 2003). In one of the earlier studies, Java, Song, Finin and Tseng (2007) identified four main user intentions on Twitter which were daily chatter, conversations, sharing information or URLs, and reporting news. In a recent study, Kimmons and Veletsianos (2016) found that both professors and students had similarities and differences in the ways they used Twitter and its particular functions such as hashtags. They suggested further research exploring how SNSs are integrated into the lives of scholars.

The conversations on Twitter are facilitated through the use of @ sign as an indicative of a tweet that is addressed to a particular user (i.e., @username), a form of "addressivity" (Honeycutt & Herring, 2009), and a marker of "social coherence and community forming" (Borau, Ullrich, Feng, & Shen, 2009, p. 84). Prior research (e.g., Ricoy & Feliz, 2016; Veletsianos, 2012) documented interactional exchanges taking place for collaborative purposes on Twitter. Honeycutt and Herring (2009), for example, revealed that a significant majority of @ signs on Twitter functioned as "addressivity" and users were already taking advantage of the microblogging for informal collaborative purposes. They claimed that tools like Twitter would soon come to be used in formal collaborative contexts, and the growing literature on the educational uses of Twitter in formal environments (e.g., Gao, Luo, & Zhang, 2012; Junco, Elavsky, & Heiberger, 2013) confirmed their predictions. Considering the ubiquity and accessibility of web 2.0 technologies, it is not surprising that educators started to explore the interactive nature of social networking tools. This study contributes to the current discourse of the scholarship by further exploring the implementation of microblogging in higher education and potential contributions of SNSs in the maintenance and formation of community of inquiries by both in-service and pre-service teachers.

THEORETICAL FRAMEWORK

This study is informed by the theoretical framework of the "Community of Inquiry" (CoI) which was developed by Garrison et al. (2000). Philosophically rooted in collaborative constructivism (Garrison & Archer, 2000), the CoI is one of the most influential models that has been used to study critical reflection and discourse in online learning in higher education (Garrison & Akyol, 2013). The core of the framework is the construction of deep and meaningful knowledge (i.e., educational experience) in online learning environments through the formation of a community of inquiry. As shown in Fig. 1, the framework is consisted of three dynamic interdependent elements: social presence, cognitive presence, and teaching presence. (Garrison et al., 2000). Social presence, the first element and of central importance in this paper, is the social and emotional projection ability of participants in a community of inquiry as 'real' people by the use of the online medium. Teaching presence, the second element and of equal prominence here, is the design and facilitation of the educational experience for meaningful and worthwhile learning outcomes. Finally, cognitive presence is the construction and meaning confirming ability of learners by engaging in a sustained reflection and discourse in an online community of inquiry (Garrison et al., 2000).

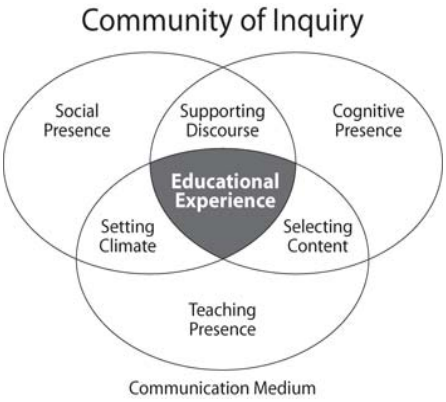

Fig. 1. The Community of Inquiry Framework (from Garrison, Anderson, Archer, 2000)

The quantitative assessment of the three elements of the CoI is conducted through content analysis of transcripts in an online community of inquiry by using the indicators which are prepared for this purpose. Three categories of indicators for social presence are affective responses (expression of emotions, use of humor, self-disclosure), interactive responses (continuing a thread in a discussion forum, quoting others, referring other's messages explicitly, asking questions, complimenting appreciation, expressing agreement), and cohesive responses (vocatives, addresses or refers to the group using inclusive pronouns, phatics and salutations) (Rourke, Anderson, Garrison, & Archer, 2001). There are three categories of indicators for teaching presence as well: instructional design and organization, facilitating discourse, and direct instruction. While the category of instructional design and organization encompasses indicators such as setting curriculum, designing methods, establishing time parameters, utilizing medium effectively, and establishing netiquette, indicators for the category of facilitating discourse reflect teacher postings ("tweets" in this research) which stimulate social process as well as individual and group learning. The final category of direct instruction has indicators showing intellectual and scholarly leadership of teachers and their subject matter knowledge (Anderson, Rourke, Garrison, & Archer, 2001). According to the model, the result of a combination of social presence with appropriate teaching presence "can be a high level of cognitive presence leading to fruitful critical inquiry" (Garrison, et al., 2000, p. 96). Guided by this information, the current study aims to test social and teaching presences in a community of inquiry by expanding the testing of the model into synchronous multimodal environment.

RELEVANT LITERATURE

Microblogging in Higher Education

There is a growing body of research concentrated on microblogging in higher education (e.g., Gao et al., 2012) and most of them focus on Twitter with the exceptions of the studies conducted by Ebner (2009) and Ebner et al. (2010), who used an institutionally developed platform, and Holotescu and Grosseck (2009) who analyzed a Romanian microblogging tool. The analysis of the literature on microblogging in higher education reveals the affordances of microblogging, the potential of Twitter to function as a platform for educational networking, and limitations of microblogging tools.

Research delineated that students often had positive inclinations and attitudes towards the implementation of microblogging tools in formal settings. They had favorable feelings (Hung & Yuen, 2010; Lim & Richardson, 2016; Ricoy & Feliz, 2016), enjoyed the experience of being involved (Carpenter, 2015), and found it less intimidating to contribute to lectures (Tiernan, 2013). However, not all learners were accounted for equal contribution and some of them did not actively participate (e.g., Elavsky, Mislan, & Elavsky, 2011; Gao et al., 2012). Nevertheless, the potential of microblogging to promote community building and facilitate engagement was consistently acknowledged in previous research. It was highlighted that microblogging helped students develop a strong community through a sense of belonging (Borau et al. 2009; Ebner et al., 2010;), feel included by finding social support and reducing isolation (Hung & Yuen, 2010; Tiernan 2013; Wright 2010). Researchers also asserted that microblogging facilitated communication, engagement, collaboration, and enhanced social presence of students (Dunlap & Lowenthal, 2009; Elavsky et al., 2011; Junco, Heiberger, & Loken, 2011). Elavsky et al. (2011), for instance, demonstrated that the extent of rich student engagement on Twitter generally improved participation and enthusiasm of students pertaining the course. Both Grosseck and Holotescu (2008) and Honeycutt and Herring (2009) directly addressed the facilitative role of @ sign in engagements on Twitter. The latter revealed that the engagements were not simply short, dyadic exchanges, but they were also coherent longer conversations including multiple participants.

Previous work also acknowledged that microblogging fulfilled the need for an even faster mode of communication. The immediate nature of Twitter was positively remarked in the literature (Ebner et al., 2010), as student issues were addressed, feedback were provided, and ideas between instructors and learners were exchanged in a timely manner (Gao et al., 2012; Junco et al., 2011). The immediacy of Twitter is partly due to the 140-character limitation, yet educators noted that learners could not express complex thoughts in 140 characters (Ebner et al., 2010), were unable to go into a lot of detail in their comments (Ricoy & Feliz, 2016), and they initially found it difficult to explain ideas (Wright, 2010). However, it was also illustrated that the character limitation garnered the attention by requiring a great deal of summarizing (Ebner, 2009; Holotescu & Grosseck, 2009), forced writing concisely (Dunlap & Lowenthal, 2009; Ricoy & Feliz, 2016), did not seem to hinder student engagement and "encouraged students to process the information and present it back to the group in a thoughtful and more meaningful way" (Tiernan, 2013, p. 15).

Despite the `noisy` environment on Twitter, and the constant flow of information which sometimes made it difficult for students to reply one another and led to information overload (Ebner et al. 2010), microblogging was found to support informal learning and promote active learning beyond classrooms (e.g., Gao et al., 2012; Junco et al., 2013) by creating an online extension of the classroom. Aside from the support for learning outside classroom, microblogging was used as a back-channel to make announcements, coordinate activities, share ideas and resources (Elavsky et al., 2011; Yakin & Tinmaz, 2013). Ebner et al. (2010) and Wright (2010) pointed out the advantage of well-documented processes in microblogging contexts. Chronologically logged entries made students' working processes, current information on the status of their learning and individual contributions to become more transparent. Finally, examining the engagement and academic achievement of college students in their empirical study, Junco et al. (2011) determined that students with whom Twitter was used were significantly more engaged in the classroom and had higher semester grade point averages compared to the control group.

Social and Teaching Presences

As laid out above, social networking tools are reported to have the potential to facilitate communication and collaboration in both well-structured settings and beyond the classrooms. Since the present research aims to investigate the role of a synchronous social networking tool in the formation of social and teaching presences of an online community of inquiry, the past research on the notions of social and teaching presences will be discussed further.

Social presence as an element of the CoI framework has been employed in previous works and identified as an important factor in the establishment of a critical community of inquiry (e.g., Lomicka & Lord, 2012, Redmond, 2011). Studies uncovered that social presence could assist learners with the development of a community of inquiry (Dunlap & Lowenthal, 2009; Lomicka & Lord, 20012; Rourke et al., 2001) and it has the potential to compensate for the absence of teaching presence (Morueta, López, Gómez, & Harris, 2016). Swan and Shih (2005) revealed that students perceiving the highest social presence projected themselves into online discussions more compared to students with low social presence. In another research, Redmond (2011) noted that social presence was required to break down the barriers among participants which would eventually lead to an increase in their willingness to share experiences and contribute to the conversation.

Even though a relatively high number of studies were conducted on social presence, little research (Dunlap & Lowenthal, 2009; Lomicka & Lord, 2012) has investigated the relationship between social presence and the formation of a community of learners explicitly in Twitter context. In one of those studies, Dunlap and Lowenthal (2009) showed that Twitter enhanced social presence in online courses and observed that "synchronous just-in-time nature of Twitter provided us [them] and our [their] students with opportunities to connect and be perceived as 'real'" (p. 133). In language learning and teaching context, Lomicka and Lord (2012) demonstrated that social presence was present in participants' tweets and Twitter was a tool that allowed learners to build social presence and create community.

Given that instructor organizes and monitors the social and cognitive dynamics of the classroom (Redmond, 2011), it is hardly a surprise that teaching presence has attracted similar attention from academia. The role of teaching presence in the formation of a meaningful online community has been shown in the previous works (Akyol & Garrison 2008; Anderson et al., 2001). To illustrate, Redmond (2011) asserted that the personalized tone of the content and discussion by instructors could make students notice the instructor's enthusiasm, which in return can increase learners' motivations. In Kim, Song, and Luo's (2016) inquiry, the findings suggested a relationship between teacher immediacy and social presence, while Song, Kim, and Luo's (2016) research revealed that verbal immediacy practices like self-disclosure contributed to meaningful online learning experiences.. Despite the research reporting Twitter to mobilize instructors into a more active role with students

(Dunlap & Lowenthal, 2009; Junco et al., 2011), a review of the CoI literature did not reveal any research systematically addressing the relationship between teaching presence as a CoI element and the use of Twitter as a social networking tool in an educational context.

The emergence and adoption of social media led scholars of higher education to examine the perceptions of students and teachers concerning the use of these technologies for pedagogical purposes. Examining the perspectives of forty-six students on a variety of online social networks, Hamid, Waycott, Kurnia, and Chang (2015) found that students recognized the value of these socio-interactive technologies for pedagogical purposes. Further evidence corroborating the positive perceptions of students comes from recent studies. The potential of social media use in education was favorably voiced by a large group of 276 students in Neier and Zayer's (2015) study, while Lim and Richardson (2016) lent support to the claim by reporting positive perceptions of eighty-two students. However, the research addressing this issue generally approached social media as a whole rather than focusing on a single category of such technologies (e.g., social bookmarking, social networking) (but see Carpenter, 2015). In a different yet relevant strand of research investigating Twitter use by in-service teachers for professional purposes (Carpenter & Krutka, 2014, 2015; Risser, 2013; Visser, Evering & Barrett, 2014; Wesely, 2013), both qualitative and quantitative findings revealed that teachers considered Twitter as an efficient and accessible venue for their professional development where they were able to interact with colleagues in a participatory environment. One of those studies (Wesely, 2013) demonstrated the successful adoption of collaborative web technologies for an innovative form of professional development specifically by language teachers. Understanding teacher candidates' opinions towards the integration of particular social networking technologies for pedagogical purposes and the use of them for their professional development should merit attention since preferences and practices of students can inform future research and provide practical implications for higher education, particularly in the contexts of technology integration, teacher education, and autonomous professional development.

Research Questions

The insights drawn from the scholarly literature have shown that both social and teaching presences had a role in the construction and maintenance of a critical community of inquiry. Yet, an overwhelming majority of the studies are conducted in settings where discussion boards are employed. This is understandable as the framework itself was initially designed for online learning and teaching in text-based asynchronous environments (Garrison et al., 2000). However, the emergence and the affordances of the socio-interactive sites like SNSs inevitably require the CoI framework to be further explored in synchronous multimodal spaces as well.

Guided by the Community of Inquiry (CoI) framework, the chief aim of this study is to investigate to what extent social and teaching presences occur in a synchronous Twitter-based collaborative environment in higher education. The following research questions were designed to lead the current study:

1. What are the levels of social presence of pre-service language teachers in a synchronous hybrid microblogging context like Twitter?
2. What are the levels of teaching presence of a teacher educator in a synchronous hybrid microblogging context like Twitter?
3. What are pre-service language teachers' opinions regarding the integration of Twitter into college courses?

METHODS

Context, Participants, and Procedure

Twitter was the medium of choice over other SNSs mainly because of the need for the implementation of Twitter from the perspective of community of inquiry in higher education and the author's familiarity with it. In addition, Twitter is one of the most popular microblogging services in Turkey, and around 6.5 million people (17% of the population) were reported to have used the medium in late 2014 (Digital News Report, 2015). Often used for social and political expression in the country, the value of Twitter for educational purposes has been recognized by universities (Yolcu, 2013), however, systematic efforts for widespread training opportunities are crucial for the implementation of social media (Gulbahar, 2014). The current study was also designed in an attempt to respond the need through the lens of scholarship in the field.

Thirty-six third-year pre-service language teachers (25 female, 11 male) were enrolled in a required three-credit "Community Service Practices" (CSP) course at a university in southeastern Turkey. The participants were between 20 and 25 years old, and a majority of them accessed internet via their personal computers/laptops or mobile phones. 24 of the students reported their weekly computer use as 9 hours or less, while the rest of the participants used computer as much as 20 hours per week. The self-reported computer literacy level (i.e., being

able to carry out tasks on a computer efficiently) of 6 students was low, whereas most of the students (n=22) ranked their literacy level as `average`. As revealed by the results of the pre-research survey, Facebook was the most popular social network site adopted by the participants (n=26). While only few of the English language teacher candidates (n=6) had used Twitter for personal purposes prior to the class, none of them had previous experience with educational use of microblogging prior to the class.

The CSP course was designed as a constructivist course where learners develop solutions to problems by engaging in sustained discourse and inquiry. Over an academic semester (approximately 14 weeks), 12 meetings (half online, half face-to-face) were held. Even though the class was not entirely online, the design was informed by Salmon's (2003) online teaching presence stages that include; a) access and motivation, b) online socialization, c) information exchange, d) knowledge construction, e) development. The first two weeks of the course was conducted in classroom context where students were acquainted with the goals and basics of the course as well as the information regarding the nature and samples of community service projects. After the introductory face-to-face meetings, Twitter as an online teaching and learning space was introduced in week 3 and 4. The author provided technical guidance and assistance for teacher candidates. While students were familiarizing themselves with Twitter, basic activities were created and initial discussions on various aspects of community services were carried out with them. The lessons in week 3 and 4 were held in computer lab of the institution in two separate sessions (18 participants per session). Following the first four weeks, groups of four to six students were formed and the remaining eight weeks of the course were conducted in both face-to-face contexts (weeks of 5, 6, 9, 10) and online (weeks of 7, 8, 11, 12) in an alternating order. Students synchronously participated in online discussions by collaboratively exchanging information and constructing knowledge for the purpose of developing various community service projects through tweets. These live online sessions were held with an average of 6 participants in each session. In face-to-face meetings, students finalized their projects and accomplished them. In the final online sessions, students met on Twitter again to share experiences about the process and reflect on their work. In brief, it was aimed that students would engage in the course both by participating in discussions in physical classroom setting and through forming an online community of practice through composing tweets in a social network context.

In addition to the self-developed collaborative group projects, each student was required to visit the local school for the visually impaired and write a report about their experiences as part of the classroom requirements. Furthermore, initiated and led by one of the groups, all of the students developed a community project to assist children at a school in a remote village. The class was finalized with the presentations of students' projects in the classroom and the evaluation of the projects.

Data Collection and Analysis

As the instructor of the class, the author interacted with students both in face-to-face and online platforms, and collected the data. Out of thirty-six students, only the tweets of those who attended all the online sessions were gathered. The tweets of students who missed one or more sessions, and those who deleted some of their tweets early in the semester were not taken into consideration. As a result, a total of 1693 tweets were obtained from 17 participants (Fig. 2). The average number of tweets posted by these students was 99.5. Since the data was large, 6 focal participants (4 female, 2 male) were selected to represent the sample. Two of these students had the highest number of tweets, two of them had the lowest, and the remaining two had the number of tweets which were closest to the median.

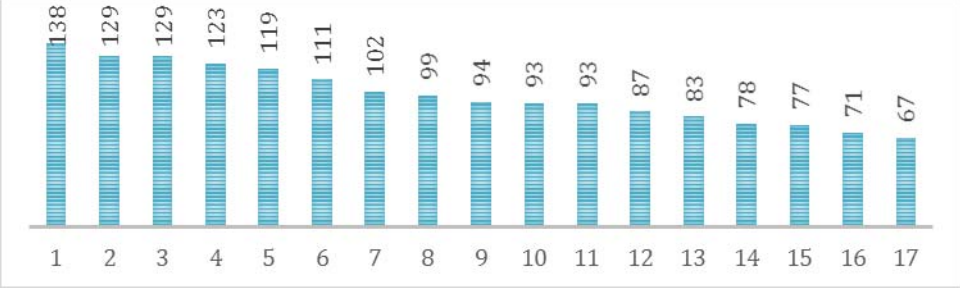

Fig. 2. Total number of tweets posted by participants (n=17) during six sessions.

The average number of the tweets composed by focal students was 100.8. Since the participation of the students in this study might not be directly associated with the number of tweets they sent, the addressivity percentage of students were taken into account as well. As shown in Fig. 3, a substantial number of the participants' tweets included "@" sign indicating "addressivity", indicating communication with others via the medium. The analysis

yielded that 79.9% of all tweets included at least one addressivity. Since the average percentage of addressivity in focal participants' tweets was 81.2%, it was decided that the selected six students could represent the sample group.

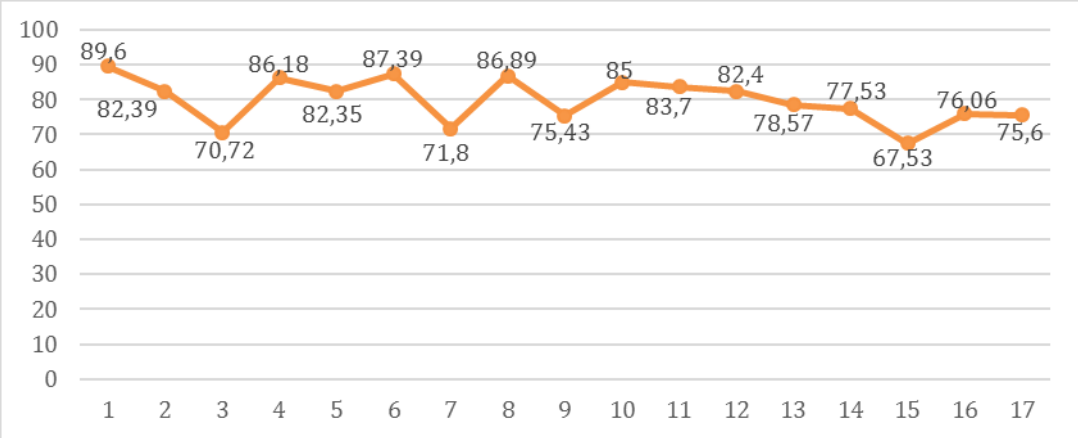

Fig. 3. The percentages of tweets with addressivity per participant (n=17) as indicated by @ sign.

Content analysis of the tweets was undertaken after the collection of all tweets of focal students (n=605) and the instructor (n=743) excluding RTs. All the tweets were coded by the author and a Turkish and English-speaking researcher who was familiar with the framework. Following the establishment of inter-rater reliability prior to coding all the tweets, the data were separately coded and verified. In case of a disagreement, the discussions were held between the raters until both of them agreed on the codes and their categories.

Social presence indicators in participants' tweets were analyzed by following Rourke et al.'s (2001) indicators. However, Lomicka and Lord's (2012) Twitter-adapted indicators were also taken into account since it was modified by the authors for indicators to reflect on the activities that specifically can and cannot be done through Twitter (Table 1). For instance, `quoting` as one of the interactive indicators correspond to the activity of retweeting on Twitter (i.e., quoting someone's message in a tweet). In many cases, more than one category was assigned to the same tweet due to the multiple presence of indicators. For example, the tweet in which one participant interacts with a colleague by typing *"@student7 reading? I love it! :)"* was categorized as *Emotion* for involving the use of emoticons, and *Self-disclosure* for revealing participant's interest in reading. In cases when there was no indicator for social presence, no codes were assigned.

Table 1: Content analysis categories, indicators, and samples for social presence

Category	**Indicator**	**Example from the present study (translated from Turkish)***
Affective	Humor (jokes, etc.)	@teacher after going to the animal shelter, I now better empathize with animal lovers, especially with [student's name] :)
	Emotion (all caps, emoticons)	@student13 @student22 ok sweetie we all love you, you know that right??
	Self-disclosure	@student7 reading? I love it! :)
Interactive	Continuing/Reply	@teacher you're quite welcome! It was a pleasure. See you.
	Quote/retweet	After the game, the king and the pawn go into the same box. Italian Proverb
	Content reference	@student1 @student32 @student23 @student25 @student10 @student14 not sure why, but I am not scared of this at all!
	Compliment, appreciation	Happy to have the class of #csp. It is very enjoyable.
	Ask question	@student17 @student6 @student12 what's the connection between two sentences???
	Agreement	@student24 @teacher yes, I completely agree.
Cohesive	Vocatives/names	@student22 welcome my dear [student's name] :))))
	Inclusive pronouns	@teacher we were waiting for you :)
	Phatics, salutations	See you, take care of yourself.
	Address group	Have a nice day, everyone! :D

*Twitter IDs and the course hashtag are replaced with pseudo-IDs for the purposes of anonymity.

Later, Anderson et al.'s (2001) list of indicators for teaching presence was employed for the analysis of the instructor's tweets (Table 2). No change was needed for the indicators of teaching presence categories although attention was paid to the identification of indicators in Twitter context. For instance, *Drawing in participants, prompting discussion* in the category of *Facilitating Discourse* was interpreted as involving students in a discussion by using their Twitter handles which functioned as their names, while *Utilizing medium effectively* included specific tips and suggestions for efficient use of Twitter. However, the original categories from Anderson et al.'s (2001) list did not require a considerable change for social network context. For example, indicators like *Summarize the discussion* or *Setting climate for learning* were categorized in the same way they would be in a study in which a bulletin board was the medium. The only difference was the length of the content since each tweet was composed of 140 characters or less in the context of the present study. Finally, similar to the coding of social presence indicators, tweets were sometimes coded for more than one category when they reflected more than one indicator.

Table 2: Content analysis categories, indicators, and samples for teaching presence

Category	**Indicator**	**Example from the present study (translated from Turkish)***
Instructional Design and Organization	Setting curriculum	Today we are going to talk about educational technologies #csp314 can you watch this video? [link to the video]
	Designing methods	#session2 now we're having a pair talk. I will share a quote and you'll discuss it in pairs.
	Establishing time parameters	Thank you for your participation today. See you next week! #csp314 #session1
	Utilizing medium effectively	This is new account. Pls follow back! #csp314
	Establishing netiquette	Say 'hi' when you are online!
Facilitating Discourse	Identifying areas of agreement/disagreement	@student15 bravo! I couldn't agree more!
	Seeking to reach consensus/understanding	@student32 @student28 @student04 @student23 @student14 I agree with "@student32", the important thing is to reach out students. I think it will be great.
	Encouraging, acknowledging, and reinforcing student contributions	Thank you for your interest, friends. We will continue to discuss same time next week. Great ideas came out!
	Setting climate for learning	Friends, you can join any conversation. You can also ask questions to your friends, feel free!
	Drawing in participants, prompting discussion	@student21 @student13 @student27 @student05 yes, let's start brainstorming. What do you have in your mind?
	Assess the efficacy of the process	Let's not distract others! :)
Direct Instruction	Present content/questions	@student22 so, our prejudices prevent us from serving the community, right?
	Focus the discussion on specific issues	@student12 good point, how about reaching out the people living in the villages?
	Summarize the discussion	Yes, we all agree that moral education matters. Especially the notions of honesty and sincerity.
	Confirm understanding through assessment and explanatory feedback	@student3 that's an important point, here comes the teacher. Then, we can say internal motivation is not always enough?
	Diagnose misconceptions	@student15 @student28 @student11 it may be hard to do that if you are not expert in drug addiction. You aren't expert, are you? :)
	Inject knowledge from diverse sources	@student32 don't try to make them love you. Remember my first class with you :)
	Responding to technical concerns	@student26 welcome [student's name], you can also follow [the discussion] from my timeline.

*Twitter IDs and the course hashtag are replaced with pseudo-IDs for the purposes of anonymity.

In addition to the analysis of the tweets, all thirty-six students' opinions on the incorporation of Twitter into the course were taken through a survey at the end of the semester. The survey mainly included open-ended questions since the purpose was to receive and document the voices and experiences of students in reference to the course

and the implementation of Twitter. In order to group similar arguments and identify patterns resulting from the participants' responses, the collected data was carefully organized and thematically categorized by means of a coding strategy. The goal of coding was "to fracture the data and rearrange them into categories that facilitate comparison between things in the same category" (Maxwell, 2013, p. 107) and there were no preset categories. Thus, the coding categories mainly emerged from the inductive coding process, which is a data-driven way to segment and label text in qualitative analysis (Schreier, 2012). As part of the process, major themes (e.g., media literacy of the participants) were formed through the combination of smaller categories. Following the categorization of the data by overarching themes, the arguments identified in each category were carefully analyzed with regard to the overall experience.

RESULTS

Social Presence

The indicators were coded in three main categories: affective, interactive, and cohesive. The content analysis of the data revealed that all three categories of social presence were present in various degrees in focal participants' tweets (Table 3). Of all the coded tweets, 53.8% (n=551) of them included at least one interactive indicator, 29.61% (n=303) had affective indicators, and 16.53% (n=169) of the analyzed tweets were coded with cohesive indicators.

Table 3: The distribution of Social Presence indicators by focal participants (FPs)

	FP #1	FP #2	FP #3	FP #4	FP #5	FP #6	TOTAL
Affective	53	112	9	44	53	32	303
Interactive	139	98	113	91	64	46	551
Cohesive	37	32	32	20	34	14	169
Total	229	242	154	155	151	92	1023

Given that the average number of tweets posted by focal participants was 100.8, the results in Table 3 indicate that social presence was clearly present in this particular community of inquiry. Considering that low frequencies may index a cold and impersonal social environment (Rourke et al., 2001), it can be argued that the data reflects that participants felt a sense of solidarity with the group in a relatively close group.

More interactive indicators (53.86%) were found than affective (29.61%) and cohesive (16.53%) ones. This outcome is not surprising, as the course design required students collaborate with each other and develop a project together. Participants often interacted with each other by asking questions, referring to the tweets of others, expressing agreement and facilitating discourse. Likewise, affective indicators were found to be high. It may be explained with the fact that not only the environment might have promoted it, but also these students knew each other before taking the CSP class and collaborated in the groups of their preferences online. The lowest category was cohesive indicators. As mentioned by Lomicka and Lord (2012), it might be due to the nature of the tool since individuals can address somebody by their usernames and not necessarily on a first name basis. Nonetheless, there were many cohesive indicators and most of them were salutations of the students who greeted their friends when they got online and employed closures when they signed off Twitter. Overall, it might be argued that social presence was present in various degrees and forms within Twitter context in this specific community.

Teaching Presence

The analysis of the data yielded that indicators in the category of "facilitating discourse" (n=655) were evidently present in the data. The category of "facilitating discourse" was followed by "direct instruction" (n=301) and then "instructional design and organization" (n=199).

Given the design and purpose of the course, it was perhaps not a major surprise to see the presence of facilitating discourse indicators at 56.70% of the coded tweets. It was evident in the teacher-student interactions that the maintenance of students' interests, motivation and engagement was targeted through the sustained discourse. As pointed out by Anderson et al. (2001), the demanding role of teacher, which carries higher levels of responsibility for maintaining discourse, creates and sustains social presence. Coded tweets illustrate that the instructor displayed his presence during the interactions by facilitating discourse through prompting questions, encouragements, identifying areas of agreements and disagreements, and assessing the efficacy of the process from time to time.

The 26.10% of the tweets were coded under the category of "direct instruction", which had the second highest number of indicators. The analysis uncovered that the coded tweets in this category generally demonstrated the instructor focusing the discussion on specific areas, presenting content and asking questions, injecting

knowledge from personal experiences. Summarizing the discussions and responding to technical concerns were generally low. While the first one is associated with the limited character interface of the medium, the latter is mostly because students developed their Twitter literacies and did not need to ask questions after the first two sessions. Meanwhile, it was expected that the category of instructional design and organization, which consisted of 17.20% of the tweets, would be lower. However, the limited experience of students with online learning process and Twitter as well as the shifting directions of the active discussions perhaps had a role on the teacher becoming more present in terms of this particular category. The medium was also used as a back-channel to communicate with students about their schedule of visits to the school of the visually-impaired and the expectations of the instructor about their reports. In sum, all three categories of teaching presence existed in various ways in the data generated from the tweets of the instructor.

The Reflections of the Participants

In order to have a comprehensive picture of the educational process and the effort of the creating an online community of inquiry, importance was attached to the insights gained from learner reflections. To serve this purpose, all thirty-six participants' opinions on the incorporation of Twitter in the course were requested. Based on their experiences, learners mentioned both benefits and drawbacks of the process, which are discussed below and illustrated by students' views. Overall, students were generally positive about the experience.

A particular issue addressed by the students was how Twitter mediated a forum for a high number of interactions to take place. One student commented, *"There were a lot of interactions. We had the opportunity to share our responses and opinions about a topic"*. However, the fast-paced nature of Twitter and the interactions that occurred were sometimes challenging for a few of students. For example, one of the students noted that following the tweets that were simultaneously composed was difficult in several occasions. In a similar vein, another student had experienced a hard time due to the `noisy` environment: *"When I was writing to my friends, I used to see that some of them were discussing another topic. I couldn't share my opinions in some of the topics because of this"*. Nonetheless, most of the students recognized the importance of such active involvement in a flexible and relaxed setting. Making a comparison between face-to-face and online aspects of the course, one of the students stated, *"Compared to a physical classroom, sharing ideas were in a very relaxed environment"*. A similar line of thought was elaborated by another student: *"I could better express the things that I couldn't talk and share in the classroom thanks to Twitter"*. Finally, several students praised the accessibility of the medium as it allowed them to participate in discussions without any physical space constraints.

The responses of students also revealed that technology and media literacy of the learners played a role in their participation in the online phase of the course. One student mentioned that his slow typing prevented him being more active in the discussions, while another student pointed out that the differences between media literacy of students sometimes caused a pause and delay in the exchange of ideas. Despite this drawback, several students believed that the overall experience improved their technological competencies such as the use of computer and the internet/SNSs. Another benefit that was voiced by students was the documentation of the process: *"Being able to read what's been written later made the discussions lasting"*. This seemed to be particularly helpful to those who missed a part of the discussions or wanted to go through the conversations taking place in other groups. As a disadvantage, students expressed their concerns about the technical problems that occurred during the sessions, such as disconnection and low quality of internet connection. Finally, a few of students were challenged by the limited number of characters allowed on Twitter, while others positively embraced the constrained space of the medium. One of the students commented, *"I could express myself briefly and concisely"*. It is to be noted that students generally experienced more character limitation than a typical user since they included the usernames of their group members in their tweets.

In brief, from the above quotations and observations, it is seen that students often had favorable feelings towards the integration of Twitter into classroom by stressing the difference of the experience from a traditional classroom.

DISCUSSION

The aim of the present study was to explore the affordances of the social networking tools in higher education. Informed by the Community of Inquiry framework, this study specifically investigated the role of a synchronous SNS in the formation of an online community of inquiry and aimed to shed light on the extent social and teaching presences could be present in the adoption of such a medium. The results indicated that a synchronous microblogging tool allowed pre-service language teachers to establish social presence, and for the instructor to establish teaching presence to a great extent in a Twitter-based community as part of a higher education course. It was also highlighted that pre-service language teacher participants generally had positive inclinations towards the integration of Twitter into their courses.

The convergence of the literature on microblogging in higher education and the CoI revealed limited research about the use of Twitter for the analysis of social presence and teaching presence elements of the CoI framework in post-secondary context. Much research focus on discussion boards which are asynchronous text-based environments, making it difficult to directly compare the outcomes of the current study and past research. However, parallels can be drawn. It was consistently shown in the literature that that social presence and teaching presence positively affected the construction and sustenance of a community of inquiry (e.g., Akyol & Garrison, 2008; Dunlap & Lowenthal, 2009; Swan & Shih, 2005; Redmond, 2011). Displaying the establishment and continuance of social and teaching presences on Twitter, this study contributes to the existing literature by showing that synchronous social networking tools have the potential to provide a space for the construction and maintenance of a community of inquiry. This is consistent with the study of Dunlap and Lowenthal (2009), which found that Twitter enhanced students' social presence in an online instructional design and technology class, and that of Lomicka and Lord (2012), which showed that Twitter was capable of allowing participants to build social presence and create a community.

The previous work highlighted social presence (Akyol & Garrison, 2008; Dunlap & Lowenthal, 2009; Swan & Shih, 2005) and teaching presence factors (Akyol & Garrison, 2008; Bangert, 2008; Redmond, 2011) among the predictors of student satisfaction with their academic programs. Redmond's (2011) study, for instance, revealed that high levels of teaching presence could encourage student participation and cognitive engagement in the course. Bangert's (2008) empirical study uncovered that online-learning environments supporting both social and teaching presence provided "prime conditions for nurturing and sustaining deep levels of critical inquiry" (p. 53). A number of studies also showed the relationship between the three elements of the CoI and social and teaching presence influencing cognitive presence (e.g., Kozan & Richardson, 2014). In consideration of the literature, it can be speculated that higher social and teaching presence in this study facilitated the participation and engagement of learners by assisting them establishing levels of cognitive presence in a Twitter-based community.

Within the scholarship of microblogging in higher education, the findings of the present study correspond to the outcomes of other studies (e.g., Taşkıran, Bozkurt, & Aydın, 2016; Tiernan, 2013), which revealed the potential of microblogging in the promotion of community building and the facilitation of engagement. In addition, this study confirms the findings of Honeycutt and Herring (2009), who documented that the nature of engagements on Twitter displayed both short exchanges and coherent longer conversations, and carries over this general finding into a formal educational context. However, the participants of the current study expressed mixed reflections about the 140-character limitation of the medium and this finding is in line with the past research (e.g., Ricoy & Feliz, 2016; Wright, 2010) in which positive and negative experiences with regard to this particular feature of Twitter were reported. Finally, investigating the interactions of educators in a popular synchronous chat on Twitter, Gao and Li (2016) warned that the character limitation might cause discussions not to go further in-depth. The findings of this study validate the warning and further add that 140-character limitation could particularly prevent collaborative conversations to be held as such collaboration may require more than one user to be addressed in a single tweet, thus leaving less space for the content.

The outcomes of this study in terms of students' participation do not coincide with the studies (Elavsky et al. 2011; Gao et al., 2012; Lomicka & Lord, 2012; Tiernan, 2013), which reported that only some of the participants actively contributed to the discussions. Despite the fact that only the data of seventeen participants out of thirty-six students were shared here, missing one session or starting to tweet later did not seem to prevent all participants to be active members of the online community. However, many of the participants discontinued to use Twitter once the course was over. This finding is consistent with the research of Carpenter (2015). Examining pre-service teachers' intended and actual use of Twitter for professional purposes in a semester following a teacher education course, which encouraged teacher candidates to use Twitter, he discovered that the majority of them did not engage in such activity. These findings notwithstanding, some studies (Dunlap & Lowenthal, 2009; Holotescu & Grosseck, 2009) reported that participants remained active on microblogging sites even though the course was finished.

With respect to the reflections of the students, the findings of this study correspond to the previous research (e.g., Carpenter, 2015; Hamid et al., 2015; Lim & Richardson, 2016; Ricoy & Feliz, 2016; Yakin & Tinmaz, 2013) in which students favored the incorporation of SNSs into their classes in higher education. It is particularly noteworthy that students drew attention to the relationship between such practices and social network literacies, praising the potential contribution of such pedagogical implementation of SNSs on the development of their digital literacies. While the study confirms the foresight of Dunlap and Lowenthal (2009) and corroborates to Tiernan's (2013) finding in terms of 140-character limitation encouraging students to write concisely, it also provides evidence for the argument of Gao and Li (2016), who warned that character restriction might cause

discussions to lack depth. This potential challenge might be overcome soon as Dorsey (2016), the CEO of Twitter, announced future plans for discarding the character limitation in a way which could also preserve the brevity feature of the medium. Finally, pertaining to the students' critical take on Twitter's fast-paced nature, the finding of this study is consistent with the past work (Tur & Marin, 2015), in which the synchronous generation of a large number of tweets negatively was reported to affect students to follow debates. This issue is yet to be under further scrutiny for the purpose of understanding the role of students' digital literacies on their efficient participation in live discussions on Twitter.

Limitations and Recommendations

The contributions notwithstanding, limitations of the present study must be recognized as well. First, the generalizability of the study is limited to the similar course designs since the data was obtained from a course designed and implemented by the author. Second, a similarly designed course in a different subject might produce different results. Therefore, it is suggested that similar hybrid courses of various subjects in different contexts are to be examined. Third, a longer period of engagement with the social media tool might produce different outcomes. However, Akyol, Vaughan, and Garrison (2011) found that effective instructional design and organization of the course and the facilitation of discourse by teacher had a more influential role in creating community of inquiry than course duration. Given that `facilitating discourse` had the highest number of indicators demonstrated in the teaching presence category in the current study, this limitation might have been overcome. Finally, most of the participants in this study knew each other as they had taken classes together before. Even though some students voiced that online meetings helped them get together, the particular role of knowing each other in advance on the formation of an online community of inquiry is not known. This issue warrants further examination along with the following issues: the familiarity of students with one another in face-to-face contexts, the ways such relationships are transferred into virtual spaces, and its role in the formation of an online community of inquiry. On the basis of the evidence provided by the current scholarship, it is suggested that SNSs should be further examined in the next wave of CoI research. Additionally, future studies may employ alternative methodologies, such as corpus-informed approaches and social network analyses for a rich quantitative analysis of the collected data, and/or in-depth interviews to provide a detailed account of the process from the perspective of the students.

CONCLUSION AND IMPLICATIONS

Applying the Community of Inquiry framework by Anderson et al. (2000) in a synchronous multimodal environment, the goal of the present study was to examine the levels of pre-service teachers' social presence and a teacher educator's teaching presence on Twitter as part of a college-level hybrid course. The results revealed that the participation of pre-service language teachers and the instructor respectively indicated social and teaching presences to a great extent on Twitter. This finding moves our understanding of the CoI by signifying that online synchronous spaces have the potential to provide a platform in which an engaging community of inquiry can be constructed, maintained, and achieved. A future co-investigation of the three elements of the CoI framework in synchronous multimodal spaces could offer further insight regarding the dynamics of online teaching and learning.

Introducing the CoI framework to Turkish higher education context, the study also investigated the opinions of pre-service language teachers regarding the implementation of Twitter into their courses. It was found that pre-service teacher participants generally agreed on the reported benefits of the integration of Twitter into the classrooms including a perceived increase in digital literacies. Understanding the use of socio-interactive web spaces and students' opinions of them is worthy of examination since such technologies may have a significant impact on increasing the efficiency of teaching and learning.

The current study has implications for the future of microblogging in higher education mainly in terms of the integration of social network sites into teaching and the use of such technologies in teacher education. As also supported by the current study, the integration of microblogging tools in higher education context, either as a backchannel or a more integrated part of the course, may contribute to the formation and maintenance of a community of practice at least for a semester. Furthermore, the use of microblogging in teacher education in particular may valuable both inside and outside the classroom as it can contribute to the professional development of pre-service teachers both via professional learning networks on Twitter and through a series of online chats (e.g., *#eltchat* for English Language Teachers) designed for professional development purposes. The number and variety of accessible networks may be even more for language teachers who can also reach resources in their target language. Finally, the meaningful implementation of technology into classroom should be explicitly addressed during teacher education and the digital literacy of teacher candidates should be increased for them to gain confidence, create an avenue for future autonomous professional development activities for themselves and personal learning environments for their students.

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Analysis of the Difficulty and Discrimination Indices of Multiple-Choice Questions According to Cognitive Levels in an Open and Distance Learning Context

Serpil KOÇDAR (Main Author)
Faculty of Open Education, Anadolu University, Turkey
skocdar@anadolu.edu.tr

Nejdet KARADAĞ
Anadolu University,Open Education Faculty, Yunus Emre Campus, 26470, Eskisehir/Turkey
nejdetkarada@gmail.com

Murat Doğan ŞAHIN
Faculty of Open Education, Anadolu University, Turkey
muratdogansahin@gmail.com

ABSTRACT
This is a descriptive study which intends to determine whether the difficulty and discrimination indices of the multiple-choice questions show differences according to cognitive levels of the Bloom's Taxonomy, which are used in the exams of the courses in a business administration bachelor's degree program offered through open and distance learning in a public university in Turkey, and to obtain the opinions of the learners on the cognitive levels of the questions. The study population consisted of 905 multiple questions which were asked in the mid-term, final, and make-up exams in the 11 major area courses. Quantitative data were gathered from item analysis reports. As well as that, qualitative data were obtained via semi-structured interviews with 20 learners. As a result, although some learners stated that they answered applying-level questions more easily, the learners were generally observed to answer the remembering and understanding-level questions more easily than the applying-level questions in parallel with the literature. Contrary to the studies in the literature, the remembering and understanding-level questions better distinguished the learners who received high scores from the learners who received low scores compared to the applying-level questions.

INTRODUCTION
Assessment of learning is an important element of an instructional design process, which provides feedback on learning and teaching processes and enables to review and improve the whole process (Haladyna, 2002). A variety of tools and techniques are used to assess learning in higher education such as assignments, tests, essays, portfolios, projects or oral examinations (Parker, 2005). One of the most common used tools has been the standardized achievement testing, which became popular in the early 1920s in the United States after the emergence of mass education (Haladyna, 2002). The use of standardized achievement tests consisting of multiple-choice questions is widespread as they are practical and provides objective results especially for mega universities with large number of learners in open and distance learning, in which learners, teachers, and learning sources are not in a central location (Simonson et al., 2012; Zhang, 2002).

Multiple-choice tests are analyzed through various methods and new tests are developed based on the outcomes of the analyses. One method is the item (question) analysis which is a process that examines learner responses to individual test items in order to assess the quality of those items and of the test as a whole. The *difficulty* (p) and *discrimination* (r) *indices* of the items are calculated in this analysis (Özçelik, 1989). Item difficulty is the percentage of learners who answered an item correctly and ranges from 0.0 to 1.0. The closer the difficulty of an item approaches to zero, the more difficult that item is. The discrimination index of an item is the ability to distinguish high and low scoring learners. The closer this value is to 1, the better the item distinguishes the learners who get a high score from those who get a low score. Analysis of each item by calculating difficulty and discrimination indices provides feedback on what the learners have learned and enables instructors to determine and correct the faulty items. In other words, it contributes to increasing the validity and reliability of the tests by revealing whether the items are working well or not.

Multiple-choice tests are prepared according to learning taxonomies. There are many taxonomies in the literature (Anderson & Krathwohl, 2001; Biggs and Collis, 1982; Bloom, 1956; Fink, 2003; Hannah & Michaelis, 1977; Marzano, 2001; Stahl & Murphy, 1981). The most commonly used taxonomy is Bloom's taxonomy of cognitive

domain (Haladyna, 2002; Seaman, 2011). According to first version of Bloom's taxonomy, there are six categories of cognitive domain which are *knowledge, comprehension, application, analysis, synthesis,* and *evaluation*. The categories proceed in a hierarchical structure, from simple to complex. Bloom's taxonomy has been updated in line with the developments in cognitive psychology and learning. *Knowledge* has been replaced with *remembering*, *comprehension* has been replaced with *understanding*, and the highest level cognitive step is determined as *creating* in the new taxonomy (Krathwohl, 2002). The categories are *remembering, understanding, applying, analyzing, evaluating*, and *creating* in the new Bloom's taxonomy.

The literature includes many studies on analyzing exam questions according to cognitive levels. These studies mainly deal with which cognitive domain category the exam questions fall into or the relationship between the difficulty and discrimination indices (Demircioğlu & Demircioğlu, 2009; Gümüş et al., 2009; Hingorjo & Jaleel, 2012; Pande et al., 2013; Sim & Rasiah, 2006; Tanık & Saraçoğlu, 2011). On the other hand, there are a limited number of studies on the relationship between cognitive levels and difficulty and discrimination indices of exam questions. These studies show that the effect of cognitive levels on the difficulty and discrimination indices of the questions are not parallel; the results differ according to the subject and context. For example, Momsen et al. (2013) found no relationship between the difficulty and cognitive levels (according to Bloom's taxonomy) of the questions for a biology course, and a poor relationship for the questions of a physics course in their study conducted at the bachelor's level. On the other hand, Veeravagu, Muthusamy, Marimuthu, and Michael (2010) found a relationship between the cognitive levels in Bloom's taxonomy and the performance of the learners for the questions of an English reading skills course. According to the researchers, the learners had difficulty in answering specifically the questions of high-level cognitive skills: analysis, synthesis, and evaluation. In parallel, Nevid and McClelland (2013) indicated that the learners had difficulty in answering the questions of *evaluation* and *explanation* at high cognitive levels in Bloom's taxonomy for a psychology course, and these kinds of questions were the most distinctive for high-performing and low-performing learners. In another study, Kim et al. (2012) found the difficulty indices of the multiple-choice questions in pharmacy studies at the *remembering*, *understanding*, and *applying* levels to be higher than the questions at the *analysis* and *synthesis/evaluation* levels. However, the discrimination indices of the questions at the *application* and *synthesis/evaluation* levels were higher than the questions at *remembering* and *understanding* levels.

In this regard, this study aims to determine whether the difficulty and discrimination indices of the multiple-choice questions show differences according to cognitive levels, which are asked in the exams of the courses in a business administration bachelor's degree program offered through open and distance learning in a public university in Turkey, and to obtain the opinions of the learners on the cognitive levels of the questions. No studies were found in the literature on the questions of business administration programs which is one of the most common programs in higher education in the world that includes a large number of learners. Research questions are as follows:

1. Do the difficulty indices (p) of multiple-choice questions show a significant difference according to cognitive levels?
2. Do the discrimination indices (r) of multiple-choice questions show a significant difference according to cognitive levels?
3. What are the learners' opinions about the questions asked at different cognitive levels?

METHOD

This is a descriptive study which intends to investigate whether the difficulty and discrimination indices of multiple-choice questions differ according to cognitive levels in a business administration program offered through open and distance learning.

Study population and the participants

The study population consisted of 905 multiple questions (with 5 choices) which were asked in the mid-term, final, and make-up exams in the 2011–2012 fall and spring semesters in the 11 major area courses of a business administration bachelor's degree program at a public university in Turkey. No sampling was made; all of the questions in the population were used. The questions of the business administration program were selected because this department has the largest number of learners in the university with about 350,000 learners.

The participants of the study consisted of 20 volunteer learners in the Department of Business Administration. The learners were selected using a convenience sampling method. The demographic characteristics of the learners are shown in Table 1. The learners were coded as L1, L2, L3 and so on to keep their identity confidential.

Table 1. Demographic Information of Learners

Learners	Gender	Age
L1	Female	40
L2	Female	22
L3	Male	23
L4	Female	22
L5	Male	27
L6	Male	30
L7	Male	23
L8	Female	38
L9	Female	21
L10	Female	23
L11	Female	22
L12	Female	29
L13	Male	27
L14	Female	40
L15	Female	27
L16	Female	21
L17	Female	32
L18	Male	26
L19	Female	27
L20	Male	35

Data collection tools

Quantitative data were collected for the first and second research questions, and qualitative data were collected for the third research question.

Quantitative data collection tools

The *item analysis documents* prepared for each course, which are prepared by the Information Processing Department of the university with the use of computer programs after each exam, were used to determine the difficulty (p) and discrimination (r) indices of the 905 questions in the study. Item analysis documents are prepared by comparing the answers of the group scoring the highest 27% and the group scoring the lowest 27% to each item after putting the scores in an order from high to low in a test. To analyze the items, first the questions are graded and the number of true answers of the learners are counted for the entire test; the number of true answers are taken as the score. After scoring is completed, the answer sheets are put in order from the highest to the lowest with the paper with the highest score placed on the top. Then the answers from the top and bottom 27% scored papers are analyzed (Özçelik, 1989). The lowest and highest numbers of learners who took the exams for the courses for which item analysis was performed were 1,998 and 71,210, respectively.

Qualitative data collection tools

The qualitative data were collected through semi-structured interviews. The interview questions were corrected in line with the opinions of three experts after being formed.

Data Collection

Quantitative data collection

Bloom's revised cognitive domain taxonomy that includes categories of *remembering, understanding, applying, analyzing, evaluating,* and *creating* was used in determining the cognitive levels of the questions in this study because it had been commonly used in the literature (Seaman 2011).

In the first step, the cognitive levels of the questions were coded by three assessment experts, and the inter-coder reliability was calculated using the formula (Inter-coder reliability= Agreement / Agreement + Disagreement) of Miles and Huberman (1994) and found to be 95%. Coders had disagreement on 39 of the 905 questions. So, they reviewed the 39 questions together on which disagreement occurred and reached an agreement on the cognitive levels of these questions. The questions were observed to be distributed at the first three levels, *remembering, understanding,* and *applying*, of Bloom's taxonomy. The distribution of the questions according to cognitive levels are shown in Table 2.

Table 2. The Distribution of the Questions according to Cognitive Levels

Cognitive Levels	**Number of Questions**	**Percentage (%)**
Remembering	350	38,6
Understanding	474	52,4
Applying	81	9,0
Total	**905**	**100,0**

After determining the cognitive levels of the questions, the p and r indices of each item was identified from item analysis documents and tabulated to be analyzed.

Qualitative data collection

The learners in the Department of Business Administration were accessed through phone and social media for semi-structured individual interviews and were informed of the subject and scope of the study. It was explained to the participants that their identities would be kept confidential and would not be shared with third parties. The learners who volunteered to participate in the study were interviewed through Skype or phone on the determined date. The permission of the learners were obtained to record the interview.

Data Analysis

Quantitative data analysis

Data were analyzed by SPSS program. One-way MANOVA Test was used. When a significant difference was found in One-way MANOVA results, the One-way ANOVA was used to determine the dependent variables that caused the difference. When a significant difference was found as a result of One-way ANOVA, Scheffe was used in cases where the homogeneity of variances assumption was ensured, and the Brown-Forsythe and Welch Test was used in cases where the homogeneity of variances was not ensured. Pairwise comparisons were made using Tamhane's T2 tests if significant results were found.

The assumptions required for MANOVA had to be checked to determine whether the difficulty and discrimination indices of the questions differed according to cognitive level using the One-way MANOVA. In addition to its advantages of testing multiple dependent variables at once (Field, 2005) and protecting against Type I errors (Bray & Maxwell, 1982; Stevens, 2009; Stangor, 2010), MANOVA also brings forth many assumptions. Checking the assumptions of univariate and multivariate normality, outliers, linearity, multicollinearity and singularity, and homogeneity of covariance matrices are the prerequisites to apply MANOVA (Pallant, 2005). Therefore, these mentioned assumptions were checked before the One-way MANOVA analyses.

At first, univariate normality of dependent variables was checked by the Kolmogorov-Smirnov (K-S) Test and the results were found to be statistically significant ($p<0.01$). However, the results of K-S should not be found to be statistically significant to meet the assumption of univariate normality. Nevertheless, it is known that even much smaller deviations can be found as significant when a large number of data is present in the study (Çetin, İlhan, & Arslan 2012). Considering that the coefficient of skewness of the data between ± 1 can be interpreted as the scores do not show a significant deviation from normal (Büyüköztürk, 2010), the coefficient of skewness of the dependent variables were analyzed to make the final decision. The skewness values were found to be -0.019 and 0.054 for the difficulty and discrimination indices of the questions, respectively. Thus, it was found that the dependent variables met the univariate normality condition.

After meeting the univariate normality condition, Mahalanobis distance values were calculated to test whether or not the data met the multivariate normality assumption. Pearson, Pearson and Hartley (1958) reported the critical value for Mahalanobis distance to be 13.82 in a multivariate analysis with two independent variables. The Mahalanobis values above this critical value are accepted as extreme values (Pallant, 2005). In this study, three Mahalanobis values (14.77, 14.12, and 13.95) were above the critical value of 13.82. These extreme values were

considered to negatively affect the results of the study and therefore, they were deleted. The study continued with the data set of 902 multiple-choice questions.

Another assumption to be checked before MANOVA is to determine whether or not a linear relation exists among the dependent variables. The relationship among the dependent variables should be linear in all categories of independent variables. The graphics obtained on the linearity of all paired combinations of the dependent variables (difficulty and discrimination indices) in all categories of cognitive levels (remembering, understanding, and applying) of the questions.

MANOVA provides the best results when a medium-level correlation exists among the dependent variables. Univariate variance analysis should be applied when the correlation is low. Over 0.80 or 0.90 correlation among the dependent variables means multicollinearity and causes problems in MANOVA (Pallant, 2005). In this study, the correlation analysis showed a medium-level relation of 0.49 among the dependent variables, so no multicollinearity occurred.

Finally, Box's M Test was used to check the assumption of the homogeneity of variance-covariance matrices. The results of the Box's M Test were found to be statistically significant, meaning that the homogeneity of variance-covariance matrices assumption was violated. In cases where numbers are not equal in the categories of the variables and Box's M Test reveals statistically significant results at $p<0.001$, robustness cannot be ensured. However, it should be noted that the Box's M Test may reveal statistically significant results due to extremely small changes in large sampling groups. In such cases, it will be appropriate to use Pillai's Trace as the evaluation criteria instead of Wilk's Lambda, which is generally used in MANOVA (Tabachnick & Fidell 2007). In this study, the results of Pillai's Trace Test showed that there were no situations that prevent to use MANOVA. In sum, the analyses showed that the dependent variable set consisting of the difficulty and discrimination indices of the questions met all the assumptions to apply One-way MANOVA to test the questions in terms of the independent variable of cognitive level.

Qualitative data analysis

The interviews were recorded, decoded, and analyzed using the descriptive analysis method. Yıldırım and Şimşek (2008) stated that descriptive analysis is more superficial than content analysis and is used in studies where the conceptual structure of the study is clearly previously determined. The data can be organized according to the themes set by the study questions or by the questions used during the interviews and observations. In this respect, the data were summarized and interpreted according to the interview questions. Two researchers coded the data for the reliability in data analysis. The inter-coder reliability was found to be at 85%. Agreement was ensured by discussing on the items that were coded differently.

FINDINGS

The descriptive statistics of the difficulty and discrimination indices of items according to cognitive levels were obtained first. These statistics are shown in Table 3.

Table 3: The Descriptive Statistics of the Items Categorized according to the Independent Variable

Independent Variable	Category	Number of Items	Dependent Variable	Mean	St. Deviation
Cognitive Level	**Remembering**	348	p_{jx}	.464	.174
			r_{jx}	.375	.155
	Understanding	473	p_{jx}	.481	.183
			r_{jx}	.359	.148
	Applying	81	p_{jx}	.376	.146
			r_{jx}	.326	.109
Total		**902**			

The mean scores of difficulty and discrimination indices of the 348 items at the remembering level were found to be 0.464 and 0.375, respectively. The standard deviations of these two values were 0.174 and 0.155, respectively. The mean scores for difficulty and discrimination indices of the questions at the understanding level were found to be 0.481 and 0.359, respectively. The standard deviations of these two values were 0.183 and 0.148, respectively. The mean scores of the difficulty and discrimination indices of the questions at the applying level were found to be 0.376 and 0.326, respectively. The standard deviations of these two values were

0.146 and 0.109, respectively. These findings suggest that the items with the highest difficulty index (the easiest items) were found to be the understanding-level items, and the items with the highest discrimination value were found to be the remembering-level items. One-way MANOVA Test results are shown in Table 4.

Table 4: MANOVA Test Results according to Cognitive Level

Test	F	Sig.
Pillai's Trace	7.663	.000*

p<.001

The Pillai's Trace coefficient was found to be statistically significant ($p < 0.01$). This showed that the difficulty and discrimination indices of items were significantly different between at least two categories of the cognitive level of the item, which is the independent variable. One-way ANOVA should be applied to each dependent variable to determine which categories show differences, and the homogeneity of variances assumption should be met to apply One-way ANOVA. The Levene Test was carried out for this purpose and its results are shown in Table 5.

Table 5: Levene Test Results for the Independent Variable of Cognitive Level

	F	Sd	Sig.
Difficulty index	6.163	2	.002*
Discrimination index	6.838	2	.001*

*p<.05

The values obtained from the Levene Test were found to be statistically significant for the difficulty and discrimination variables ($p < 0.05$), so homogeneity of variances assumption could not be met. Therefore, Welch and Brown-Forsythe Tests were used before making paired comparisons for the levels in the independent variable using One-way ANOVA. The results are shown in Table 6.

Table 6: Welch and B-F Test Results for Difficulty and Discrimination Indices of the Items

Independent Variable		Sd	Sig.
Difficulty Index	**Welch**	2	.000*
	Brown-Forsythe	2	.000*
Discrimination Index	**Welch**	2	.004*
	Brown-Forsythe	2	.009*

*p<.025

Two separate analyses are used to analyze the effect of the same independent variable for the independent variables of the difficulty and discrimination indices of items. In these cases, the Bonferroni correction should be applied to prevent Type I error (Pallant, 2005). The easiest calculation of the Bonferroni correction is to divide the alpha (the generally used value is 0.05) into the number of dependent variables (Tabachnick & Fidell 2007). Since two dependent variables are in this study, the 0.05 alpha value was divided into 2 and the new alpha value was found to be 0.025 (0.05/2 = 0.025). Accordingly, the paired comparisons of the difficulty and discrimination indices of items for the categories of independent variables were found to be statistically significant (p<.025).

The next step was the Post-Hoc Tests for the paired comparisons of the mean scores of dependent variables according to the levels in independent variables because the Welch and Brown-Forsythe test results were statistically significant. Tamhane's T2 Test, one of the Post-Hoc Tests, was used since the homogeneity of variance assumption could not be met. The results are shown in Table 7.

Table 7: The Results of Tamhane's T2 Multiple Comparison Test for the Difficulty and Discrimination of Items according to Cognitive Level

Dependent Variable	Cognitive Level (I)	Cognitive Level (J)	Mean Difference (I-J)	Std. Error	Sig.
Difficulty Index	**Remembering**	**Understanding**	-.018	.013	.410
		Applying	.088	.019	.000*
	Understanding	**Remembering**	.018	.013	.410
		Applying	.106	.018	.000*
	Applying	**Remembering**	-.088	.019	.000*
		Understanding	-.105	.018	.000*
		Understanding	.016	.011	.378

Discrimination Index	**Remembering**	**Applying**	.049	.015	.003*
		Remembering	-.016	.011	.378
	Understanding	**Applying**	.034	.014	.048*
		Remembering	-.049	.015	.003*
	Applying	**Understanding**	-.034	.014	.048*

According to the results of Tamhane's T2 Test, no significant difference was found between the discrimination indices of the remembering and understanding-level questions
($p = 0.378 > 0.05$), and a significant difference was found between the discrimination indices of the questions at the remembering and applying levels ($p = 0.003 < 0.05$) and the questions at the understanding and applying levels ($p=.048<.05$).

The opinions of the learners on the cognitive levels of the questions showed differences in the individual interviews. Many learners expressed that they answered the remembering-level questions more easily and quickly, and they had difficulty in understanding and applying-level questions. On the other hand, L4 stated that she found the remembering-level questions to be more difficult and preferred the understanding and applying-levels questions. Similarly, L6 stated that he found the remembering and understanding-level questions to be more difficult and the applying questions to be easier. Examples of the learners' opinions are as follows:

L11: I have difficulty in understanding-level questions. And I most easily answer the remembering-level questions.

L13: I only answer the remembering-level questions more easily and quickly. The understanding and applying-level questions are both time-consuming and difficult...

L4: I think the remembering-level questions are more difficult. It is very hard to exactly remember the information in the book. Instead, as a hard-working learner, I prefer the understanding and applying-level questions. These questions better distinguish the hard-working learners.

L6: I find the remembering and understanding-level questions to be more difficult and the applying-level questions to be easier.

While some of the learners expressed that the questions measuring the high-level cognitive skills should not be asked, some other gave a positive opinion for questions in higher levels which are *analyzing, evaluating*, and *creating*. Examples of the learners' opinions are as follows:

L13: The commentary questions would not be useful for the Open Education Faculty; it would become harder to pass.

L6: Existence of high cognitive level questions would be challenging, therefore it would be useful for the hardworking learners.

L16: It would be difficult; I don't prefer.

L19: Sometimes there are such questions. I prefer commentary questions. I prefer and more easily answer the questions which are not exactly the same in the books. They make me think.

DISCUSSION AND CONCLUSION

This study aimed to determine whether the difficulty and discrimination indices of the multiple-choice questions in the exams of the courses in a business administration bachelor's degree program offered via open and distance learning showed differences according to cognitive levels, and to obtain the opinions of the distance learners on the cognitive levels of the questions. The questions in the study were found to be at three levels: remembering, understanding, and applying. Although some learners stated that they answered applying-level questions more easily, the learners were generally observed to answer the remembering and understanding-level questions more easily than the applying-level questions in parallel with the studies of different researchers in the literature (Kim et al., 2012; Nevid & McClelland, 2013; Veeravagu et al., 2010). The different opinions of the learners can be explained by the differences in their cognitive competencies.

The studies in the literature showed that the questions measuring high-level cognitive skills better distinguish the high-performing and low-performing learners compared to the questions measuring low-level cognitive skills (Kim et al., 2012; Nevid & McClelland, 2013). Contrary to the studies in the literature, the remembering and understanding-level questions better distinguished the learners who received high scores from the learners who received low scores compared to the applying-level questions in this study. In other words, the questions measuring low-level cognitive skills performed better. One reason for this may be the different subject- business administration- and the context of the study-the open and distance learning involving heterogeneous learner groups unlike the studies in the literature. The learners were mostly adults and varied in terms of formal

education, age, experiences, and characteristics when compared with the studies conducted in the context of traditional education in the literature.

Another reason that the questions measuring low-level cognitive skills performed better may be that the distracters (incorrect answers) were not strong enough and therefore the low-performing learners estimated the answers correctly even though they did not know the answers. Incorporation of strong distracters is crucial while forming questions to prevent this situation. In this regard, the analysis of the performance of the distracters could have included in the study which could lead to more correct interpretations. So, it is recommended to include distracter analysis for similar future studies.

The results of this study may be used as a guide but cannot represent all business administration programs. The study should be repeated for different sets of questions asked in the exams of the current business administration program in different years, and different business administration programs specifically offered via open and distance learning. Moreover, the question set in this study included remembering, understanding, and applying levels. A question set should be analyzed including the questions that also measure higher level cognitive skills to better explain the relationships between the cognitive levels and the difficulty and discrimination indices of the questions.

This study was conducted within the scope of Classical Test Theory, in which item parameters are dependent on the group. Scaling and analyzing the questions according to Item Response Theory may reveal different results. Therefore, the cognitive levels of the questions may be analyzed within the framework of Item Response Theory in future studies.

The questions which were examined in the study should have been prepared for the same learning outcome to ensure the consistency of the subject. However, the number of questions for a specific learning outcome was insufficient to make an analysis. Therefore, only the questions asked in the major area courses were included instead of the questions asked in all courses to ensure subject consistency.

The study is intended to contribute to the quality of assessment practices, and guide teachers, test developers and assessment experts while preparing multiple-choice questions. Assessment of learning is one of the most important elements of learning design process as it provides feedback to the learners and teachers and enables to improve the quality of the system. The validity and reliability of the assessment systems is one of the prerequisites for quality assurance and accreditation of institutions. However, especially in open and distance learning programs where there are a large number of learners, multiple-choice questions may be the only assessment tool. In this respect, conducting studies in different subject areas and contexts to determine the relationship between the cognitive levels and the difficulty and discrimination values of such questions is important to ensure validity and reliability of assessment tools and to increase the quality of questions in an open and distance learning context.

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Blended E-Learning Acceptance as Smart Pedagogical Tools: An Initial Study in Malaysia

Kung-Teck, Wong
Sultan Idris Education University, Malaysia
Thomas@fppm.upsi.edu.my

Mohd Sahandri Gani Hamzah;
Sultan Idris Education University, Malaysia

Pauline Swee Choo, Goh
Sultan Idris Education University, Malaysia

Mohd Azli b. Yeop
Sultan Idris Education University, Malaysia

ABSTRACT
The use of technology in classrooms has been considered as the solution to social, economic and educational problems since its introduction to education in mid-1970. There have been many studies conducted on the different aspects of the use of technology in teaching and learning. However, study on teaching with Blended Learning in teaching and learning has not been highlighted especially in Malaysian context. It examines the effects of the exogenous variables towards with use of Blended Learning in teaching and learning among secondary teachers. The proposed research variables are based on previous models of technology acceptance. A total of 98 secondary teachers completed the questionnaire measuring their responses to computer attitudes (CA), computer teaching efficacy (CTE) and school environment (SE) and Blended Learning (BL). Structural Equation Modelling (SEM) was used as the main technique for data analysis. All hypotheses were supported by the data and have direct effects towards Blended Learning use. To sum up, the study provided larger implications for development in theory, practices and policymaking that could be related to the BL use among teachers.

Keywords: Educational technology, structural equation modelling, technology integration

INTRODUCTION
The integration of technologies in classrooms to enhance learning have been highlighted in numerous studies (Wong, Teo & Russo, 2013; Katsamani, Retalis, & Boloudakis, 2012; Lu & Law, 2012). In this regards, Malaysian teachers are expected to integrate technologies in their daily teaching and learning activities. Having that, many Malaysian schools, with the support from related government departments, have devoted considerable resource to technology. Malaysian schools and colleges have included computer technology as an integral part of learning experiences and as a way to equip them with the skills and knowledge necessary to succeed in the 21st century. As the consequence, electronic based teaching tools are becoming increasingly more prevalent in Malaysian classrooms. The Malaysian Ministry of Education (MOE) has highlighted the significance of computer-based technology in schools.

THE STUDY
With the innovation and web-based commercialisation of educational technology, blended e-learning environment has been widely deployed in the teacher institutions throughout Malaysia. Blended e-learning (BL) is the combination of e-learning (synchronous and asynchronous) and traditional way of teaching where it takes the benefits of both practices to create a distinguished instructional. Combination of various methods of practices, teaching tools and media formats is the main criteria in forming the blended e-learning approaches. Hence, BL is the new way of pedagogical practices that mixes various types of activities to create constructive and interesting learning environments.

There are a number of blended e-learning applications that have become easier to integrate with traditional classroom paradigm. Moodle, Blackboard and WebCT are some of the applications that seem to be bringing beneficial to students who prefer an individualised or less structured environment and optimise the learning effects.

Most of the BL applications could support e-learning activities such as revealing information, notes, quizzes, forum, assignment submission, group chat and assessments. Having such features, BL is not only able to help teachers to deliver learning materials but also at the same time track students' performance and participation.

However, despite the impetus to build blended learning realisations among teachers in higher institutions, integrating and understanding on blended e-learning environment among teachers are in the very beginning level. Many teachers revealed that the opportunity to integrate blended e-learning environment is often severely constrained by the limited information, skills and knowledge that they have gained from teacher education professional development training. Given that, undoubtedly, teachers are dealing with challenges of incorporating traditional and technology as a balance to cater holistic development of students in the newly introduced Standards-based Secondary School Curriculum (KSSM). It is pertinent to point out that in the School Based Assessment (PBS), blended e-learning platform provides room for students to improve their results (band) accordingly based on their own initiative. Teachers could furnish differentiated instructional for diverse students where demonstrated varying degrees of learning style and intelligences. Teacher can design curriculum for those in need as well as those who are ready for new challenges. Furthermore, the integration of technology in teaching and learning has been focused in the new syllabus in teaching under Ministry of Education, Malaysia.

Besides that, many studies in educational technologies have indicated the advantages of integrating blended learning in teaching and learning in developed countries (Escobar-rodriguez & Monge-lozano, 2012; Katsamani, Retalis, & Boloudakis, 2012; Lu & Law, 2012). Escobar-rodriguez & Monge-lozano (2012) and Wong, Goh and Osman (2013) revealed that learners able to achieve higher grades when teachers using technologies in teaching and learning. Indeed, students can learn more skills throughout the integration of BL.

Advocates also noted that, BL teaching and learning tools have become very suitable to encourage collaborative and constructive learning which highly emphasized in today learning styles. Furthermore, based on Malaysian curriculum, many subjects in which educational technologies are frequently employed to achieve the above learning practices.

Given the vital role of BL teaching and learning for in our current Malaysian educational system, and growing concern the vital responsibility of practicing teachers the process of integrating blended learning in schools, time has come to review and examine factors that influence BL acceptance among these teachers.
The findings from this study enable policymakers and educators have a better view and more informed knowledge on the factors that have significant impacts on the use and acceptance of BL. They are more inclined to design programmes that enhance the use of BL among teachers. Thus, the purpose of the study is to explore and understand how far factors such as School Environment, Computer Attitudes and Computer Teaching Efficacy could have significant relationship with BL acceptance in teaching among Malaysian teachers.

Research model and hypotheses development

Computer Attitudes

Based on literature studies, many establish technology acceptance models have revealed that computer attitude is the significant contribution to the use of technologies in teaching and learning. Theory of Planned Behavior (TPB) (Ajzen, 1985), Technology Acceptance Model (TAM) (Davis, 1989). Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) are the noted technology acceptance models. TAM, TPB and TRA were based on the relationship of attitude-intention-behavior (actual) constructs. Based on those models and theories, attitudes construct has been the main focus. Ajzen (1975) argued that by understanding an individual's attitude toward an object, one can predict his or her overall pattern of response to the object. An individual's attitude represents an individual's personal convictions and feelings towards a specific object or behavior. Generally, a person who believes that performing a given behavior will lead to positive outcomes will hold a favourable attitude toward performing the behavior. On the other hand, a person who believed that performing a given behavior will lead to negative outcomes will hold an unfavourable attitude toward performing the behavior.

Arising from the technology acceptance models, many studies have been carried out in developing countries and also reveal that computer attitudes have significant correlation with the actual acceptance and use of technology (Liu, Chen, Sun, Wible, & Kuo, 2010; Luan & Teo, 2009; Wong, Osman, Pauline & Khairezan, 2013; Wong, Russo, & McDowall, 2013; Wong, Teo, & Goh, 2014; Wong, Teo, & Russo, 2012). Based the above statement, the following hypothesis was developed.

H1. CA will have a significant influence on BL.

Computer Teaching Efficacy

According to Bandura's social cognitive theory (Bandura, 1977), individual with high self-efficacy will have better ability to cope with roadblocks and endure stress related to change. Conversely, an individual with low self-efficacy will be less likely to attempt innovation or follow through as barriers arise. Many previous researchers, such as Marcinkiewicz (1994), Torkzadeh, Pfulghoeft and Hall (1999), Gibson (2001), Tracey *et al.* (2001), Riggs and Enochs (1990), Bandura (2001), Cassidy and Eachus (2002) and Sugar (2002) have suggested that self-efficacy, by itself, will influence actual performance and practices.

According to the Bandura's theory, there are two dimensions of expectancies of behavior; efficacy beliefs and outcome expectation. Efficacy belief is the feelings of confidence in performing certain task. Outcome expectation was defined as the belief about the consequences that action will produce. Furthermore, other researchers such as Gibson and Dembo (1984) also supported the concept. Given those two dimensions, this study hypothesized that CTE which includes teacher's personal evaluation on their own capability to use computer for teaching (efficacy beliefs) and learning and personal beliefs in using computer as an effective teaching method to improve student's motivation and performance in learning (outcome expectation) have impact on BL use.

H2. CTE will have a significant influence on BL.

School Environment

In this study, school environment refers to the support from administrators, such as non-academic staff, principal and senior assistants and technical support like facility availabilities when adopting computer in teaching and learning process. The study has hypothesized that the higher the support from school environment, the higher the use of computer in teaching and learning. In Goldstein and Ford's (2002) model, the working environment acted as important variable towards actual outcomes. ChanLin, et al. (2006) and ChanLin (2007) noted that the school environment play important role in the use of computer in teaching and learning. Based the above statement, the following hypothesis was developed.

H3. SE will have a significant influence on BL.

METHOD

Research Design

This study intends to understanding BL acceptance among teaching in teaching and learning. Data were collected through using a survey questionnaire comprising questions on demographics and multiple items for each variable in the research model. The survey question composed of 4 constructs. (BL use, school environment, computer attitudes and computer teaching efficacy).

All the participated teachers need to respond to the four point Likert scale questionnaire which consists from strongly agree (4), slightly agree, (3), slightly disagree (2) and strongly disagree (1).

Methodologically, analyses were conducted using AMOS 17 and the usual steps for conducting structural equation modelling (SEM) approach were employed to test the research model with latent variables against the observed data which has the ability to explain relationships among four variables in this study: computer attitudes (CA), computer teaching efficacy (CTE), school environment (SE) and BL use (BL). From the literature, SEM is used widely to predict and explain the determinants of users' acceptance regarding the acceptance of technology in educational settings (Luan & Teo, 2009; Wong et al., 2013).

ANALYSIS AND RESULTS

In this study, two phases analysis have been carried out. A total of 98 teachers in Malaysia involved in this study. The first phase revealed the preliminary analysis which examined the descriptive statistics of the measurement items, and assessed the reliability and validity of the measure used in this study. This was to ensure the data adequate for structural equation modelling testing. For second phase, assessments on the contributions and significance of the latent variables against the observed data and explain its variance with regard to the dependent variable.

Preliminary Analysis

A descriptive analysis was preliminarily carried out on variables involved. Computer attitudes, computer teaching efficacy, school environment and BL use have been identified for their mean and standard deviation (Table 1). From the results, the lowest mean is 2.46 and it is higher than the midpoint score of the data (2.5). Moreover, skew and kurtosis indexed have shown that the data is normal for the analysis of structural equation modelling (Kline, 2005).

Table 1. Descriptive statistics of the study constructs

Construct	Mean	Standard deviation	Skewness	Kurtosis
Computer attitudes	3.63	.48	-1.20	1.12
Computer teaching efficacy	2.12	.66	.02	-.58
School environment	2.37	.94	-.12	-.01
BL use	2.46	.72	-1.09	-1.17

Analysis of Cronbach's alpha was carried out to assess the composite reliability (CR). From the analysis, it proven that all variables loaded accordingly and the index measurement within the acceptable range (0.53 to 0.79) (Table 2).

Table 2. Results for the measurement model

Latent Variable	Item	Factor Loading (>.60)*	Average Variance Extracted (= or >.50)*	Composite Reliability (= or >.70)*
Computer Teaching Efficacy	CTE1	.821	.59	.532
	CTE2	.798		
	CTE3	.672		
Computer Attitudes	CA1	.811	.62	.571
	CA2	.781		
	CA3	.772		
School Environment	SE1	.691	.56	.793
	SE2	.835		
	SE3	.722		
BL Use	BL1	.618	.57	.743
	BL2	.818		
	BL3	.811		

[a] AVE: Average Variance Extracted is computed by adding the squared factor loadings divided by number of factors.
[b] Composite Reliability = $(\sum\lambda 2) / (\sum\lambda 2) + (\sum (1 - \lambda 2))$.
[c] This value was fixed at 1.00 in the model for identification purposes.
*Indicates an acceptance level or validity.
**$p < .01$.

Based on above table, the results of AVE indexes are suitable for testing structural equation modelling as it is around 0.50.

Hypothesis Testing

Table 3 shows parameter estimates for the significant hypothesized paths. All hypotheses were significant according to the collected data on the relationship between computer attitudes, computer teaching efficacy and school environment toward BL use among practising teachers in Malaysia. Computer teaching efficacy was a significant influence on BL use (β=.19, p<.01) and computer attitudes has a significant influence on BL use (β=.22 p<.01). Finally, BL use was found to be influenced by school environment (β=.63, p<.01).

Table 3. Results of Hypothesis testing

Hypothesis	Relationship	P. C	Finding
H1	CA→BL	0.11**	Supported
H2	CTE→BL	0.18**	Supported
H3	SE→BL	0.60**	Supported

*$p < .05$; **$p < .01$.

Computer attitudes variable has been indicated as the important factor which influence the use of BL among teachers. Based on the above results, R^2 of the computer attitudes is 0.11. Having that, it proven that computer

attitudes variable contributed and explained 11 percent of the variance in the BL use among practicing teachers in Malaysia.

BL use was also significantly determined by computer teaching efficacy and school environment with 18 percent ($R^2 = 0.18$) and 60 ($R^2 = 0.60$) percent respectively. Thus, it has contended that school environment is the most important factor influencing the use of BL in Malaysian schools.

Overall, the combined effects of computer attitudes, computer teaching efficacy and school environment explained 55.9% of the variance of BL use.

DISCUSSION AND IMPLICATIONS

The findings of the study have offered some vital implications in the context of educational technologies especially related to the use of technologies in teaching and learning among practicing teachers.

As anticipated, computer attitudes, computer teaching efficacy and school environment have direct effects towards the levels of integration of BL use in teaching and learning. Together, the variables in the research model in this study explained 55.9% of the variance in BL use among teachers towards BL use in teaching and learning. Overall, the findings have supported existing theories and assumptions that those selected exogenous and endogenous variables affected the BL use among them. Using structural equation modelling, data also indicated that the resulting model was an adequate fit to the observed relationships among the factors that influenced teachers in BL use in teaching and learning.

From the results, it has been corroborated that computer attitudes have positively influenced the use of computer among teachers. Therefore, it goes to show that computer attitude has an important role to play in influencing teachers' use of computers. The finding is in line with previous findings in Western settings. Indeed, from the literature, it appears that many technology studies, conducted in Malaysia setting, have highlighted the importance of computer attitudes in the use of technology (Teo, 2009; Wong, et al., 2013; Wong, et al., 2014; Wong, et al., 2015). Henceforth, in this regard, the Ministry of Education and the related government departments should do more in terms of encouraging positive computer attitudes among practising educators. Furthermore, based on previous findings and the results of this study have indicated that computer attitudes have significant impact on teachers' use of computer in teaching and learning, schools should provide training, funding and support required for this process. By strengthening staff training in technologies, schools can help encourage more positive attitudes toward computers, especially to reduce teachers' anxiety towards computers in general. The school boards of management should ensure that teacher education technology training program to be a part of their yearly activities.

It was also conclusively reported that school environment has very strong impacts on BL use. This is consistent with previous research by ChanLin, et al. (2006) and ChanLin (2007). The significance of school environment in enhancing the use of computer in teaching and learning could be due to the fact that teachers need administrative and technical support to encourage them to use the computer. Teachers need strong and enthusiastic leadership from principal in order to achieve higher confidence and belief in the use of computers. Technical support is vital when teachers are having difficulties in operating the computer based technologies equipment. Having knowledgeable people and willingness to answer questions are critical in overcoming the obstacles of using computer. In the Malaysian schools, especially in the rural areas, lack of availability of computers and software, and incompatibility between the software and hardware are very common situations. The government should inject more financial support and attention to rural schools which with intention to minimize the digital divide between the urban and rural schools. Training for principals is vital in ensuring that they are conscious of the importance of computer in teaching and learning. Through training, they would be able to know how to encourage (giving coaching, feedbacks and leading) teachers to use computers. School districts should look for different funding resources to make computer technologies available for each teacher and in each classroom. Principals or headmasters should give motivation and support to their staff and encourage them to use computers although at the initial level it could be very difficult.

LIMITATIONS OF THE STUDY

Although care has been taken to ensure that the methodology in this study is sound, there are limitations. It is important to state the limitations of the study to frame the above discussions, recommendations and conclusion within its proper context and perspective.

The total numbers of participated teachers in the study were 98. Hence, the findings might not adequately reflect the perceptions of the whole population of Malaysian teachers. Secondly, the questionnaire used in this study

may not be able to measure all aspects for the variables concerned. Finally, this study is the timeliness of the data and finding process. At the time of this writing, the data was collected more than a year old. Thus, during this period of time, there may have been some changes in syllabi and curricula in teacher educational training program. However, the main findings of this study will remain true regardless of the aforementioned changes. In the area of inquiries on technology integration among teachers, there is always ample room for additional research. Indeed, more studies should be carried out based on larger sample, so that the results can be more generalized as a whole. Since technology will continue to grow and develop rapidly, a replication of this study might be conducted periodically in order to examine education technology trends. Thus, teacher educational programs would be able to update courses and provide appropriate knowledge and skills for teachers.

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Blended Learning Experience in a Programming Language Course and the Effect of the Thinking Styles of the Students on Success and Motivation

Mustafa YAĞCI
Computer Education and Instructional Technology, Ahi Evran University, Kirsehir, Turkey
mustafayagci06@gmail.com

ABSTRACT
High-level thinking and problem solving skill is one requirement of computer programming that most of the students experience problems with. Individual differences such as motivation, attitude towards programming, thinking style of the student, and complexity of the programming language have influence on students' success on programming. Thus, curriculums and learning environments should be designed in order to support students' learning attempts and willingness to achieve the goals of the course. Blended learning is one of the educational approaches that used in Information and Communication Technology (ICT) courses in order to ease the learning process. In this manner, the purpose of this study is to investigate the effect of blended learning approach, consisted be blending face-to-face and e-learning approaches, on academic success and motivations of students with different learning styles in a programing language course. Results of the study showed that courses supported with online learning tools has a positive effect on students' motivation, and correspondingly has a positive effect on academic success. In addition, the results revealed that introvert students need online learning tools more than others. Furthermore, it was found that thinking styles have an effect on motivation and academic success. Eventually, using blended learning approach in a programming language course has a positive effect of students' motivation, academic success and satisfaction.

Keywords: programming languages, thinking styles, computer programming, motivation, academic achievement.

1. INTRODUCTION

There are many differences that affect the learning behavior of the students. The learning styles of the students (cognitive styles, learning styles and thinking styles) are the leading in the individual differences, which affect the learning in the learning process (Buluş, 2005). There are some differences between these styles and skills. Sternberg (1997) defines the skill as "the thing that an individual can make" and defines the style as "the choice of the individual related with the skill usage form". The thinking style is the way, which an individual prefers in using his talents. The thinking styles are not classified as good or bad, only their differences may be mentioned (Sternberg, 1994) and they are the approaches and inclination which the individuals present as the result of the mental processes against various problems, cases, phenomenon and variables confronted by the individuals. Sünbül (2004), Buluş (2005), Sternberg (1994), Sternberg and Grigorenko (1995), and Zhang (2000) have identified the thinking styles as an expression of the choices for the method of the efficient usage of the talents. The thinking styles are neither talent nor intelligence; they are the style of intelligence usage (Fer, 2005).

The individuals have thinking styles which are different from each other therefore the individuals are evaluated not only with the type of thinking style but with the level of the various features of the individuals. The individuals think different from each other in the solution of a problem or in a situation which they need to make a decision and they seek different solutions. They use some of them in upper level and some of them in lower level according to the special cases. Besides, the thinking styles of the individuals may change according to the social environment, time and the culture of the society (Zabukovec & Kobal-Grum, 2004).

There are many style theories, which are suggested as the result of the studies made by the researches for describing the thinking form of the people (Holland, 1973; Renzulli & Smith, 1978). The thinking styles, which are suggested by Sternberg (1997) for Mental memory theory, are taken as the basis in this study. 13 thinking styles under 5 factors as to be functions, forms, levels, scope and inclinations are as follows (Stenberg, 1997).

Thinking Styles

DIMENSIONS	SUB DIMENSIONS	CHARACTERISTICS
Functions	1. Law maker	They are innovative, generate ideas, and prefer unstructured problems. They are focused on planning designing and formatting.
	2. Judgmental	They are focused on evaluation, judgment and comparison. They evaluate rules and procedures; compare incidents and phenomenon and analyze them.
	3. Executive	They follow given instructions. They prefer to implement processes in the same way they have been done so far.
Forms	4. Progresser	They very well concentrated on what will implement; and they work by determining their priorities on majority of their assignment.
	5. Singularist	They focus on doing single task and dedicate all of their energy to this task.
	6. Pluralist	They perform multiple works at the same time without determining their priorities.
	7. Anarchical	They evaluate problems arbitrarily. They tend to focus on relax and flexible works instead of planned and systematic tasks.
Levels	8. Elaborator	They focus on tasks which require them to work by concentrating on details. They tend to perform their assignments based on concrete opinions.
	9. Integrator	They prefer to concentrate on theoretical opinions and whole concept of an opinion. They are interested in abstract thoughts and general framework.
Tendencies	10. Innovative	They prefer to deal with indetermined indefinite works; they are innovative and visionary.
	11. Conservative	They are traditionalists, realist; and they are attached to the codes relevant with their works.
Inclinations	12. Introvert	They prefer to work alone; they are self-sufficient and less social.
	13. Extrovert	They prefer works require cooperation. They enjoy establishing relationship with others.

The thinking styles of the people may change according to the time and their life styles and may be formed by the conditions of the people (Yıldız, 2012). Besides the thinking style is an important individual distinctness variable, which affects the success of the individuals in academic and professional lives (Dinçer & Saracaloğlu, 2011).

The teachers may create learning environments that shall provide thinking ability for developing different points of view and increase the efficiency in the discussion environment (Von Oech, 1983; as cited in Çubukçu, 2004). The participation to the course and active role of the students in learning environment, bring the academic success together. The fundamental of the transition to the student-based education from teacher-based education, rests on this. The efficient usage of the computers and the Internet in the education activities today makes an efficient contribution to the interaction between teacher and student and to the success of the student. Therefore, it is thought that the usage of online interaction tools in the education activities, the observation of course activities and the discussion of the results shall make contribution to the body of literature. As mentioned by Emir (2013), the usage of the learning environment which provides opportunity to the students for using their thinking styles, shall develop the critical thinking skills and high level problem solving skills.

The high level thinking strategies of the persons may be developed with the educational activities (Duman & Çelik, 2011) and the mental style choices of the individuals may change (Esmer & Altun, 2013). According the literature, thinking styles affect the motivation and academic success of the student (Cano-Garcia & Hughes, 2000; O'Hara & Sternberg, 2000; Zhang & Sternberg, 1998). When the literature is considered again, it is seen that the various demographic features predict the thinking styles (Sternberg & Grigorenko, 1995; Zhang, 1999; Zhang, 2002). For example, the results which examine the thinking styles,

social skills and the relation between their attitude for some learning environment and the learning methods in terms of various variables (Duman & Çelik, 2011; Yıldız, 2012; Paliç & Rize, 2011, Balgalmış & Baloğlu, 2010, Dinçer & Saracaloğlu, 2011), have effect on the thinking styles. In addition to this, new learning strategies must be developed which shall offer an easier and attractive programming teaching and provide motivation to the students (Verdú et al., 2012). To consider the thinking styles in planning educational activities (Paliç & Rize, 2011) and to examine the learning processes of the student groups (Rodríguez Corral, Civit Balcells, Morgado Estévez, Jiménez Moreno, & Ferreiro Ramos, 2014) increase the efficiency. Besides, for an efficient learning environment in the education to be given to the teachers who are one of the most important sharers of the education, the thinking styles must be determined in advance (Esmer & Altun, 2015). In this respect, it is thought that this research shall increase the academic successes of the students who have problems in learning programming languages and shall make a contribution in determining the variables.

The computer programming started to be one of the occupations which its importance increases each day in present where the information sector grows rapidly. The success in computer programming depends on the amount of the problem solving, logical and quantitative thinking skills of the individual (Korkmaz & Demir, 2012; Lau & Yuen, 2009).

The programming courses are the leading among the hardest subjects for the students (Askar & Davenport, 2009; Başer, 2013; Milne & Rowe, 2002; Pillay & Jugoo, 2005). Because programming information requires the highest level problem solving skill. Besides, the motivation, attitude against programming, complication of the programming language is the factors which affect the programming success of the students.

One of the main targets of the lecturers of the Information Technologies and Computer Engineering Departments is to have the students obtain a strong infrastructure in computer programming (Zyda, 2009). It is inevitable that the students in mathematics and some science departments, shall have a good programming infrastructure.

There are many researches which emphasize the negative effect of the attitude, motivation, negative perception and self-efficacy belief in body of literature (Law, Lee, & Yu, 2010; Anastasiadou & Karakos, 2011; Hawi, 2010; Hongwarittorrn & Krairit, 2010; Özyurt & Özyurt, 2015; Korkmaz & Altun, 2013). Besides, it is possible to see some studies which various education methods and implementations for increasing the efficiency of programming education (Lau & Yuen, 2009; Cheng & Chau, 2015; Çetin, 2014; Eckerdal & Thune, 2005; Fleury, 2000; Haberman & Averbuch, 2002; Khalife, 2006; Winslow, 1996). In the literature, thinking styles and programming languages have intensively been studied separately or by different variables. However the number of studies examining the relationship between these two structures is few.

The number of studies made for the implementations and factors (Geçer & Dağ, 2012) affecting the programming process (Özdinç & Altun, 2014), is limited. For example, Abdul-Rahman & Du Boulay (2014) examined the success of the students they grouped according to their learning style in the programming languages course. As a result, they found that learning aproach of students in programming education differentiated the academic achievement. Besides, it is suggested to examine the effect of the programming languages where Web 2.0 tools are used, on performance and satisfaction (Hwang, Shadiev, Wang, & Huang, 2012; Shaw, 2012). To examine the method and techniques, the education process related with programming education and to discuss the reasons of the success or failure, may make a contribution to the literature. To determine the thinking style of the student may help to understand the individual differences and to reach the desired success in the education of programming languages. Therefore, as Esmer and Altun (2015) noted, planning learning environments in a way that enhances the dominant learning style in accordance with the academic subjects to be learned and expected teacher qualification or making prospective teachers become compatible with dominant learning styles can be seen as an important step in improving the quality of teacher education. Through various educational strategies, the thinking styles may be oriented in the best way both in class and out of class (Cheng & Chau, 2015). Besides, it is understood from the literature that the course contents and the learning environments which are designed more careful, increase the desire and effort of the students in target acquisition of the students (Verdú et al., 2012 ; Forte & Guzdial, 2005). In this respect, it is thought that this research shall lead the educators about the route to be followed in programming education which is the leading in the hardest courses.

As a result of the researches carried out, it is observed that thinking styles are very effective individual difference variables in achieving academic and business lives of individuals as well as in their daily lives. Also, as Abdul-Rahman & Du Boulay (2014) who have examined the learning approaches and Tekedere & Mahiroğlu who have examined the locus of control mention, it is necessary to examine the different individual characteristics on success and motivation. In this context it is expected that, in a course requiring high level thinking skills such as programming languages, researching the relationship between thinking styles and academic achievement will contribute to the literature.

The purpose of this research is to examine the effect of the programming languages requiring high level problem solving skills which are designed and implemented through blended, face-to-face and e-learning, methods on the academic successes and motivation of the students with different thinking styles. In accordance with this general purpose, the below research questions are tried to be answered.

1. Do the online learning tools used in learning process form a significant difference in pretest- last test success points of the students?
2. What is the thinking style usage level of the students?
3. Do the success points of the students show a significant difference according to their thinking styles?
4. Do the motivations of the students against the course show a significant difference according to their thinking styles?
5. Do the thinking style and the motivation against the course show a significant difference according to the gender variable?
6. What are the opinions of the students related with the learning process?
7. Do the pretest- posttest success points of the students show a significant difference according to the thinking styles?

2. METHOD

2.1. PARTICIPANTS OF THE STUDY

The population of the research in pre-test post-test semi experimental design model, is formed by 2nd grade students which study in Computer Education and Instructional Technology (CEIT) department of Faculty of Education in Ahi Evran University spring semester of 2013-2014 academic year. The distribution of the participants of study according to the gender and thinking styles, are summarized in Table 1.

Table 1: Demographic features of the students

Variable	Feature	f	%
Gender	Male	30	66,7
	Female	15	33,3
Thinking Style	Self-Enclosed	23	51,1
	Extraverted	22	48,9
Total			

When the specifications of the teacher candidates in research are considered, it is observed that the number of the male students (30) is twofold of the number of the female students (15) and their thinking style choices (%51.1) are nearly equal with Self-Enclosed and %48.9 Self-Enclosed rates.

2.2. PLANNING AND IMPLANTATION OF THE COURSE

In the process of 10 weeks implementation that is made in scope of research, an environment is developed including the online interaction tools as to provide the online information sharing by the author for the course, which is carried out in the form of three hours theoretical, two hours application. The blog tool, which provides opportunity for the interaction between the students and the instructor and messaging tool having the similar features with the e-mail which the students can communicate with the instructor, is benefitted in this environment. The print screens of “Education Management System” can be seen in Figure 1 and Figure 2.

Figure 1. *"Main Page Screen" of education management system*

Figure 2. *Status of the users*

An evaluation point is given in four different categories at the end of the learning activities; participation of the students in discussions at *BLOG site*, project implementations in scope of semester end activity, evaluation of the result by watching and implementing the videos including C# courses and academic success test which its reliability and expert opinion has been provided in the previous semester.

2.3. DATA COLLECTION TOOLS

For determining the thinking styles of the students in scope of the research "Thinking Styles Scale" is used, for determining their motivations "Motivation and Learning Strategies Scale" is used, and the student opinion form and individual information form which is developed by the researches is used. Besides, for measuring the programming success of the students, pretest and posttest programming information success tests which are developed by the author by taking the opinion of an expert and are analyzed in terms of validity and reliability, are used in 2012-2013 academic year. In measuring the posttest success points, task points which are given within the implementation process together with the academic success test; course activities participation points and project points are used. An opinion is taken from the expert of five different fields and whole data collection tools and online learning environment to be used in scope of the application and it is used after giving the last form by making the essential regulations.

2.3.1. SCALE OF THINKING STYLES

Five likert type "Thinking Styles Scales" which is formed from 94 items and 14 factors and which is adopted into Turkish by Sünbül (2004), is used for determining the thinking styles of the students. 10 items were removed from the scale of Sternberg & Wagner (1992) consisting of 104 items, as the result of the factor analysis and reliability analysis. In each article of the scale, a case is presented which shows the mental mindscape and forms of the person in any information and problem status and the individuals are requested to mention the frequency of this case on the scale (Sünbül, 2004). The items are graded in the scale as follows; "Always (1)", "Frequently (2)", "Sometimes (3)", "Rarely (4)" and "Never (5)". Cronbach α reliability coefficient which is calculated for determining the internal consistency of the scale, change between 0.70 and 0.86 for all lower dimensions. At the same time, it is verified that the factor analysis and the scale form a structure of 13 factors after the change made by taking the item test and the item correlations as the basis. 13 factors which are gathered under five main titles;

a. Functional style: Subjective thinking, normative thinking, judgmental thinking.
b. Figural Style: Singular, gradual, equivalent, irregular.
c. According to level: Monolith thinking, elaborative thinking.
d. According to scope: Self-Enclosed, Self-Enclosed.
e. According to inclination: Innovative and traditional thinking styles.

2.3.2 MOTIVATION SCALE

Motivated Strategies for Learning Questionnaire (MSLQ) which is developed by Pintrich, Smith, Garcia and McKeachie (1991) and is adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004) has been used in determination of the students' motivation. The motivation section of the scale, which is established from the motivation, and learning strategies section, is used. In the septet likert type consisting of 31 items and 6 factors, the reply answer changing between "absolutely wrong" (1) and "absolutely right form me" (7) has been used in answering each items. The validity study of the scale has been actualized with the explanatory factor analysis and confirmatory factor analysis calculations. The scale is formed of internal target regulation, external target regulation, task value, control belief related with learning, self-efficacy and exam concern related with learning and performance. The internal consistency coefficients related with the sub-dimensions of the scales, change between .59 and .86.

2.3.3. STUDENT OPINION FORM

As to be in conformity with the purposes of the research, an open ended opinion form with two question is prepared for mentioning the opinion of the students related with the learning process and online learning environment. This form has been submitted to the expert opinion and has been used in application after making the essential changes. The student opinion form has been shared with the students at the end of application process, has been shared with the students and the opinions of the students have been taken related with the questions in the form.

Student Opinion Form:
If you evaluate your education over 5 points, what point you shall give? Please mention your opinion by explaining the positive and negative applications.
Please evaluate your satisfaction level related with your education over 5 points. Please mention your reasons.

2.3.4 ACADEMIC SUCCESS TEST

Academic success which has been developed by the researcher, has been used for measuring the cognitive skills of the students for C # programming language course. The draft academic success test consists of 8 items. The weight of the courses in the distribution of the questions are considered for increasing the scope validity of the test and the validity of the question is provided by applying to the expert opinions. The validity of the questions is controlled with a pivot study by applying to 53 students before application.

2.4. DATA COLLECTION AND ANALYSIS

The data which is obtained in scope of the research, has been analyzed by using SPSS (The Statistical Package for The Social Sciences) packaged software and all hypotheses have been tested in 0.95 trust level ($p < 0.05$). Thinking styles scales and the collected data is analyzed through calculating the dimension averages by calculating each thinking style separately. It is expected to have an apparent difference between the size averages. The student may use more than one thinking styles (Sünbül, 2004)so it is possible to have equal or close values of the size averages.

Before starting the analysis of the data, Kolmogorov – Smirnov normality test results are considered for mearing whether each dependent variable shows a normal distribution. Kolmogorov-Smirnov normality test analysis results show a normal distribution for gender, class level variables so non-parametric tests are used because the parametric tests do not show a normal distribution for the academic success level variable.

In determination of the satisfaction level of the students' thinking styles, motivation related with evaluation of the learning process, frequency (f), percentage (%), average (X) and standard deviation (Ss) values are used as descriptive statistics. For measuring the relation between demographic features (gender) and motivation average points and thinking styles of the students T-test and bilateral Anova tests are used. For testing whether the academic success points and motivations of the students show a significant difference according to the thinking styles, t test in the level of $p<.05$, Anova test and Ancova test are made.

In the evaluation scale used in commenting the findings which are obtained after data analysis; (5-1) / 3 evaluation interval is taken as the basis and the relation level between the average point limits and

information levels are determined as 1 – 2.33 Low level, 2.34 – 3.67 Medium Level, 3.68 – 5.00 Advanced Level.

3. FINDINGS AND COMMENTS

The findings obtained as the result of the research, are summarized as follows.

3.1. Do the online learning tests used in learning process form a difference in pretest- posttest success points of the students?

Dependent sample t-test results, which are made for determining the existence of significant difference in the pretest-posttest success points of the students, are given in table 2.

Table 2: Results of dependent sample t-tests according to pretest, posttest of the students

Thinking Style	Success Test	N	$\overline{X}$	S	Sd	t	P
Self-Enclosed	**Pretest**	23	62.57	5.366	22	-2.414	0.025*
	Posttest	23	71.74	4.519			
Self-Enclosed	**Pretest**	22	60.23	5.07	21	-3.24	0.004*
	Posttest	22	68.59	4.9			

p<.01

According to table 2, a statistically significant difference is seen in the pretest, posttest points (p<.01) of both Self-Enclosed and Self-Enclosed students in programming languages course which is supported with the online learning tools. An increase of 9.17 points is observed in the pretest- posttest success point averages of the students choosing Self-Enclosed thinking styles and an increase of 8.36 points is observed in the students choosing Extraverted thinking style. This result shows that the discussions made in the blog site, video and project development applications form a statistically significant difference in the academic successes of the students. Besides in table 2, it is seen that the increase in the success points of the Self-Enclosed students are higher than extraverted students. This information may be commented in the form that the Self-Enclosed students need the course supported with online learning tools. In similar way, in the experimental study of Çetin & Top (2014) where they examine the success and "visualization and ACE cycle in programming education", a significant difference is found in posttest success points of the experimental group students and control group. Well-structured web and multimedia technologies for problem solving skills and integrated design affect the academic success positively (Uysal, 2014).

3.2. What are the levels of students in using the thinking styles?

The descriptive statistics analysis results related with the thinking styles of the students, are given in table 3.

Table 3: Descriptive statistics related with the thinking styles of the students

Thinking style	Point interval	N	$\overline{X}$	SS
Self-Enclosed	16-40	45	27.96	6.075
Extraverted	14-39	45	28.16	5.713

According to Table 3, it is observed that the average points of Self Enclosed thinking styles which like the works requiring cooperation of the students ($\bar{X} = 28.16$) are higher than the Extraverted thinking style average points which likes working in single form ($\bar{X} = 27.96$). According to this finding, we may say that the students prefer to take part in the learning environment which requires cooperation like blog sites, project applications in educational activities.

3.3. Do the evaluation points of the students who a significant difference according to their thinking styles?

The results of t-test analysis made for determining whether the average points of the students obtained from each measuring tool show a significant difference according to their thinking styles, are given in table 4.

Table 4: T test results of the students according to the thinking styles of project, video, exam and blog points

Thinking styles		N	$\overline{X}$	S	Sd	t	p
Participation in discussion in BLOG	**Self-Enclosed**	23	61.39	5.868	45	.332	.742
	Extraverted	22	58.59	6.070			
PROJECT Evaluation Point	**Self-Enclosed**	23	72.61	3.280	45	-.113	.910
	Extraverted	22	73.18	3.872			

VIDEO Watching	**Self-Enclosed**	23	79.78	4.327	45	-.466	.644
	Extraverted	22	82.27	3.064			
Academic Success Test	**Self-Enclosed**	23	61.96	6.355	45	.549	.586
	Extraverted	22	56.59	7.468			
General Average	**Self-Enclosed**	23	71.74	4.519	45	.223	.639
	Extraverted	22	68.59	4.906			

It is observed from Table 4 that the points averages which the students obtain from application tools (blog, project, video) and from the academic success test do not have a statistically significant difference according to the thinking styles. This finding can be commented as the form that the thinking styles of the students do not affect the academic success of the students in programming language courses which are supported with the online learning tools. It is possible to confront the similar results in literature. Dinçer and Saracaloğlu (2011) mentioned that only the academic success levels of the students preferring a global and conservative thinking style shows a significant difference. Similarly Buluş (2005) expressed that there is a relation between the academic success points and thinking styles of the teacher candidates preferring the anarchic and conservative thinking styles. Lam (2000) reached the conclusion in his study that only the global style has positive effect on the academic success.

3.4. Do the motivation of the students against the course show a significant difference according to the preferred thinking style?

T test analysis results which are made for showing whether the motivation of the students against the course show a significant difference according to the preferred thinking style, are given in table 5.

Table 5: T test results of the students' motivation against the course according to their thinking styles

Thinking Style	N	$\overline{X}$	S	Sd	t	p
Self-Enclosed	23	151.65	4.519	43	0.080	0.937
Extraverted	19	151.14	4.650			

In table 5, it is observed that the motivation of the students against the courses does not show a significant difference according to their thinking styles. This case shows that the thinking styles of the students do not motivate the interest and curiosity of the students against the course. Besides it is observed that the motivation of the students against the course, are in advanced level. Under the light of this finding, we may say that the students like the programming languages course which they found as hard and boring at the beginning through the online learning tools. It is understood from the literature that the programming language course which is offered with these types of learning environments, affect the motivations of the students positively. For example Forte & Guzdial (2005) and Serrano-Cámara, Paredes-Velasco, Alcover, and Velazquez-Iturbide (2014) mentioned that the students have higher motivation and attitude than the course which is carried out with traditional method in programming languages course adapted in terms of instructional design. In a blended learning study, Cheng and Chau (2015) found that the motivation and participation is higher.

3.5. Do the thinking styles of the students and their motivation against the course show a significant difference according to gender variable?

The relation between the thinking styles, motivation and genders of the students, is given in Table 6.

Table 6: T test result of the thinking styles and motivations of the students according to the gender

		N	$\overline{X}$	S	Sd	t	p
Self-Enclosed	**Male**	30	28,03	6,083	43	,120	,905
	Female	15	27,80	6,270		,119	,906
Extraverted	**Male**	30	27,73	5,771	43	-,697	,490
	Female	15	29,00	5,695		-,700	,489
Motivation Point	**Male**	30	154,40	19,753	43	1,336	,189
	Female	15	145,40	24,204		1,247	,225

It is seen in table 6 that the thinking styles and the motivation of the students do not show a significant difference according to the gender variable. According to this finding, we may say that the gender does not affect the thinking style and motivation of the students. While this result overlaps the research results of Verdú et al. (2012), Robinson (1995), Çubukçu (2004), Duman & Çelik (2011), Saracaloğlu, Yenice & Karasakaloğlu (2008), Düzgün'ün (2011) , it contradicts with the research results of (Dinçer & Saracaloğlu

(2011), Balgalmış & Baloğlu (2010) and Sünbül (2004). In the study of Yıldızlar (2010) with the title "Thinking Styles of the teacher candidates coming from different culture", it is concluded that the male teacher candidates in Turkey prefer Self-Enclosed thinking style more than the female teacher candidates.

3.6. What are the opinions of the students related with the learning process?

A student opinion form is used for evaluating the education of the students. The findings related with the answers given to the questions in this form, are discussed below.

The average of the points given to the questions "What grade you will give for evaluating your education over 5 points? Please mention your opinion by explaining the negative and positive applications" is found as 3.69. The point average of the answers given by the students preferring Self-Enclosed thinking style is 3.87, and the point average of the answers of the students preferring the extraverted thinking style is 3.50. This finding may be commented as the students are within a positive attitude in advance level related with the programming languages education. In the evaluation of the students related with the education, while the expressions like providing interaction opportunities" and "prompting to the research" come to the forefront "experiencing technical failures" and "requiring internet access" are expressed as the negative features.

T test results according to the thinking styles of the students related with the evaluation points, are given in table 7.

Table 7: T test results according to the thinking styles of the students related with the evaluation points

Thinking Styles	N	$\overline{X}$	S	Sd	T	p
Self-Enclosed	23	3.87	.202	43	1.352	.183
Extraverted	22	3.50	.183			

It is understood from Table 7 that the evaluation points related with the preferred education do not show a significant difference according to the thinking style preferred by the students ($p > .05$). This finding may be commented as the non-existence of the effect of the learning styles on the opinions of the students related with the education.

The point average of the questions *"evaluate the level of satisfaction related with this education over 5 points. Please mention the reasons."* is found as 3.62. The point average of the replies given to this question by the students preferring the Self-Enclosed thinking styles is 3.74 and the point average of the replies given to this question by the students preferring the extraverted thinking style is 3.45. According to this finding, the satisfaction level of the students related with the education is *"medium level"*. In the evaluation related with the satisfaction of the students for the education while "the applicable form of the course" and "encouraging for learning" expressions come to the forefront, "experiencing technical failures" and "excessive workload" expression come to the forefront as the negative features. In a qualitative study of Geçer & Dağ (2012) which they made by blending the face to face and e-learning method; they reached to the conclusion that the applied method provides active participation of the students and the students find the implementation of education activities in web environment as interesting and beneficial. Similarly Uluyol & Karadeniz'de (2009) has found the result that in the blended learning environment, the students are in a positive attitude and they think that they have acquisitions in different and positive aspect.

The reason of high evaluation and satisfaction points, is to have an instructor of the course provide a feedback to the students as individual and group in the discussions in blog site and during the intramural group studies, encourage them for making the activities and help the students in video activities.

T test results of the point average of satisfaction level related with the education according to their preferred thinking styles, are given in table 8.

Table 8: T test results of the point average of satisfaction level related with the education according to their preferred thinking styles

Thinking styles	N	$\overline{X}$	S	Sd	t	p
Self-Enclosed	23	3.74	.201	43	.945	.350
Extraverted	22	3.45	1.057			

As seen in Table 8, the points of satisfaction level related with the education of the students do not show a significant difference according to the preferred thinking style ($p < .05$). In another words, the satisfaction level of the students related with their education, does not change according to their thinking level.

The literature is in the qualification of supporting these findings. In an experimental study Forte & Guzdial (2005) has found that the students have higher motivation and attitude than the traditional courses in the programming languages which are carried out in terms of instructional design. The students have expressed that to follow the course content, homework and project in online learning environment provide active participation to the course (Geçer & Dağ, 2012). Similarly, Çetin & Top (2014) has found that the majority of the experimental group students find the activities in the school efficient but the motivation desired in the extra scholastic group studies, is not provided.

3.7. Do the pretest- posttest success points of the students show a significant difference according to their learning styles?

For the validity of Covariance analysis, the homogeneity test must be made for the variance. According to Levene's Test results p value is calculated as .164, this value is higher than .05 therefore the homogeneity of the variance is provided. According to the test results for determining whether the inclination of dependent variable (posttest) and co-variable (pretest) is approximately the same, the p value is calculated as .175, this value is higher than .05 therefore the hypothesis of "the inclination is same for two groups" is provided. The posttest average points of the students having the different thinking styles which are corrected according to pretest and posttest, are seen in table 9.

Table 9: Posttest average points which are corrected according to the thinking styles

	N	$\overline{X}$	$\overline{X}$ (Corrected)
Self-Enclosed	23	71.74	70.928
Extraverted	22	68.59	69.439

It is seen in Table 9 that the corrected posttest average points (70.93) of the students preferring the Self-Enclosed thinking style are higher than the average points (69.44) of the students preferring extraverted thinking style and these points are very close to each other. Hwang et al. (2012) similarly found a relation between the learning performance and learning behavior. The significance of the difference observed in the average points of the students, has been analyzed with ANCOVA test.

In table 10, the Ancova test analysis results are given for determining whether the pretest- posttest points show a significant difference according to groups.

Table 10: ANCOVA results according to the final success points which are corrected pursuant to the pretest success points

Source of the variance	Total of Squares	sd	Average of Squares	F	p
Pretest (Reg.)	13310.064	1	13310.064	68.628	,000*
Internal external	24.892	1	24.892	.128	,722
Failure	8145.689	42	193.945		
Total	243329.000	45			

When Table 10 is evaluated, it is understood that the average points of the posttests which are corrected according to the pretest points of the students preferring the different thinking styles, do not show a significant difference ($F_{[1-45]} = 0.13, p > 0.05$). This finding shows that the thinking styles preferred by the students do not form a significant difference on the thinking styles in programming language courses.

4. DISCUSSION AND CONCLUSION

In the research, it is found that the programming languages course which is supported with the online learning tools, form a significant difference in the pretest-posttest success scores of the students. It is seen that when the programming languages requiring the high level problem solving skills are actualized in cooperative learning environment like online discussion environments and project applications, academic success and motivation can reach to the desired level. Besides, the higher increase in the success points of Self-Enclosed students, shows that the extraverted students need the courses which are supported with the online learning tools.

The self-enclosed thinking style point averages of the students are higher. We can infer that CEIT Department students prefer being in the applications requiring cooperation and productivity and contrary to this they stand apart from the studies requiring individual study.

The students find the programming language education in advanced level. According to this finding, the satisfaction level of the students related with the education is *"medium level"*. In the evaluation related with the satisfaction of the students for the education while "the applicable form of the course" and "encouraging for learning" expressions come to the forefront, "experiencing technical failures" and "excessive workload" expression come to the forefront as the negative features. In a qualitative study of Geçer and Dağ (2012) which they made by blending the face to face and e-learning method; they reached to the conclusion that the applied method provides active participation of the students

Together with this, no significant difference is seen in the evaluation and satisfaction points of the students related with the preferred thinking styles of the students. While the education environment is considered as positive in terms of "providing interaction opportunities" and "prompting to the research and application", it is considered as negative in terms of "requiring internet access", "experiencing technical failures" and "excessive workload".

It is observed that blog, project, video and academic success test average points which are given for evaluating the education process, do not show any difference according to the thinking styles of the students. The motivation of the students against the course, does not show a statistically significant difference according to the thinking style choices. However it is observed that the male students have higher motivation than the female students. Besides the posttest points which are corrected according to the pretest thinking styles do not show a significant difference according to the thinking styles.

In this study, it is understood that a learning design which is blended with online learning tools, must be planned strategically. While this type of course requires more effort for the instructor, the permanent learning and development of high level cognitive skills are provided. It is seen that to offer the courses requiring problem solving skills like programming languages within blended learning environments, affects the academic success, motivation and student satisfaction in positive way.

Besides, it is seen that the thinking styles of the students affect the academic success and motivation. The blended learning environment motivates the academic successes of the students preferring the Self-Enclosed thinking style. This shows that the thinking styles of the students must be predetermined and must be designed.

Under the light of the research findings, the below suggestions can be made.

1. The acquisitions desired in programming education, may be obtained by forming education environments that shall provide integrated problem solving skills with web and multimedia technologies.
2. The success of the programming may be increased by using the alternative programming education methods which are connected with the structural programming techniques.
3. This study is designed in semi experimental pattern model, in further studies, the understanding problems in programming languages may be understood better by making experimental studies including control and experimental groups.
4. In the learning environment which is designed with the blended learning method, the programming language success of the students who have individual features like learning approaches, focus of audit and individual innovations.

One of the limitations of the study is the number of samples and the sample consists of only a university's CEIT department teacher nominees. Therefore, generalizations to be done are limited. This study can be carried out on students taking programming languages courses in different departments of different universities by expanding the number of samples. The second limitation is that the research covers only one educational term. The same study might be carried out with programming languages courses taken at university from 1st grade to the 4th. Another limitation is designing course materials considering thinking styles.

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Flexible Studies as Strategy for Lifelong Learning

Liv Susanne BUGGE
Department of Social Sciences, Faculty of Education and Natural Sciences, Hedmark University College, Norway
liv.bugge@hihm.no

Gerd WIKAN
Department of Social Sciences, Faculty of Education and Natural Sciences, Hedmark University College, Norway
gerd.wikan@hihm.no

ABSTRACT
Many countries face a challenge in recruiting teachers. At the same time, the labour market is changing and the demand for re-education is increasing. In this situation, lifelong learning is seen as relevant and higher education institutions are asked to offer flexible and decentralised study programmes in order to accommodate the need for formal education for adults. High dropout rates, partly explained by a diverse student body with little time for study, aggravate the situation. Progress might be influenced by how the study programme is organised. In this quantitative study among 511 student teachers, we examine whether there are differences between students attending differently organised studies. The findings indicate that flexible and campus-based study programmes attract students with different characteristics. In a lifelong learning perspective, it looks to be a promising strategy to offer flexibly organised studies to meet the demands of an increasingly diverse student body.

Keywords: Study programme, flexible studies, teacher education, lifelong learning

INTRODUCTION
Many countries face a challenge in recruiting teachers and the mismatch between demand and supply of teachers is well recognised internationally. There is an ongoing discussion about what means could be used to expand the pool of qualified teachers. As UNESCO points out: 'Universal primary education (UPE) will remain a distant dream for millions of children living in countries without enough teachers in classrooms' (UNESCO, 2014). The same situation is observed in the area of Early Childhood Education and Care. For instance, in almost all countries in Europe there is a shortage of places in kindergartens (European Commission, 2014) and meeting this demand requires more kindergarten teachers.

Also in Norway, teacher shortage concerns educational authorities. The discrepancy between the number of student teachers and the demand for teachers is alarming. According to the latest estimates developed by Statistics Norway, the shortage of teachers will be about 38 000 in the year 2025 (Gjefsen, Gunnes & Stølen, 2014). There is thus an increasing need for teachers. However, enrolments in teacher education are too low, despite national campaigns aimed at increasing enrolments. Norwegian kindergartens and schools at all levels face a growing shortage of teachers and there are several reasons for this. The shortage in kindergartens is a consequence of the high rise in the number of places during the last decade. In primary, secondary and upper secondary school, a high proportion of teachers will retire in the period to come (Næss, Prøitz & Aamodt, 2014). The lack of teachers at all levels is even more concerning as the labour market is changing rapidly. The economy of the 21st century moves towards a situation where 'the knowledge worker' in what could be called the knowledge economy tends to be of the greatest importance for society (Lee, 2014). The proportion of jobs which presupposes higher education has augmented during decades to the detriment of the need for unskilled workers. The demand for re-education is present in many branches since new jobs often require new skill profiles. However, to assume that individuals are generally willing and able to develop employability skills and that this guarantees continuous employment is contested (Haasler, 2013). According to Serban (2013), labour market rigidities (among them scarcity of skills) prevent rapid adjustment of employment with regards to volume and structure. This situation, characterised by a scarcity of teachers and at the same time a growing demand for educated employees, implies a pressure on higher educational institutions to graduate more candidates.

Dealing with the above-mentioned challenges lifelong learning is increasingly mentioned as a solution. The discourse has emphasised equal learning possibilities for all, however this could cause problems for individuals not able to perform as expected (Siivonen, 2016). The EU seems to underline lifelong learning as a means to reform the national education systems (Volles, 2016). The aim is to give people of all ages equal and open access

to learning opportunities of high quality (Eurostat, 2016). As part of the EU Lisbon process, all member and associated countries should develop a strategy for lifelong learning. Lifelong learning is part of the strategy to increase Europe's global competitiveness. The term 'lifelong learning' is a political objective and implies that the conditions for learning shall be so favourable that individuals will continue to learn throughout their lifespan. Under the influence of the Bologna process, major reforms within higher education have had some effect of increasing opportunities for adults to have higher education (Saar, Täht & Roosalu, 2014). However, there are important differences across European countries (Souto-Otero & Whitworth, 2016). In 2007, the Norwegian Government launched the present strategy for lifelong learning (Ministry of Education and Research, 2007). However, the legislative roots are older and go back to the Adult Education Act in 1976 and the first 'Lifelong Learning Report' from 1986. So even though the concept was not new; the arguments had become more comprehensive and now focused on the need for individuals to continually upgrade their competence due to the fast changes in the modern labour market (op.cit.). As part of the strategy, higher education institutions are asked to offer flexible and decentralised study programmes in order to accommodate the need for formal education for adults who need to combine work or other obligations with studies. An Official Norwegian Report states that the majority of the population have to expect that choices regarding education and career have to be made several times during life span (NOU, 2016).

Because of many factors, the student body has become more heterogeneous as new groups seek higher education. This means that students are increasingly combining studies with other commitments such as family obligations in addition to paid work (Alltree & Quadri, 2007). The idea of the full-time student without paid work has become less and less true (Beerkens, Mägi, & Lill, 2011; Hall, 2010). Many students experience problems about time allocation. Students with children often meet challenges; a study from the UK finds that universities have a tendency to ignore students' conflicting demands of family and study (Bowl, 2003). The student role has changed and a consequence of this is that study time among full-time college students in general is lower than before (McCormick, 2011). At first glance, it seems obvious that less study time means lower progress and performance. However, this correlation is complicated, and empirical research in the field is inconclusive (Nonis & Hudson, 2010; Wikan & Bugge, 2014).

Progress and performance might be influenced by how the programme is organised. Programmes characterised by a high degree of compulsory lectures and seminars might be problematic for students who have paid work or other obligations. Flexible programmes presupposing more self-study might be easier to attend (Darmody & Smyth, 2008; Bugge & Wikan, 2014). There are many different models of flexible studies. Lectures can be offered at different times of the day, for example in the evenings or on Saturdays. Studies may be offered decentralised; educators travel to more remote areas to give lessons. Yet another way is studies based on online facilities, or a combination of net support and classes on campus. Research shows that net-based tutoring seems to be popular among students (Bugge & Wikan, 2013). One may argue that the universities must offer studies that are more flexible in order to accommodate a heterogeneous student group. This might not be easy for all institutions because there are studies - like many of the professional studies such as medical schools, teacher education, nursing etc. - where students' presence is needed to a high degree. So there are a number of dilemmas when planning a quality university programme designed for full-time and part-time, on-campus and off-campus students.

To sum up; teacher shortage is an issue of concern in many countries. The situation is aggravated because of a changing labour market, which triggers a demand for re-education. In this connection, lifelong learning has been launched as a strategy to create an adequately educated labour force.

RESEARCH QUESTION

A strategy for lifelong learning presupposes study programmes which are adapted to the target group. In this case, the institutions must develop studies which are possible to combine with students' many social roles, including roles such as employee, parent, etc. In this study, by analysing students attending differently organised studies, we show whether there are differences between the student groups attending the programmes. This will indicate what type of programme suits which type of students. In the present article we investigate students attending both Kindergarten- and General Teacher Education.

METHODOLOGY

Data was gathered in a quantitative study using structured questionnaires. Questionnaires were administered in May 2011 and between February and April 2012. Questionnaires were administered during compulsory lecture time. All students present on that occasion completed the questionnaires, which were collected immediately. Either one of the researchers or the lecturer in charge administered the data collection.

The questionnaire includes background variables (sex, age, living situation, parents' education, study program and grades from upper secondary school), reason for study choice, grades from their college studies, evaluation of study programme, study progress, time used on study, time used on paid work and other activities, motivation for study and questions on finances.

The respondents are students at a Norwegian University College. They attend Kindergarten Teacher Education Programme (KTE) or General Teacher Education Programme (GTE). In total, 511 students completed the questionnaire; of these 110 are KTE flexible students, 168 are full-time KTE campus students and 233 are full-time GTE students.

The students range from first-year students to third-year undergraduates. The response rates were 88% (flexible), 89% (campus KTE) and 84% (campus GTE). Compared to other studies the response rates are high, which strengthens the significance of the findings. However, given the objective of the study, we must discuss the consequences of the missing students. If those who were not present when the questionnaires were administered are students differing with respect to for example sex or age, this might influence the findings. However, we are not able to tell if the non-attendance is systematic.

STUDY PROGRAMMES

The purpose of the Kindergarten Teacher Education is to provide qualified personnel for educational work with children up to age six. The Kindergarten Teacher Education is a three-year course of 180 credits. The course includes a compulsory component of 150 credits and an elective component of 30 credits (Kunnskapsdepartementet, 2013). The national curriculum regulations constitute a mandatory basis for the institutions, staff, students and practice kindergartens. On this basis, the institutions develop a *course curriculum* in collaboration with students and practice institutions. The curriculum must provide an outline of the course as a whole and also contain a practical training plan, individual subject/subject area syllabuses (for both compulsory and elective course modules) and syllabuses for interdisciplinary course modules. It is up to the institution to stipulate the number of teaching hours, how much compulsory attendance and compulsory work is required, and how to grade the students. The University College in this study has developed differently organised programmes for Kindergarten Teacher Education. The campus model is characterized by mostly compulsory student attendance. In addition, the weekly schedule is quite full; it is up to 18-20 hours a week with lectures and seminars. The flexible studies consist of part-time study (three years full-time study during four years) or full-time study comprising gatherings combined with online facilities. The flexible studies imply more individual opportunities to schedule the week according to personal requirements.

The General Teacher Education Programme qualifies teachers for the primary and lower secondary school. Subject studies and practical training form an integrated whole. General Teacher Education consists of a four-year vocational training course of 240 credits. The course comprises a compulsory component of 120 credits and an elective component of 120 credits (Kunnskapsdepartementet, 2013). As was also the case with Kindergarten Teacher Education, it is up to the institution to develop a course curriculum and to stipulate the number of teaching hours, how many of the classes should be compulsory, obligatory work and how to grade the students. The University College in this study has also developed differently organised programmes for General Teacher Education. Similar to the Kindergarten Teacher Education the campus model implies a course curriculum where much of the attendance is compulsory for the students. The flexible study is a full-time study comprising gatherings combined with online facilities. In this article we analyse both Kindergarten Teacher Education (KTE flexible and KTE campus) and General Teacher Education (GTE campus) programmes.

STUDENT CHARACTERISTICS

In this section, we will analyse background characteristics of students according to study programme. We will look at sex, age, family situation and parents' academic background. In addition, we will investigate to what extent they have paid work, which implies less flexibility with regards to studies.

The majority of students are female (table 1). It is not surprising that these study programmes attract mainly women, regardless of how the programme is organised. In Norway, females have always constituted the majority of employees in kindergartens and primary schools. The flexible study programme is even more female-dominated than the other programmes. It would seem that becoming a kindergarten teacher is viewed as a viable option because there are so many kindergartens and it is therefore possible to find local employment. From 1.1.2009 all Norwegian children have the right to a kindergarten place from the age of one (Lov om barnehager, 2009).

The students enrolled in the flexible programmes are older than the campus students. 86% of flexible students are older than 24 years; among campus students the corresponding figures are 24% (KTE) and 15% (GTE) (table 1). These figures indicate that the flexible programme really is seen as an option for older students.

The flexible students are usually in a different family situation than the campus students (table 1). 87% of the flexible students live with partner, compared to 38% (KTE) and 44% (GTE) of campus students. As regards children, we see that 75% of the students on the flexible programme live with their own children; the corresponding figures for campus students are only 12% (KTE) and 11% (GTE). The family situation for the typical flexible student is one with many obligations and this makes it difficult to attend full-time campus studies. Attending a flexible programme is then a viable way to get formal education.

It is well known that social background is one factor that determines whether an individual attends higher education (Boliver, 2011; Field & Morgan-Klein, 2013). Flexible programmes offer education to persons where they are living and might be one way to rectify this social inequality. In the present study, we find that campus students more often have an academic background than do students on the flexible programme - that is, at least one of the parents has higher education. 55% (KTE) and 59% (GTE) of campus students have at least one parent with higher education, compared to 38% of flexible students (table 1). This difference indicates that the flexible programme reaches other social groups than the campus programmes.

Table 1. Student characteristics. Percentages

	Flexible KTE	Campus KTE	Campus GTE
Women	92	85	72
> 24 years	86	24	15
Live with partner (with/without children)	87	38	44
Live with children	75	12	11
At least one parent with higher education	38	55	59
Paid work	87	64	70
15 hours or more paid work per week	92	37	37
Work daytime on working days	88	27	44
Work weekends	1	34	19
Paid work is relevant for studies	92	45	55

Paid employment is often seen as a reason for adult individuals to be unable to attend university studies. In remote districts in Norway, many women work part time or full time as unqualified assistants or teachers in schools and kindergartens. In order to raise the standard of the whole educational sector, it is necessary that more employees get formal qualifications. Offering flexible studies is one important strategy to meet this aim.

In the present study most students, independent of study programme, have paid work during term time. The highest proportion is among the students on the flexible programme. 87% of the students on the flexible programme and 64% (KTE) and 70% (GTE) of campus students have paid work (table 1). As we have seen, both on a national and international scale, the proportion of students with paid job has increased during the recent decades. This could be explained in several ways and is mainly linked to meagre student financing programmes. That students attending the flexible programme are more likely to have paid work might be because they are older and more often have a family and thus have greater economic responsibilities. Another obvious reason for the higher working rate among flexible students is that they have better possibilities for adjusting working hours to study time, and lastly, they might have enrolled in the flexible programme because they already had another job.

As regards number of hours of paid work, the study shows a considerable difference between students according to study programme. 92% of flexible students have paid work for 15 hours or more per week. The corresponding figures for campus students are 37% for both groups (table 1). This result is not surprising, because flexible students have more possibilities to coordinate work and study and they might also have been in full-time employment when they enrolled in the programme (as discussed above).

The students were asked whether they work daytime, evenings, nights or weekends. Working daytime during the working days could be expected to be more common among flexible students, as day-time work probably could conflict directly with a campus-organised study. This is confirmed by our findings: 88% of the flexible students work daytime, compared to 27% (KTE) and 44% (GTE) of the campus students. 34% of KTE and 19% of GTE campus students work during weekends, compared to only 1% of flexible students (table 1). This finding could

be due to the fact that flexible students both have better possibilities to work Monday - Friday, and in addition more often have family obligations which in turn means that it is difficult to work weekends.

Paid work during term may be expected to have negative effects on study performance. Flexible students most often agree that paid work influences their studies negatively. This perhaps is a consequence of the fact that they work mainly during the day-time hours and more frequently than campus students. However, in all student groups a substantial proportion report that their paid work is relevant for their studies. 92% of the flexible students claim that their paid work is relevant: figures for campus students are lower, 45% and 55% respectively (table 1). Probably many students on teacher education programmes either work in kindergartens or in schools during term time.

The analysis of student characteristics shows that students enrolled in the flexible programme have different characteristics than campus students. They are more often female, older and have more often children and live with a partner than students enrolled in campus programmes. In addition, they more seldom come from an academic background than campus students. The fact that they work more hours in paid work, and mainly during the day, also indicates that they had work obligations before they enrolled in the study programme.

CONCLUSION AND DISCUSSION

According to the strategy of lifelong learning, institutions in higher education should offer study programmes designed to suit other students than just the traditional young childless student. In this article, several factors have been studied to analyse whether differently organised studies attract students in different life situations. The present study confirms that there is a relationship between organisation of study and student characteristics. The students who attend flexible study programmes are different from those attending campus studies on all variables analysed. In a lifelong learning perspective, one of the most interesting findings is the fact that students attending flexible programmes are considerably older than campus students. In view of this, it is not surprising that our data show that flexible students also to a much greater extent have their own family, with partner and children. In sum, this indicates that flexible study programmes seem to be more suitable for older, established people, who at the same time are the target group for lifelong learning.

As regards academic background there is a tendency that flexible students more seldom have parents with higher education. This means that a higher proportion of flexible students are the first people from their family to get higher education. This may be seen to agree with the social equity perspective raised among others by Lee (2014) and Weiss and Steininger (2013). In a study of distance learners, it was found that studying is bounded by social relations, among them social class (Selwyn, 2011). In sum, this indicates that flexible study organising could contribute to a more socially just educational profile.

The analysis of different aspects of paid work reveals notable differences between flexible and campus students. Flexible students have more often paid work during term time, they work more hours and they more often work on working days. Together this gives a picture of flexible students as people who really utilise the possibilities flexible study organising gives. We have no data that could tell how many of the flexible students would be able to study on a campus programme, but there are reasons to believe that a high proportion of them are dependent on wage-earning. This line of reasoning follows Lei and Chuang (2010) who find that older students more often are employed and hence have difficulties with full-time studying. Online facilities and flexible time for courses are seen as favourable for many students. This is also found in an Australian study (Hall, 2010).

Based on the findings of this study it seems likely that differently organised studies attract different kind of students. At the University College in this study the flexible Kindergarten Teacher Education Programme seems to fulfil the intention of offering an education to students who do not have the possibility of a traditional full-time student-life. Furthermore, the flexible programme does not compete with the campus programme regarding recruitment; as we have seen the two groups of students are quite different.

It has become a universal trend that attending a university study is not only for young people directly from college. Lifelong learning - learning from cradle to grave – is a strategy in Norway as well as in the EU to accommodate the need for formal education for adults. A growing proportion of students have family obligations and paid employment, a fact which must be taken into consideration when planning university programmes. If the study programmes are to be flexible, the persons designing them also have to be to some extent free from prejudices with regards to the advantage of traditionally organised studies. Many studies could be organised in new ways while still maintaining quality. On the other hand, there are also studies where students' attendance is crucial, so every education is not equally suited in the perspective of lifelong learning.

Another reason to develop more flexible studies is that by reaching a more heterogeneous student group the variety of age, social backgrounds and family situations among the students will enrich student life. In many study programmes students' diverse backgrounds might influence and enrich the climate of learning.

In this study, by analysing students attending differently organised studies, we have shown that there are differences between the student groups attending the programmes, which could be seen as an indication of what type of programme suits which type of students. This is one study from one specific university college, which of course limits the possibility to generalise the findings. However, our findings are in accordance with other findings that indicate that for many adult students it is the flexibility in the programmes which gives them the possibility to study.

Flexible study programmes will probably expand further as they meet students' demands in many different ways. However, at our institution most of the study programmes are still traditionally organised with on-campus lectures and seminars. Little activity is web-based and online even though it is well documented that flexible programmes based on more self-study might be easier to combine with paid work and family, and hence also facilitate lifelong learning.

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How Students Perceived Social Media as a Learning Tool in Enhancing their Language Learning Performance

Orachorn Kitchakarn
Language Institute, Bangkok University, Thailand
orachorn.k@bu.ac.th

ABSTRACT
Social media like Facebook has been used for teaching and learning for quite some time. Since it allows for better participation in the learning activities, a fundamental English course at a private university integrated Facebook as a learning platform making it possible for students to do self-study, exchange ideas, give comments, and submit the assignments in order to improve their grammar knowledge and writing ability. This study investigated to see how students perceived Facebook in terms of ease of use, usefulness, and attitude toward the use of Facebook for doing the activities and examined whether these factors were correlated. The participants were 86 first-year students who took an English course in the first semester of 2015 academic year. This study employed the proficiency test and the questionnaire to collect data. The results reveal that overall mean scores of perceived ease of use and perceived usefulness were at a high level, and students had a positive attitude toward the use of Facebook for doing the activities. It was also found student learning performance was positively correlated with perceived usefulness of Facebook and attitude toward doing the activities in Facebook. The perceived ease of use had positive relationships with perceived usefulness of Facebook and attitude toward doing the activities in Facebook. Moreover, attitude was related to perceived usefulness while no relationship was found between perceived ease of use and learning performance. The concluding remarks suggested the possibility to integrate social media in future courses with an awareness of some factors that may facilitate or obstruct learning via online learning environments.

Keywords: Facebook, writing ability, social media, learning activity

INTRODUCTION
As a tool to relay the writer's thoughts to the reader, writing is a skill that is hard to master because it requires learning and understanding, social factors, and necessity in one's daily life (White & Arndt, 1991). It is not an innate skill, but one that has to be academically acquired (Silva, 1993). Students have to study and practice writing in order to be well-versed in it (Kitchakarn, 2013). However, writing can be used as an indicator of a student's English proficiency. Students doing a writing task are often faced with obstacles. First, they have difficulty translating their thoughts into words as they do not know how to select the correct words (Cimcoz, 1999; Silva, 1993). Second, because of their lack of a workable knowledge of , they tend to makes a lot of grammatical mistakes in their writing. Third, for students whose ideas or language competency are wanting to begin with, writing can be a traumatic learning process (Warchauer, 2011). Different methods and approaches have been tried to develop students' writing skills, one of them being teaching via technology.

Technology is currently being used to make teaching and learning more engaging and stimulating. We see more and more websites and applications such as Facebook and email becoming part of the teaching and learning process. Probably the most widely used social networking site in the world, Facebook enables people to share and get in touch with other people who make up their network (Boyd & Ellison, 2007). They also serve to facilitate online communication, interrelation and cooperation. A large number of students rely on Facebook as a means to get in touch with friends. Wise et al. (2011) found that freshmen mainly used Facebook about an hour daily to socialize with friends. This shows what potential Facebook has as a method for online learning. Ranked in the top 20 countries with the most Facebook users, the social networking site is now an essential aspect of daily life (Cloete, Villiers, & Roodt, 2009). Apparently, Facebook is highly likely to prove advantageous to students should it be capitalized on as part of the learning process.

Facebook as a Learning Tool
One of the most effective ways to learn a foreign language is to use that language in daily life. But when such an opportunity is not available, websites like Facebook can prove rather effective in helping in enhancing learners' proficiency.Vigotsky (1978) found that apart from serving as a means for communication, using a language also

helps learners create their own knowledge. This is also applicable to Facebook, which provides a great opportunity and space for expression through writing. Facebook users can share whatever written materials they want such as exchanging lecture notes, documents, and assignments (Mazman, 2009; Ractham, & Firpo, 2011). They can also offer feedback and comments. They actively engage themselves in learning activities (Alm, 2006). There are researches pointing put the advantages of Facebook in improving language learners' proficiency (Lockyer & Patterson, 2008; Nakatsukasa, 2009). Wang, Lin, Yu, and Wu (2012) found that, with the help of Facebook as a joint learning tool, students performed better, and displayed more participation in and contentment with their studies.

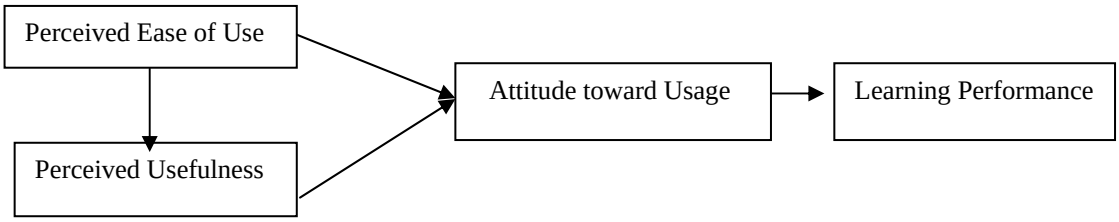
Many studies have dealt with the uses of social networking sites and learners' opinions toward them, most of which were favorable. Tashir, Al-Dheleai, Harun, and Shukor (2011) concluded that students evaluate the use of social networks as part of their eLearning activities quite positively. According to Valenzuela et al. (2009), students who were also Facebook users were more satisfied with their lives and displayed more engagement as members of their society. Lewis and Nichols (2012) found that students viewed in-class social media favorably. Wang, Woo, Quek, Yang, and Liu (2012) found that students were satisfied with the integration of Facebook into the course because it has the same functions as a Learning Management System.One study showed that students were convinced that with the use of Facebook, learning English could be made easier (Kabilan, Almad, & Zainol, 2010). Consequently, using Facebook as a learning tool should be promoted since the language used on Facebook is genuine English, and it also encourages students to learn and augments their language proficiency. Even though these researches revealed that students viewed Facebook favorably as an online learning tool, more studies should be conducted to find out whether and to what extent Facebook can help improve students' English competency in the long run.

Theoretical Framework

This research used the adapted model of the Technology Acceptance Model (TAM) by Davis (1989). TAM was developed to predict the adoption of new technologies in various situations and in different contexts (Park, 2009; Teo, 2009). The three factors used were Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Attitudes Toward Usage (ATU) (Davis, 1989). PU is the notion of a person that technology has benefits. For instance, it can enhance his/her proficiency. PEOU is a person's notion of how easy it is to use technology. ATU is a person's notion of how technology is viewed. According to Ajzen and Fishbein (2005), attitude is referred to the way that individuals respond to or ignore an object. The model suggests that how a person views technology is influenced by PEOU and the benefits of technology. The three factors are related. As revealed in a study, ATU was affected by PEOU (Park, 2009; Chang, Yan, & Tseng, 2012). PEOU had a significant effect on PU (Adwan, Adwan, & Smedley, 2013; Shroff, Daneen, & Ng, 2011).

The current study set out to study undergraduate students' views toward social media as a tool for learning and activities. Technology, Facebook included, that was incorporated into a course had to be easy to use, or it would be viewed as obstructive to learning. Students' willingness to engage in activities relies significantly on how easy or difficult it is to use the technology involved. This study also emphasized students' views toward Facebook and PU. New technology may cause problems for some students and it proves advantageous if their ideas and viewpoints are collected and taken into consideration. One other element, learning progress, was incorporated into the model because this research also put emphasis on technology-induced language competency. It is hoped that this study will answer the question of whether the factors above facilitate or obstruct learning via technology.

The conceptual framework in this study was adapted from TAM as follows:



Research Questions

1. What are the students' perceived ease of use and usefulness of Facebook?
2. How do the students respond to doing the activities in Facebook?
3. Are there any relationships among the students' learning performance, perceived ease of use, perceived usefulness of Facebook, and attitude toward doing the activities in Facebook?

Research Hypotheses

After reviewing literature, the four research hypotheses are defined as follows:

H1: Students' perceived ease of use is positively related to perceived usefulness.
H2: Students' perceived ease of use is positively related to their attitude toward usage.
H3: Students' perceived usefulness is positively related to their attitude toward usage.
H4: Students' attitude toward usage is positively related to their learning performance.
H5: Students' perceived usefulness is positively related to their learning performance.
H6: Students' perceived ease of use is positively related to their learning performance.

METHODOLOGY

Participants

The participants were 86 students who were enrolled in a bachelor's degree level course entitled 'English in Action'or EN0111 offered at a university in Thailand during the first semester in 2015. It was a 3-credit, 14-week compulsory course taken by the first-year students from all faculties. The selection of this course was based on the following reasons. Firstly, the course content such as grammar and writing tasks provided an opportunity to create activities in Facebook to improve students' language proficiency. This course was a pilot project of using social media to support language learning. Therefore, Facebook was used instead of the Learning Management System to connect with students. Students needed to follow up the course contents or announcements through Facebook. The last reason was that the first-year students were new at the university. They were rather active and energetic in doing the given tasks.

Teaching and Learning Process

This course made use of Facebook in teaching and learning process. Students were required to join the activities performed in Facebook which aimed to improve their grammar and writing, starting from week 2 to week 14. On the first week, students would be informed of the course syllabus comprising score allocation, assignments, especially the activities that they had to do in Facebook. The contents that would be improved through the activity were grammar and paragraph writing. At the end of the class on this week, they were asked to join Facebook provided by the teacher and created a group of 5-6 members.

On week 3, 5, 7 and 10, students were required to work together with their team members in Facebook. The teacher posted the content of grammar followed by an assignment. Students in each team had to do a self-study and completed the assignment together. They could use Facebook as a channel for discussion with friends. Then each team submitted it by uploading it in Facebook so that other teams could take a look at all submission. The teacher checked the answers and uploaded the answer key in Facebook so that everyone could notice their mistakes.

Regarding the writing tasks, the teacher posted the topic for writing in a paragraph of at least 60 words. Each student was required to compose the content and posted it in their group so that the members would read, correct, and give comments. The teacher got into each group to check whether they were able to make any changes in their written tasks. In this activity, the teacher acted as a facilitator who often read students' writing and gave suggestions about the grammar and mechanics of writing. If the writing was improved, they would be informed to write the content in a piece of paper and submit it in class. There were three pieces of writing to be done on week 4, 6, and 9. On week 12, all students had to take a grammar and writing test. The full score was 20 points.

Apart from the aforesaid activity, the teacher also made use of Facebook in posting announcements or educational issues such as reminding students of the upcoming presentation or informing them about resources or materials useful for their study. Sometimes, the teacher put links of websites regarding grammar or writing that were beneficial to them.

Research Instruments

The first instruments of this study were an English proficiency test that was given to the students on week 12. There were two main parts, each of which had 10 points. So, the total score was 20 points. The contents for testing students were written to cover EN 011 contents covering grammatical points and paragraph writing. The 10 questions in the grammar part were a kind of multiple-choice, and in the writing part students were given several topics, one of which they had to choose to write in at least 100 words. Time allotted for the test was 60 minutes.

The next instrument was a questionnaire comprising two main sections. The first section contained data concerning age and gender. Section two consisted of 21 items that measured "perceived ease of use" (3 items), "perceived usefulness" (10 items), "attitude towards usage" (8 items). A five-point Likert scale response format

was used with the following categories: 5 = strongly agree; 4 = agree; 3 = undecided; 2 = disagree; and 1 = strongly disagree. Then the items in the draft questionnaire were examined and corrected by three experts in the English teaching field for clarity and accuracy. The values of congruence index for items in Section II (containing a five-rating scale) were proper. They were between 0.67 and 1.00. The experts' comments and suggestions in terms of the wording and statement of each description were considered for modification of the questionnaire. To investigate the internal consistency among all items, the questionnaire was administered to a test group of university students and was then revised and finalized based on their feedback. The reliability of the questionnaire of this study was .82 (Cronbach's alpha), indicating a high level of internal consistency.

Data Analysis

Data were statistically recorded and analyzed by SPSS/Windows program. Personal data of the participants and a survey of social networks use were calculated for frequency and percentage. Data concerning perceived ease of use, perceived usefulness, and attitude toward usage were analyzed quantitatively for means and standard deviations. The ranges were as follows: 1.00-1.50 = very low/ very negative, 1.51-2.50 = low/negative, 2.51-3.50 = moderate, 3.51- 4.50 = high/ positive, 4.51-5.00 = very high/very positive. The score gained from the proficiency test was calculated for mean and standard deviation. These factors were then calculated for relationships using Pearson Correlation Coefficients to test the hypotheses.

RESEARCH RESULTS

Research Question 1: What are the students' perceived ease of use and usefulness of Facebook?

Table 1 demonstrates the overall mean score of students' perceived ease of use which was at a high level (Mean = 4.18). When considering each item, it was found that the three items could be arranged from most to least as follows: ease of accessing from mobile phone (Mean = 4.38), ease of making a post, uploading pictures and videos (Mean = 4.31), and ease of finding school-related information (Mean = 3.86). These three items were at a high level.

Table 1 Mean and Standard Deviation of Students' Perceived Ease of Use of Facebook

Statement	Mean	S.D.	Level
1. Facebook is easier to access from my mobile phone.	4.38	.79	high
2. It's easy to make a post, upload pictures and videos on Facebook.	4.31	.77	high
3. Facebook is easier to find school-related information.	3.86	.72	high
Total	**4.18**	**.62**	**high**

Table 2 shows the overall mean score of perceived usefulness of Facebook which was at high level (Mean = 4.00). The first highest mean score fell on item no. 1 (It is a good place to keep in contact with other students in class, Mean = 4.35), followed by item no. 8 (It is a good place to access links to resources provided by the teachers, Mean = 4.08), and item no. 3 (It is a good place to check class notes or homework posted by the teacher, Mean = 4.06). The lowest mean score was on items no. 9 (It is a good place to read articles and prepare for next class, Mean = 3.69). It is interesting to see that all of the items were at high levels.

Table 2 Mean and Standard Deviation of Students' Perceived Usefulness of Facebook

Statement	Mean	S.D.	Level
1. Facebook is a good place to keep in contact with other students from class.	4.35	.73	high
2. Facebook is a good place to contact my teacher outside classroom.	3.96	.66	high
3. Facebook is a good place to check class notes or homework posted by the teacher.	4.06	.76	high
4. Facebook is a good place to ask for help about homework assignments.	3.96	.75	high
5. Facebook is good place to check for class-related information and notices.	3.90	.74	high
6. Facebook is a good place to discuss different topics with classmates.	4.05	.78	high
7. Facebook is a good place to post writing assignments.	4.04	.75	high
8. Facebook is a good place to access links to resources provided by the teachers.	4.08	.71	high
9. Facebook is a good place to read articles and prepare for next class.	3.69	.70	high
10. Facebook is a good place for classmates to review or edit writing assignments.	3.90	.72	high

Total	**4.00**	**.50**	**high**

Research Question 2: How did the students respond to the use of Facebook for doing activities?

Table 3 shows that the overall mean score of attitude toward doing the activities in Facebook was positive (Mean = 3.72). The first highest mean score fell on item no. 7 (feeling actively involved in all activities, Mean = 4.01), followed by item no. 5 (saving time when submitting writing tasks, Mean = 3.86) and item no. 6 (increasing vocabulary usage and grammar knowledge, Mean = 3.78). The lowest mean score was on items no. 2 (increasing productivity, Mean = 3.49). Nearly all of the items were positive except no.2 which was at a moderate level.

Table 3 Mean and Standard Deviation of Students' Attitude toward Doing Activities in Facebook

Statement	Mean	S.D.	Level
1. Doing the activities in Facebook is convenient.	3.56	.69	positive
2. Doing the activities in Facebook can increase my productivity.	3.49	.66	moderate
3. Doing the activities in Facebook provide me with a motivating learning environment.	3.66	.67	positive
4. Learning new vocabulary and grammar in Facebook is helpful for my study.	3.74	.76	positive
5. Submitting writing tasks in Facebook helps me to save time.	3.86	.74	positive
6. I increase my vocabulary and grammar knowledge through the activities in Facebook.	3.78	.71	positive
7. I feel actively involved in all activities in Facebook.	4.01	.70	positive
8. I become prudent after a practice of writing in Facebook.	3.66	.61	positive
Total	**3.72**	**.41**	**positive**

Research Question 4: Are there any relationships among students' learning performance, perceived ease of use, perceived usefulness of Facebook, and attitude toward doing the activities in Facebook?

This research question was to examine the relationships among four factors. Apart from data from the questionnaire, the result from the test was calculated as an important factor. Student learning performance was measured by the grammar and writing test score earned out of 20. It was found that the mean score was 13.51, with S.D. of 2.33. Several analyses were, therefore, performed using Pearson Correlation Coefficients to find out whether any relationships existed. Findings revealed that student learning performance was positively correlated with perceived usefulness of Facebook ($r = .273$, $p = .014$) and attitude toward doing activities in Facebook ($r = .348$, $p = .002$). That is, the more students perceived usefulness of Facebook and the more they had positive attitude toward doing activities in Facebook, the higher learning performance they gained. However, there was no correlation between student learning performance and how they perceived ease of use ($r = .185$, $p = .101$). In addition, it is noted that the perceived ease of use had positive relationships with perceived usefulness of Facebook ($r = .660$, $p = .000$) and attitude toward doing activities in Facebook ($r = .283$. $p = .011$). That is to say, the easier Facebook was, the more useful they perceived it and the more positive attitude toward doing the activities they had. The results also indicated that students' perceived usefulness of Facebook was correlated with their attitude toward doing the activities in Facebook ($r = .566$, $p = .000$). The detail was presented in Table 4.

Table 4 Intercorrelations among Variables

	Ease of Use	Usefulness of Facebook	Attitude
Language Performance	.185	.273*	.348**
Ease of Use	-	.660**	.283*
Usefulness of Facebook		-	.566**
Attitude			-

*Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Table 5 summarizes the results obtained from testing the research hypotheses. Five hypotheses were accepted while only one hypothesis was rejected. Based on findings, perceived ease of use was found to have relationships with usefulness and attitude toward usage, thus H1 and H2 were accepted. Hypothesis 3 proposed that perceived usefulness had a positive relationship with attitude toward usage, and the result found the relationship with $p < .01$. Therefore, H3 was accepted. Moreover, students' learning performance could be explained by the two

significant factors comprising perceived usefulness and attitude toward usage since relationships were found. Therefore, H4 and H5 received support. However, perceived ease of use was not related to their learning performance with p>0.05, thus, H6 was rejected.

Table 5 Summary of Hypotheses Testing

Hypotheses	Relationship between Factors		Results
H1	ease of use	usefulness	supported, p< .01
H2	ease of use	attitude toward usage	supported, p< .05
H3	usefulness	attitude toward usage.	supported, p <.01
H4	attitude toward usage	learning performance	supported, p< .01
H5	usefulness	learning performance	supported, p < .05
H6	ease of use	learning performance	not supported, p > .05

DISCUSSION

The first discussion is about the two factors comprising perceived ease of use and perceived usefulness which are at high levels. The findings indicate that students felt comfortable when social media was used as a learning tool in the course. One of the reasons may have been the use of Facebook, which is undeniably the most popular social networking site they use in daily life. As a result, they found it rather easy to communicate with one another on Facebook. Regarding the high level of perceived usefulness, Facebook was viewed as a good place where members could either learn alone or learn together. The functions of Facebook itself made learning more meaningful. Apart from that, there were many other elements of the learning context involved that they might consider useful such as subject content, communication, and learning tasks. Interestingly, perceived ease of use had positive relationships with perceived usefulness of Facebook. The finding was consistent with previous studies in that perceived ease of use had the strongest significant influence on perceived usefulness (Adwan et al., 2013; Shroff et al, 2011). We might conclude that comfort with Facebook usage enabled students to see the importance of it. The more they were comfortable with Facebook, the more they perceived its usefulness. Facebook is not a difficult tool since they always use it in daily life. It is rather user-friendly. As a learning tool for language development, Facebook has ample space for anyone who wants to put materials and post explanations so that others can get more detail and have better understanding.

The second issue for discussion is about students having positive attitude toward the use of Facebook for doing the activities. The result was similar to previous studies which also found positive attitude toward social media as a learning tool (Lewis & Nichols, 2012; Tashir, 2011). This is probably because all of the activities to be done in Facebook allowed them to notice the benefits of social media as a learning tool. It facilitated their learning in many aspects. They could learn and work together very well. Facebook provided a great opportunity and space for expression through writing. They were able to share whatever written materials they want such as exchanging lecture notes, documents, and assignments (Mazman, 2009; Ractham, & Firpo, 2011). Based on the findings, attitude had positive relationships with perceived ease of use. This may be concluded that a positive attitude comes from the comfort with Facebook. Students usually use Facebook for social activities. In this regard, choosing the right social media or the one that students are familiar with is likely to enhance their attitude. The findings were found to be similar to the previous studies in that perceived ease of use had the strongest significant influence on attitude towards use (Chang et al., 2012; Park, 2009).

The next important issue is about learning performance. After doing the activities for 12 weeks in Facebook, it was worthwhile to assess their ability. It is strongly believed that the activities students did in Facebook enabled them to learn more about grammar and writing. The finding showed the average mean score of 13.51 from the full score of 20, which was rather high when compared to other classes taught by the traditional way only. This was in accordance with Wang et al (2012) who used Facebook as a valuable tool for students to learn and work together, and the results revealed students' achieving better grades. This is probably because doing a self-study and tasks in Facebook were not boring since it provided students with a platform for writing and expressing opinions. In this kind of environment, students were encouraged to become active participants in a learning community (Alm, 2006). Getting the feedback and comments from peers provided them with more ideas, knowledge and skills to process. The way they learned together could solve the problem of inadequate ideas for students with low writing proficiency.

In this study, learning performance was found to have positive relationships with perceived usefulness and attitude. This was supported by the study conducted by Lee & Lee (2008) which found that perceived usefulness was defined as the user's belief that the technology will improve their performance. This showed that the more students perceived useful, the higher their learning performance was. Moreover, the more students demonstrated their acceptance of Facebook to be used for doing the activities, the higher their language ability was. Therefore,

when designing the course, the teacher needs to think carefully about how to make good use of the feature that Facebook offers. The learning objective of each activity needs to be clear, focusing on benefits that students will gain. In addition, promoting attitude can be done by pointing out the efficiency of social media that it is not only employed for social connection, but it is also useful if used as a learning tool for language learning. It can make learning more interesting and not boring. Based on the finding, it may conclude that attitude towards technology is one of the key factors in the learning performance. That is, positive attitude leads to better grade.

CONCLUSION

The results from this study will be useful for any teachers who want to integrate social media in future courses for language development. There are two issues to be addressed. Firstly, even though Facebook can be used to facilitate students' learning in English to increase students' grammar knowledge and writing skills, there are many factors to be considered when creating any learning tasks. In this study, it is found that student learning performance was positively correlated with perceived usefulness of Facebook and attitude toward doing activities in Facebook. Students' perceived usefulness of Facebook was also correlated with their attitude toward doing the activities in Facebook. Therefore, the selected activities or tasks should be beneficial and helpful to improve learner's language proficiency. This will certainly motivate them to learn. In addition, choosing the right social media has a huge impact on participation. Facebook is suitable for the course as the features of Facebook are user friendly, so students tend to have positive attitude toward learning through Facebook. In this regard, students can increase other skills such as cooperative working skills and interpersonal skill. For teachers, it is very easy to design any tasks which require learner contributions in groups. Facebook can be a platform of supplementary materials that teachers provide for learners to study outside class in order to gain knowledge. This allows them to have more time for other contents in class.

LIMITATION OF THE RESEARCH

The results of the current study should be interpreted with some limitations. First, the participants were restricted to university students in Thailand; therefore, the results may not generalize to students of younger ages or in other countries. Second, in this study Facebook was selected to facilitate language learning. It was the only one platform used for mutual learning. Since students' perceptions on other social media were not investigated, it is rather difficult to conclude that Facebook is the most effective learning tool. Therefore, future research should include other types of social media in the course in order to find out which tool students perceive the most effective in enhancing their language proficiency.

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Impact of Text-Mining and Imitating Strategies on Lexical Richness, Lexical Diversity and General Success in Second Language Writing

Sevcan Bayraktar Çepni
YıldırımBeyazıt University, Turkey
sbayraktar@ybu.edu.tr

Elif Tokdemir Demirel
Karadeniz Technical University, Turkey
elif@ktu.edu.tr

ABSTRACT
This study aimed to find out the impact of "text mining and imitating" strategies on lexical richness, lexical diversity and general success of students in their compositions in second language writing. The participants were 98 students studying their first year in Karadeniz Technical University in English Language and Literature department. Participants in the experimental group were instructed on how to use mining and imitating strategies in their essays to be more competent in vocabulary choice while writing. On the other hand, students in the control group were only instructed on how to write their essays following lesson plans. After treatment, participants in the both group were asked to write two essays. A corpus of 15826 (control group) and a corpus of 25027 (experimental group) words were compiled in two months, and these essays were tagged using a computerized tagging system (Biber 1993). Though there is statistically slight difference in terms of lexical richness, the study revealed that compositions in the experimental group are lexically richer than those in the control group. Common nouns and general verbs subclasses were found to be used more in compositions of the experimental group. In addition to that, students in the experimental group received significantly higher grades than those in the control group.

Keywords: Text mining, imitating, lexical richness, lexical diversity, learner corpora.

INTRODUCTION

Development of vocabulary is a fundamental part of learning a second or a foreign language. Wilkins (1992: 111) declared that "little can be conveyed without grammar but nothing can be conveyed without vocabulary." Therefore, the essential need for vocabulary learning in the process of second or foreign language has gained increasing recognition in research agenda. To address this need, many studies on vocabulary learning have been conducted so far (Nassaji, H. 2006; Lee, S. H. & Muncie, J. 2006; Nation, I. S. P. 2008). These studies revealed mutual relationship between the knowledge of vocabulary and other language skills. In respect to the importance of vocabulary as a fundamental skill underlying other skills, this paper presents the relationship between vocabulary knowledge developed through reading and writing achievement in specific.

SIGNIFICANCE OF THE STUDY

The importance of competence in writing has been explicitly elaborated by many researchers. Weigle (2002: 1), for example, wrote that "The ability to write effectively is becoming increasingly important in our global community, and instruction in writing is thus assuming an increasing role in both second- and foreign- language education". To write effectively, students need to use their vocabulary knowledge properly. However, as vocabulary is generally learnt through lists and memorization, students can only achieve short term memorizations and cannot use these words properly and actively in the long term use of the language learning process. In other words, learners have difficulties in adapting their vocabulary knowledge into writing or speaking skills.

In line with what Weigle (2002) said, Gorell (1987: 53) stated "unskilled writers do not have a clear sense of form. The sense for them is all mixed up with jumbled, half-remembered rules, unsuccessful trials at writing, heavily marked papers, and insufficient and ineffectual reading". The question of what increases learner competence in the use of vocabulary for effective writing has been the focus of much research so far. As writing in a second language is different from writing in the first language, most of the research conducted on impact of L1 reading on L1writing production fails to answer questions in EFL research. It has been put that there is a

positive correlation between reading and writing in the target language; however, the question of which reading strategies for writing should be used to facilitate vocabulary use in written productions has not yet been answered completely. In order to understand how reading informs writing in terms of vocabulary and what happens when readers are also writers, students should be asked to use certain strategies called "text mining" and "imitating" to reach a conclusion about the usefulness of these strategies on vocabulary knowledge. These questions are important as they can lead to a shift in emphasis from teaching of reading and writing to the nature of learning how students use and adopt these strategies.

LITERATURE REVIEW

The relationship between vocabulary knowledge and writing competence has been the focus of many research studies. (Laufer and Nation 1995, Folse 2006, Barcroft 2007). Schellekens (2007: 103) claimed that "Many students struggle with writing and they often find it hard to write at all, even about topics that they know well, such as their home life, their children, or their job". This difficulty may stem from the fact that students' lexical knowledge is not enough to help them produce detailed expressions while writing in a second or foreign language. Relationship between reading and other skills have been focus of concern for many researchers. The power of meaningful reading to increase learner language proficiency has been highlighted by Krashen (1989: 109) who stated that "reading exposure is the primary means of developing language skills". That is, he (2004: 37-132) claimed that "reading is a powerful means of developing reading comprehension ability, writing style, vocabulary, grammar, and spelling" ; we acquire writing style, the special language of writing, by reading". Focusing on the similarities between reading and writing, Cooper (1993) suggested that reading and writing should be taught together as they are both constructive processes, share similar processes and kinds of knowledge, improve achievement, foster communication, and lead to outcomes not attributable to either process alone. Similar to Krashen's and Cooper's ideas on impact of reading on writing, some L2 writing researchers such as Grabe (1997) and Paradi (2006), who highlight the relationship between reading and writing claim that L2 learners' writing ability can be facilitated by encouraging students to use model essays as they present rhetorical elements, principles and patterns of written discourse. According to such views, reading and writing are connected as they depend on similar knowledge representations, cognitive processes, contexts and contextual constraints. Therefore, it is not unusual to think that reading and writing development has close interaction, which may lead some pedagogical combinations that may be useful in making learning more efficient.

Following Krashen's theory that holds writing skill is affected positively by extensive reading, a number of studies on reading and writing relationships in L2 have been conducted. Ito (2011) investigated relationship between L2 reading skills and persuasive essay quality in EFL Japanese high schools students. It was found that L2 reading has an effect on L2 writing quality. Özçelik (1996) sought an answer to the question whether the writing process of low level EFL students improves if it is taught through reading with the help of reading texts. Participants of the study were 20 low level prep school students. He divided these participants into two and made one group an the experimental group and one group of a the control group. Participants in the experimental group were exposed to pre-writing activities through reading with the help of reading texts but the participants in the control group was not exposed to pre-writing activities during the study. He found that reading had an effect on writing. That is teaching writing through reading text produced a significant increase in the composition profile total score of learners. Shanahan (1984) tried to find out the relationship between reading and writing by examining second and fifth graders phonic skills, reading comprehension, reading vocabulary, spelling, and prose writing. She analyzed writing samples for syntactic complexity, diversity of vocabulary, and organizational structure. She found that reading and writing measures were positively correlated, but only to a small or moderate extent. Shanahan concluded that the association between diversity of vocabulary in writing, and reading ability had an increase from second to fifth grade.

Some studies endeavored to document how reading informs writing in terms of vocabulary usage. Elgord and Warren (2014), for example, investigated acquisition of second language (L2) vocabulary from reading a connected authentic text. The study revealed that number of encounters with new words in reading helped learners gain explicit word knowledge. However, advanced learners and those with lower proficiencies differ in gaining such knowledge. While extensive reading may be sufficient to sustain vocabulary development for advanced learners, lower proficiency reading needs to be supplemented with deliberate word learning and vocabulary learning strategy training.

It is believed that students can learn about writing by "imitating" good models of written discourse. In such an approach, students are expected to internalize the style, grace, and correctness that make these works exemplary. Gorell (1987: 54) claimed that unskilled writers learn from imitation by focusing on form and structure while generating and finding the expression for their own ideas. By imitating, they learn to shape their sentences, develop their paragraphs, express their own voices, and perform many of the complicated tasks that writing

process involves. In addition to this, he asserted that "when writers read, they pick up not only meaning but also the way in which that meaning is expressed.". He also (1987) touched upon functions of imitation explaining one as having a problem solving capacity with which students make use of experience- one's own and that of others to find solutions. Applied to writing, imitation means students do not need to invent a new form every time they want to express an idea. However, role of imitation has also brought some speculations as Greene (1991: 152) said:

> One might wonder if students can articulate or apply the discourse knowledge they tacitly learn through imitation to their writing in different situations and across a number of varying tasks. Will imitation serve our students when they must transform their knowledge in order to contribute something new to an ongoing conversation in a given field?

Greene (1991) supported the view that employing this strategy students can only learn "the forms and genres and the ways of speaking that writing is a discipline demands" (Jolliffe and Brier, as cited in Greene 1991: 55). The question as to what extent these approaches teach students— individual writers— to negotiate the complex demands that a rhetorical situation places upon remains unanswered. Accordingly, Greene (1991) claimed that if students are expected to make reasonable choices and decisions in widely different rhetorical situations, abstract instruction will not suffice to them. Therefore, the term pragmatic reading to facilitate writing has been used by Greene (1991: 155) whose metaphor of "text mining" holds that in order to achieve goals in composing, writers should read purposefully and intently. Tsai (2006) defines text mining as a strategic approach that is used to dig out valuable language sources such as grammar and vocabulary. By using this strategy, writing and vocabulary skills of students are expected to improve as students pay attention to grammatical and lexical features of the texts, organization of the texts, and expressions which are unfamiliar to them. In addition to that, this strategy is thought to help students improve their reading skills, and, at the same time, build the foundation of future writing. This kind of pragmatic reading, according to Greene, is fueled by three key strategies. Three keys strategies that can inform reading are "reconstructing context", "inferring or imposing structure", and "seeing choices in language". Green (1991) sees language as a lens through which people can understand something in a particular way. Therefore, even subtle changes in language can change the ways how meaning is located, which requires a process which involves a plan, selective evaluation and organization of information in order to get a sense of the topography. So people can reflect upon one's choices and decisions about the use of this accumulated knowledge to the best effect. Mining process is like an excavation during which miner uses certain tools that are convenient for the situation to help uncover what is most desired. This means that readers who are also writers use these strategies to reconstruct context, infer or impose structure, and see choices in language. This leads readers to make informed guesses about the use of the ideas or discourse features of a given text in light of his or her goals as a writer (Greene, 1991). Mining suggests a strategic process that can be considered to be the key factor in raising student awareness on how discourse patterns organize subset information.

Intensive research on vocabulary acquisition in the process of learning a foreign language has brought the need for tools that may ease investigating large samples of students' written productions. In line with this need, developments in computer text-processing capabilities has made it possible to investigate large samples of learner writing through corpus based research. With the ease of these tools, learner corpus studies have flourished discovering more and more linguistic problems that learners have. This flourishment brought the term "Learner Corpora" in the agenda. Electronic collections of spoken or written texts that are produced by foreign or second language learners are defined as computer learner corpora. Two types of corpora have been focus of SLA research so far: corpora by learners and corpora for learners. Sylviane Granger and her team developed the International Corpus of Learner English (ICLE) in 1998 which resulted in growing interest in producing corpora that can be used to study interlanguage of learners. The general idea behind such work is that if learners' language is identified or analyzed, it may be possible to focus on teaching methods and contents in order to make teaching context more fruitful. Learner corpora can be compiled from both writing and spoken products of learners.

METHODOLOGY

This is an experimental study aiming to find out possible impact of certain reading strategies called "text mining" and "imitating" on lexical richness, diversity, and general success in learner compositions. The participants of this study, 98 students ; 39 in the control group, 59 in the experimental group, were first year students of Karadeniz Technical University in English Language and Literature department in academic year 2012- 2013. The students, who were native speakers of Turkish, were chosen with convenience sampling technique. Even though the participants chosen via convenience sampling might not represent the whole population (Paton, 2002), students who were eager to take part in the study were chosen. After attending a year of preparatory class of intensive English courses: writing, speaking, listening, reading and grammar, students advanced to first year in their departments. In order to show equality of proficiency levels of these students in

writing skill, all students were assigned to write a narrative essay before the treatment. First drafts of their essays were compiled, and randomly selected 20 essays from each group were submitted to two independent raters who are teaching writing classes to be scored by using essay scoring rubric developed by Oshima and Hogue in 2006.

An independent-samples t-test was conducted to compare the scores of compositions of the students before the treatment. The results indicated nonsignificant difference between the control group (M = 68.10, SD = 9.276) and the experimental group (M = 69.88, SD = 10.511), t (96 = -.881, p = .381). The analysis showed that students in both groups had nearly same writing performances prior to the study. In order to make sure that students understood how to apply text mining and imitating strategies, they were checked one by one when analyzing their model essays. If needed, researcher provided them with one by one training on using these strategies.

INSTRUMENT

For this study, participants were assigned to write one descriptive essay entitled "the person you admire" and one advantage disadvantage essay on "employee monitoring". They were asked to write five paragraph essays with at least 250 words.Students in the control group were instructed with power point presentation on how to write a descriptive and advantage and disadvantage essays. They were provided with charts and graphic organizers and instructions on rhetorical style and organization (see appendices 5-12 for sample student essays).

Their essays were compiled and tagged with Biber (1993) tags (see appendix 1). Bennet (2002: 14) stated that:

> When a corpus is tagged, it means that each word included in the corpus has a marker added to it that gives additional information. Often, tags are part of speech markers, enabling users of corpora to search not only for specific words, but also for specific words used as a particular part of speech.

CORPUS DESCRIPTION

Two parallel corpora of learners studying in the first year of English Language and Literature Departments were compiled in expository writing lesson. 39 essays acquired from the control group that constituted a corpus of 15826 tokens while 59 essays acquired from the experimental group which constituted a corpus of 25027 tokens. All texts in student corpus were grammatically annotated using an automatic grammatical "tagger" (a computer program developed and revised over ten year period by Biber1993. A large number of linguistic features in spoken (transcribed) and written forms are identified by this tagger. Tagging this corpus made it possible to conduct a series of more sophisticated analyses than would have been possible with an untagged corpus. Preparing student texts for the program was labor intensive and extremely time consuming. Spelling of each word is edited as not only English characters are required but also spelling of words should be correct. Each part of speech is tagged according to its classes. If a word has two functions, the one that is more commonly used is chosen to be tagged. For example, "name" has both verb function and noun function. As "name" as a noun is more used in dictionaries and corpus of native speakers, the program tags it as a name. Following table shows sentences from tagged texts.

DATA COLLECTION

At the beginning of the term, students in the experimental group were taught certain reading strategies called "text mining" and "imitating". They were trained to work on model essays to gain insights into how and where writers use words where needed. For each class and topic, they were provided with model essays. By reading and mining these essays, they tried to produce their own compositions. On the other hand, students in the control group learnt writing essays with charts and organizers; they were not exposed to reading texts or analyzing texts through text mining. They were only taught how to write an essay, and were asked to write their own essays following guidelines provided by these graphics.The data for the writing were collected via writing tasks covering the topics that were assigned to them. Two parallel corpora of students in the control group and students in the experimental group were compiled and (39 essays in the control group (a corpus of 15826 words); 59 essays (a corpus of 25027 words) in the experimental group) these essays were tagged (with Biber tagger's tag descriptions) in order to ease the analysis.

DATA ANALYSIS

Corpus-based studies often measure vocabulary richness in terms of Type-Token Ratio (TTR) in which the number of different words (types) a learner writes in a text is divided by the total number of words (tokens) in order to determine the degree of variation. However, this traditional model brings out some problems with it. Johansson (2008:63) mentions about this problem as follows:

> A problem with the TTR measure is that text samples containing large numbers of tokens give lower values for TTR and vice versa. The reason for this is that the number of word tokens can increase infinitely, and although the same is true for word types, it is often necessary for the

> writer or speaker to re-use several function words in order to produce one new (lexical) word. This implies that a longer text in general has a lower TTR value than a shorter text, which makes it especially complicated to use TTR in developmental comparisons, e.g., between age-groups, where the number of word tokens often increase with age.

As an alternative to TTR model, some models have been proposed to measure lexical richness "Theoretical *vocabulary model*" is one of these models which has been proposed (Broeder, Extra & van Hout 1986) tomeasure word types in the samples. The principle behind this measure, as Johansson (2008) says, is to pick a number of words (e.g 100 words) from a text randomly and calculate the number of word types in the sample. Therefore, theoretical vocabulary takes into account all possible ways of choosing 100 words from the text. By doing this, one can easily compare texts of different lengths with limiting number of words by random selection.
In order to find out lexical richness, this theoretical vocabulary model was used. 200 words were chosen randomly from all essays. These essays were analyzed in terms of Type-Token Ratio. To measure lexical density, tagged files were analyzed by concordancing softwareAntConc 3.2.4 which is used for carrying out corpus linguistics research and data-driven learning. It helps researchers with a comprehensive set of tools including a powerful concordancer, word and keyword frequency generators, tools for cluster and lexical bundle analysis, and a word distribution plot.

Written productions of learners were compiled and tagged. An analysis with AntConc 3.2.4 was performed to find frequencies of parts of speech. Obtained frequencies were assessed and compared with Log likelihood ratio to find statistical differences, if any, between the frequency of nouns, verbs, and adjectives. In corpus studies, when comparing different sized datasets, chi-square value has often been performed to compare word frequencies across corpora; however, Rayson and Garside (2000) stated that log-likelihood tests are considered to have higher reliability than other statistical methods. Significance difference is tested by log-likelihood ratio which computes overuse and underuse of words. If the log-likelihood ratio is ±3.84 or more a significant difference exists between the two datasets at a 5% significance level. Rayson and Garside (2000: 40) described log-likelihood ratio as follows:

> "Log Likelihood has] the effect of placing the largest LL value at the top of the list representing the word whichhas the most significant relative frequency difference between the two corpora …. Words which appear with roughly similar relative frequencies in two corpora appear lower down the list.

General success of students was evaluated by two raters. These raters independently read the essays according an essay scoring rubric (developed by Oshima and Hogue 2006). Peat (2006) suggested that, because of their explicitly defined criteria, rubrics lead to increased objectivity in the assessment of writing. Results of this grading were first analyzed in terms of reliability. This analysis was done with SPSS 16. Program and Cronbach Alpha's of these grades were found.

RESULTS

The purpose of the study was to analyze and compare written corpora of two groups of students: those in the experimental group and those in the control group. First, lexical richness of two parallel corpora were analyzed and compared. Three types of nouns in the noun category, three types of adjectives in the adjective category, finally, general verbs category were analyzed and compared. Type token ratio of each essay assessed and data from the experimental group and the control group were compared with SPSS 16. Independent samples T-test.It was found that there is no statistical significant difference between two groups in terms of lexical richness.
Nouns are one of the most frequent words that were used both in essays of the experimental group and the control group. Out of 25027 words with 6134 concordances, common nouns constitute 24,5 %of corpus of the experimental group. Percentage of singular nouns, with 4115 concordances, is 16,5 and %8 of corpus is plural nouns, with 2019 concordances; while, in the control group common nouns are %20,5,with 3260 concordances, singular nouns are %14,8, with 2351 concordances, and plural nouns are %5,7, with 909 concordances.

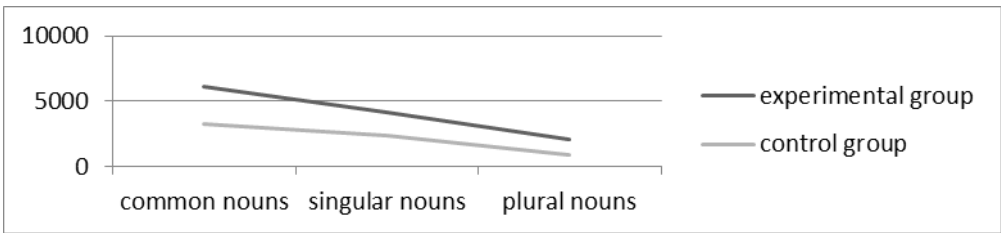

Figure 1:Noun distribution according to its subclasses.

Frequency of nouns in two corpora of students was compared with log-likelihood ratio in order to detect the results of the treatment. Concordances of singular common noun, singular noun + nominalization and plural noun + nominalization were found. The results of Log-likelihood ratio showed that there is a significant difference between writings of students in the experimental group and the control group (LL=65.54 $p < 0.05$ (critical value: 3.84). Findings indicated a significantly higher frequency of use in the experimental group corpus relative to nouns compared to the control group corpus. Depending on the findings in the noun frequency, it can be said that reading strategies, text mining and imitating had a fostering impact on students' use of common nouns in their essays.

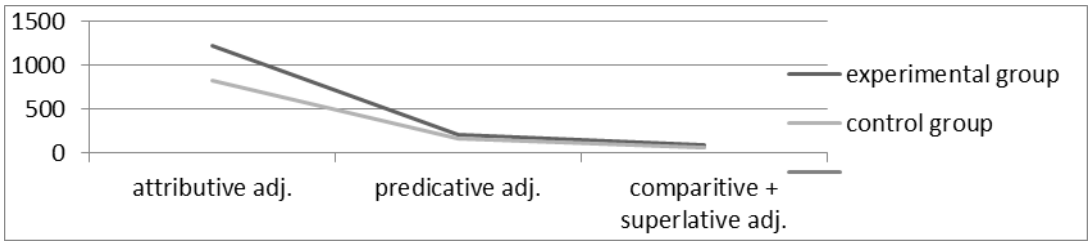

Figure 2. Adjective distribution according to its subclasses

Attributive adjectives constitute 4.9 % of corpus of the experimental group with 1226 concordances out of 25027 words while this number is 5.23% in the control group. Adjectives with predicative function constitutes 0.86% in the experimental group with 214 concordances; 1.03% in the control group. Frequencies of comparative and superlative adjectives were computed together and results showed that frequency of these adjectives is 0.36% in the experimental and 0.35% in the control group.

Log-likelihood ratio results indicated that there is no significant difference between the experimental and the control group in terms of use of frequency of adjectives in their written productions (LL = 2.13, 3.17, 0.03 < 3.84)

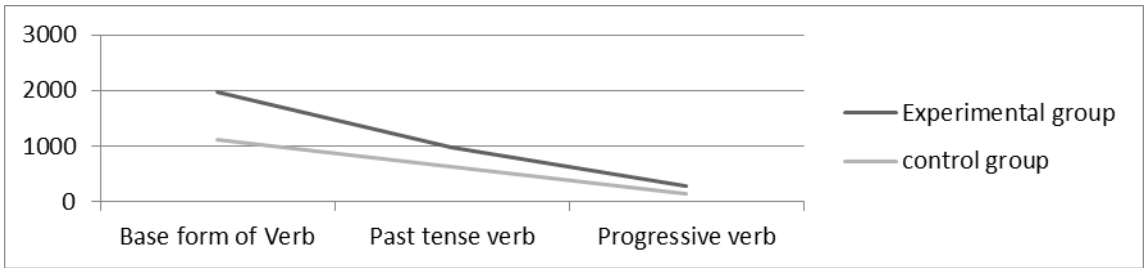

Figure 3: General verb distribution according to its subclasses

Verbs have been investigated in writing samples in terms of base form of a verb, past tense verbs and progressive verbs. Base form of verbs constitute 7,86 % of corpus of the experimental group with 1967 concordances while this number is 7,09 % in the corpus of the control group with 1122 concordances. Students in the experimental group used past tense verbs 966 times, % 3,86 of corpus, while students in the control group used it 633 times, % 4 of their corpus. Progressive verbs were used 286 times (%1,14) by the experimental group; 129 times (%0.82) by the control group.

Log-likelihood ratio showed that there is a statistically significant difference between two groups of students in terms of use of base form of verbs (LL=7.66 >3.84) and use of progressive verb (LL= 10.55 >3.84) in their essays. However, it was found that there is no statistically significant difference between two groups in terms of use of past tense verbs.

The last research question was related to general success of students in writing in terms of essay grading. Two independent raters graded papers according to Essay Scoring Rubric (developed by Oshima, Houge and Butler in 2006. To measure of internal consistency of two raters, Cronbach's Alpha Coeeficientwas calculated by using Spss 16. The alpha coefficient for the two items is .89, suggesting that the items have relatively high internal consistency. A paired-samples t-test was conducted to compare two compositions of the participants. The analysis indicated a significant difference in the scores of the experimental group (M=80.59 SD=5.857) and of the control group (M=69.17 SD=10.027), t(97)=-11.067 p=.000.

DISCUSSION AND CONCLUSION

The present study aimed to investigate the impact of text mining and imitating strategies on lexical richness, diversity and on general writing success of the students. With regard to first research question**,** the statistical analysis of two parallel corpora indicated that there is no significant difference between two groups in terms of type token ratio. As lexical richness is directly related with the quality of written and spoken language produced by learners of second language, at the start of the study, it was assumed that students in the experimental group will have better lexical richness ratio, related to this assumption, it was thought that these students will have statistically significant higher levels of lexical richness. However, tough not statistically significant, the "mean" of lexical richness of the experimental group was higher than that of the control group, which shows there is a slight difference between these two groups. Having similar findings, Laufer (1991: 445) examined written compositions of advanced L2 learners of English and found no improvement in lexical richness over two semesters. Upon this result, Laufer proposed the "active vocabulary threshold hypothesis" which assumes that "passive vocabulary knowledge may continue to develop throughout the lifespan, but "our productive lexicon will grow only until it reaches the average level of the group in which we are required to function." This model may give answers to contradictory results regarding the relationship between lexical richness of the control group who were expected to have significantly lower level of lexical richness and the experimental group vice a versa. From a pedagogical point of view, it can be concluded that lexical richness can be used as a diagnostic tool to identify vocabulary choice of students; however, it cannot be used as a tool that helps discriminate type token ratio of student writings.

With regard to second research question which was concerned with lexical diversity of student writing, the results showed that there is a statistically significant difference in terms of general nouns between the experimental group and the control group. When zoomed in on finer-grained subclasses, statistical analysis also showed that there is a significant difference between two groups in terms of use of plural and singular nouns. The results of the statistical analysis showed no significant difference between two groups in terms of use of attributive, predicative and comparative+ superlative adjectives. Statistical analysis of general verb category showed a significant difference in terms of use of base form of verbs and progressive verbs between two groups of students. As for the effectiveness of text mining and imitating, one cannot deny the value of these strategies in improving student use of general nouns in their essays. This result may stem from the fact that students who analyze model essays tend to use more nouns because of the fact that they have acquired new words incidentally from reading, and their awareness on use of nouns has increased. Similar to this result, Elgord and Warren (2014) investigated acquisition of second language (L2) vocabulary from reading authentic text. The study revealed that number of encounters with new words in reading helped learners gain explicit word knowledge. Similarly, Ponniah (2001) conducted a study on incidental vocabulary learning. He compared performance of the students who devoted their time to reading, and the students who learned meaning of words consciously to develop their vocabulary knowledge. Results of the study showed that the group who tried to learn subconsciously from their readings could use words that they have learnt in sentences while learners who spend their time learning meanings of words from dictionary could not use the previously unknown words in sentences. This study shows that words that are leant incidentally are retrieved better during writing process and learners can put their knowledge of new words into practice better when they read and learn a new word. As text mining requires learners to purposefully dig out for valuable information, it can be thought to include both incidental and intentional word learning. It can be concluded that reading strategies such as text mining and imitating may facilitate both incidental and intentional word learning. This result shows that it will be beneficial for teachers of English to provide their learners with model essays by using text mining and imitating strategies as a pre-writing activity.

General success level of the students in the experimental group has been found to be statistically significantly higher. The most obvious reason for this success may be the opportunity to mine and imitate model essays as pre writing activities which served students as a source of example for rhetorical functions of a text. When had chance to analyze these model essays and see choices in language, students' awareness on how to use what word where has increased, which resulted in better performance in their writing.

LIMITATIONS AND SUGGESTIONS

In this study, impact of reading strategies on writing performance of students, on lexical items in specific, was investigated. Taking number of students (59 in the experimental; 39 in the control group) into account, the results of the study cannot be generalized. However, this study may give a reference point for further research. It is believed that replications of this study with more students at different age levels and educational backgrounds in various ELT contexts such as compulsory service English classes and preparatory English courses will contribute to the field. This study lasted two months, if it were longer, it may have given

more significant results as means of two groups indicate that students in the experimental group use higher rate of parts of speech.

Further research might be conducted to shed light on the use of all categories of parts of speech and discourse markers.

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Implementation of Online Peer Assessment in a Design for Learning and Portfolio (D4L+P) Program to Help Students Complete Science Projects

Karntarat Wuttisela
Faculty of Science, Ubon Ratchathani University, Warinchamrap, Ubon Ratchathani 34190, Thailand
Research and Innovation in Science Education Center, Ubon Ratchathani University, Warinchamrap, Ubon Ratchathani 34190, Thailand
karntarat.w@ubu.ac.th

Sura Wuttiprom
Faculty of Science, Ubon Ratchathani University, Warinchamrap, Ubon Ratchathani 34190, Thailand
Research and Innovation in Science Education Center, Ubon Ratchathani University, Warinchamrap, Ubon Ratchathani 34190, Thailand

Sonthi Phonchaiya
The Institute for the Promotion of Teaching Science and Technology, Phra Khanong Subdistrict, Klong Toei District, Bangkok 10110, Thailand

Sayant Saengsuwan
Faculty of Science, Ubon Ratchathani University, Warinchamrap, Ubon Ratchathani 34190, Thailand

ABSTRACT
Peer assessment was one of the most effective strategies to improve students' understanding, metacognitive skills, and social interaction. An online tool, *Designing for Learning and Portfolio (D4L+P)*, was developed solely to support the T5 (tasks, tools, tutorials, topicresources, and teamwork) method of teaching and learning. This research used the D4L+P program ina project-based learning (PBL) approach and developed a marking scheme rubric as a topic resource in a task to improve peers' abilities as assessors. The objectives of this research were to compare the points offered for effort to plan proposals for science projects and the points offered for effort to give feedback, and also to analyze students' reflections as evaluators of the science projects using the D4L+P program compared to the reflections of teachers and experts in PBL. The participants were twenty-five grade 10 students aged 15 and 16 in a science enrichment program, 15 teachers, and five experts Findings showed that 94% of students preferred giving suggestive feedback about doing science projects. Results also indicated that the students and the experts had similar patterns of giving feedback (suggestive-corrective-reinforcing) while the teachers' patterns emphasized reinforcing feedback. The researchers regard the use of the D4L+P program with the marking scheme rubric in a PBL approach as an alternative learning strategy that requires students to practice the giving of suggestive feedback online.

Keywords: online peer assessment; D4L+P program; project-based learning; science project

INTRODUCTION
A number of researchers (Tsivitanidou, 2016; Liu, 2013; Freeman, 2002) found that web-based peer reviewswere an effective instructional strategy and innovative assessment method to encourage students to be constructive and focus on the improvement of thequality of their work. Peer interaction constructs conflictedwith their existing knowledge and resulted in disequilibrium. However, through dialogues, questions, and discussions with peers, a new equilibrium with higher understanding (Piaget, 1959, cited in Fawcett & Garton 2005) and cognitive development of the learners (Vygotsky, 1978) was reconstructed. Peer assessment was a process in which students or their peers graded assignments based on teachers' criteria (Sadler, Good, 2006; Tenorio, 2016a). This practice improved their understanding, social interaction (Sobhanian, 2016), and metacognitive skills (Yusuff, 2015).

In the performance of science projects, it was found that students lacked skills in the setting of research questions (Wuttiprom et al, 2016) and peer assessment (Ballantyne, 2002; Ng, 2016), and Wong et al. (2016) stated that students preferred online and teacher assessment. Tenorio et al. (2016b)revealed that the provision of points and medals by teachers encouraged students to participate more frequently in peer assessment, and support guidelines were essential to develop good feedback skills.Kritikos et al. (2011)found that peer discussions in PBL tutorials provided opportunities for students to learn from peers and Hou et al. (2007)indicated thatin-depth considerations of peers' reports resulted in the improvement of the quality of projects.

A survey of the behaviour of internet users in 2015 showed that people aged between 15 and 34 years were thosewho accessed the internet the most, totalling eight hours per day. Also, 92.1% and 85% of them accessed

Facebook and Line respectively (Electronic Transactions Development Agency, 2015). Generally, these two programs were used to exchange opinions with family and friends, and for academic purposes (Kirschner and Karpinski, 2010). Facebook and Line programs are powerful tools of instructional design in the 21st century in terms of the enhancement oflearners' reflective skills. Reflection was a process of systematic consideration of knowledge or experiences to comprehend them to conceive how knowledge and experiences are meaningful and affect the individual and others. The process enhances the potential of learners to be skillful in the solution of complex problems or unpredictable situations (Mann et al., 2009). However, these programs have a limitation on systematic learner assessment.

In response to this situation, the researchers developed a learning management system based on Richards and Sophakan (2006)called the *Design for Learning and Portfolio (D4L+P)* and created a learning environment based on a co-operative learning approach called the T5 learning model which emphasized Tasks (learning tasks with deliverables and feedback), Tools (for students to produce the deliverables associated with the tasks, which was D4L+P in this case), Tutorials (online support/feedback for the tasks integrated with the tasks), Topics (content resources to support the activities), and Teamwork (role definitions and online supports for collaborative work) (salter et al., 2004). Learning tasks require students to engage in the course content to produce a deliverable artifact. The deliverables and feedback to these deliverables were the primary vehicles for learning. The relations among these components are illustrated in Figure 1.

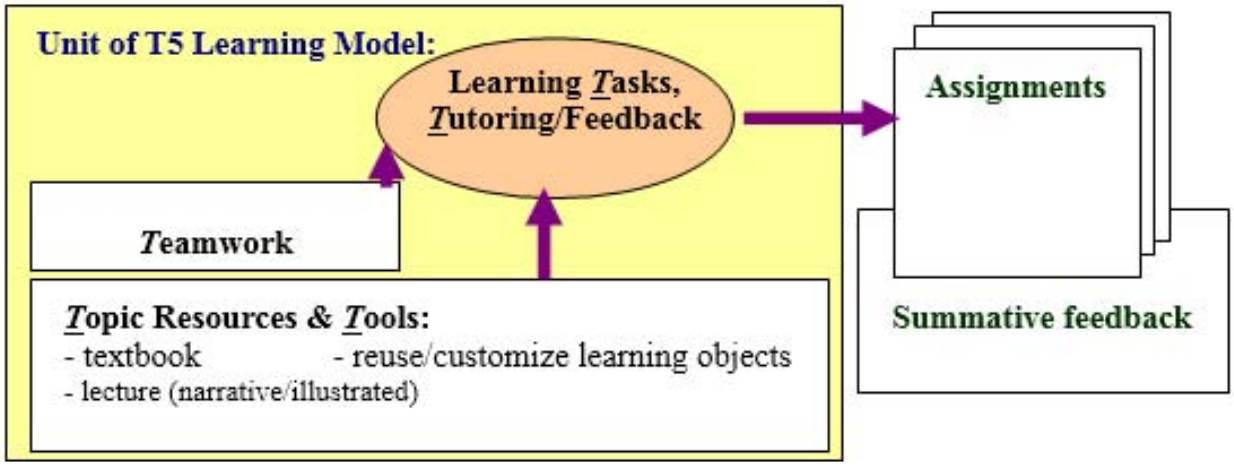


Figure 1: Unit of T5 learning model (Buzza et al., 2005)

This program was incorporated in a project-based learning approach in an 'information management' subject and it made use of coding to classify online discussion content into groups.

The tutorials part was the instructional design for adults (andragogy) (Cross, 1981) which strengthened students' fundamentals to complete science projects equivalent to university students' research, and encouraged active learning and social constructionism. Research revealed that the application of the D4L+P program efficiently increased conceptual understanding (Wuttiprom and Chaiwatthana, 2014), learning achievement (Supasorn, 2014), and the positive attitude of learners towards instructional design (Wuttisela, 2014). The researchers agreed that the main reason for the use of the D4L+P program was the increased peer collaboration and discussion and fewer overdue assignments. It also recorded the history of feedback, similar to WIDE (Hou, Chang, and Sung, 2007), a program called*web-based instructional design environment*that contained a feature by which students were able to give feedback online.

However, there was a lack of research that links D4L+P to PBL, an instructional design that creates a new learning skill for the 21st century in which communicating, co-operating, finding and evaluating information, creating and innovating, problem-solving, and analytical thinking are required. To address this lack of research, this study applied the D4L+P program to PBL instructional design in science.

OBJECTIVE

1. To compare points awarded for effort to plan science projects and points awarded for effort to give feedback
2. To analyze students' reflections on the D4L+P program as evaluators of science projects compared to the reflections of the teachers of the science projects and experts

METHOD

Participants

Data were collected from a group of 25 outstanding grade 10 students aged 15 and 16 in an enrichment science classroom program which focused on the development of creativity in research and science project management skills. Data were also collected from 15 teachers and 5 experts from a published article by two of the researchers of this study (Wuttiprom et al., 2014).

Procedures

The instructional activity of PBL in this research was designed to allow the students to take the roles of persons who gave feedback and assessed this feedback through the D4L+P program.

The steps in the procedure were:

1. Engagement in PBL instructional design. The sample group engaged in PBL instructional design with the teacher who taught science projects for three months.
2. Participation in a workshop. The sample group participated in a three hour workshop with the researcher on the principles of giving feedback for each part of a science project (Table 1). The researcher uploaded teaching material to the D4L+P program as a checklist as a guideline of project proposal assessment (Table 1). The teachers and experts gave feedback without a checklist.

Table 1: Guideline for feedback for each part of a project

Parts	Guideline for Suggestions
Title	□Title includes independent variable and dependent variable □Title is comprehensible and implies the content of the project
Background and significance	□The answer to the "Why" questions, such as why does pineapple shell accelerate the growth of plants?
Objective	□Each objective contains independent variable and dependent variable □The project has two parts, so that there are two objectives
Hypothesis	□Predict the answer with reasons connected to scientific theory
Independent variable	□The factor deliberately changed in an experiment □Identify the independent variable in all steps if there are many parts to the experiment □Identify the type or quantity, such as type of soil or quantity of soil □Be measurable by scientific tools
Dependent variable	□ The amount that results from the independent variables □Identify dependent variables in all steps if there are many parts to the experiment □Be measurable by scientific tools
Controlled variable	□Results will be erroneous without controlling this factor
Experiment design	□Has only one independent variable □Others can follow the instructions and get the same results □Identify quantity of solid as gram and mL for liquid □Identify the reasons why certain chemicals are required in each step □Establish that the experiment is reliable and valid □Continue Part 2 with the best experimental results of Part 1 □Establish that the experiment is reliably based on scientific principles

3. Writing of the project proposal. Each student wrote a project proposal on the designed form, the topic being based on individual interest.
4. Upload of the proposal. After the due date for proposal submissions, all students were required to upload the proposal file onto an online system (D4L+P). The system randomly shared proposal files and each student received three proposal files.
5. Students' reflection and evaluation. Each student gave feedback for the project proposals of the three files and assessed the project proposals based on Marking Scheme Rubric (Table 1). Points for effort were awarded (1 to 5) for completion of the proposals.
6. Completion of peer assessment. Each student read the feedback from the peers and assessed the students' reflections received from the peers. Points for effort were awarded to the peers giving feedback (1 to 5).
7. Group discussion and revision of project proposals completed. The students discussed and revised the project proposals based on the peers' feedback.
8. Completion of discussions with teacher. Teacher and students discussed interesting aspects.

All the steps had clear submission dates and times on the D4L+P system. Students who were overdue were not allowed to submit the tasks.

Data Analysis

The students' reflections were divided by two researchers into three categories: corrective feedback, reinforcing feedback, and suggestive feedback (Chi, 1996). The division into these categories by the two researchers (Tseng and Tsai, 2007) was found to be consistent at a rate of 80%. The students' inconsistent reflections were discussed again by the researchers and a consensus was reached.

FINDINGS AND DISCUSSION

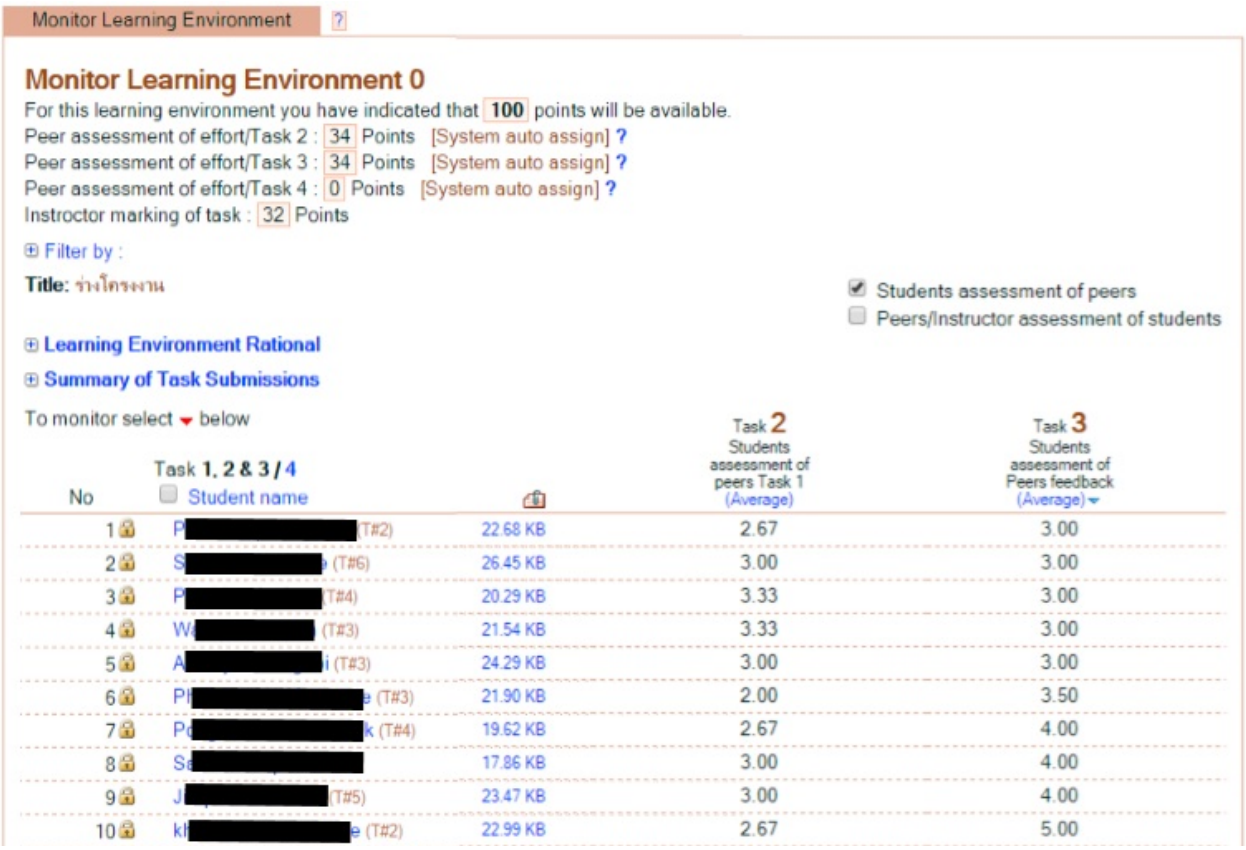
Part 1 Comparison of points awarded for effort to plan a science project and points for effort to give feedback

In the D4L+P program, the students submitted proposals in Task 1 before the reviewer gave a score and comment. To minimize bias, multiple reviewers were used in a peer assessment process (Tseng and Tsai, 2007).The program sent a score and comment back to the reviewee without the name of the reviewer. Therefore, the D4L+P system required students to give and receive feedback with a blind review. The system not only gave feedback but also required the students to award points for effort to peers. Generally, students gave points for effort to do a science project in task 2 and gave feedback in task 3 at averages of 2.86 and 3.55 (Figure 2) out of 5 respectively. These indicated that students attempted to do proposals of science projects and gave feedback at moderate and high levels respectively. A possible reason for the points for effort to give feedback being higher than to do the proposals of science projects may be because this research promoted giving suggestive feedback based on the marking scheme rubric. This meant that the students had more guidelines for giving feedback on projects, similar to the online peer assessment task of Tseng and Tsai (2007).Wong (2016) agreed with this finding that the students still needed forms of assessment to improve their skills to develop expertise in the future.

In regard to the peer reviews, students read three peer proposals and the rubric and also gave scores and feedback. These were cognitive activities to improve the review process, the projects, the students' reading and writing skills, and the promotion of active student-centered learning. Further studies are required to investigate the quality of peer feedback and students' ability to write the final reports of science projects.

High scores in peer assessment revealed that the students preferred peer interaction. However, previous research REF? stated that students preferredpeer assessment and teacher assessment. This may be due to the fact thatteacher assessment may help students to gain more knowledge and provide better guidance.

Scores for the proposals of the science projects were lower. Freeman (2002) believed that such scores may be improved by students' self-assessment before submission of their work. Self-assessment with the marking scheme rubric similar to Task 2 may increase the scores and enhance the quality of the proposals.



Monitor Learning Environment

Monitor Learning Environment 0

For this learning environment you have indicated that 100 points will be available.
Peer assessment of effort/Task 2 : 34 Points [System auto assign] ?
Peer assessment of effort/Task 3 : 34 Points [System auto assign] ?
Peer assessment of effort/Task 4 : 0 Points [System auto assign] ?
Instroctor marking of task : 32 Points

Filter by :

Title: ร่างโครงงาน

Students assessment of peers
Peers/Instructor assessment of students

Learning Environment Rational
Summary of Task Submissions

To monitor select below

Task 1, 2 & 3 / 4

No	Student name		Task 2 Students assessment of peers Task 1 (Average)	Task 3 Students assessment of Peers feedback (Average)
1	[redacted] (T#2)	22.68 KB	2.67	3.00
2	[redacted] (T#6)	26.45 KB	3.00	3.00
3	[redacted] (T#4)	20.29 KB	3.33	3.00
4	[redacted] (T#3)	21.54 KB	3.33	3.00
5	[redacted] (T#3)	24.29 KB	3.00	3.00
6	[redacted] (T#3)	21.90 KB	2.00	3.50
7	[redacted] (T#4)	19.62 KB	2.67	4.00
8	[redacted]	17.86 KB	3.00	4.00
9	[redacted] (T#5)	23.47 KB	3.00	4.00
10	[redacted] (T#2)	22.99 KB	2.67	5.00

Figure 2: Points for task 2 and task 3 in D4L+P program

Part 2 Analysis of students' reflections on the D4L+P program as evaluators of science projects compared to the teachers' and experts' reflections

The researchers classified the students' reflections as evaluators of science projects into three categories: 1) Corrective feedback – given when incorrect facts were stated – for example, information that the province of Ubon Ratchathaniplanted the most rice was incorrect and the year of reference was not identified; 2) Reinforcing feedback – given to encourage students' good work – for example, good content; 3) Suggestive feedback – given to make suggestions to students about incomplete information – for example, did you study the nutrients of the preserved ants' eggs?

Comparisons of the percentages of the feedback of the experts and teachers based on information from the research of Wuttiprom et al. (2014) and the percentages of the feedback of the students in this study are shown in Figure 3.

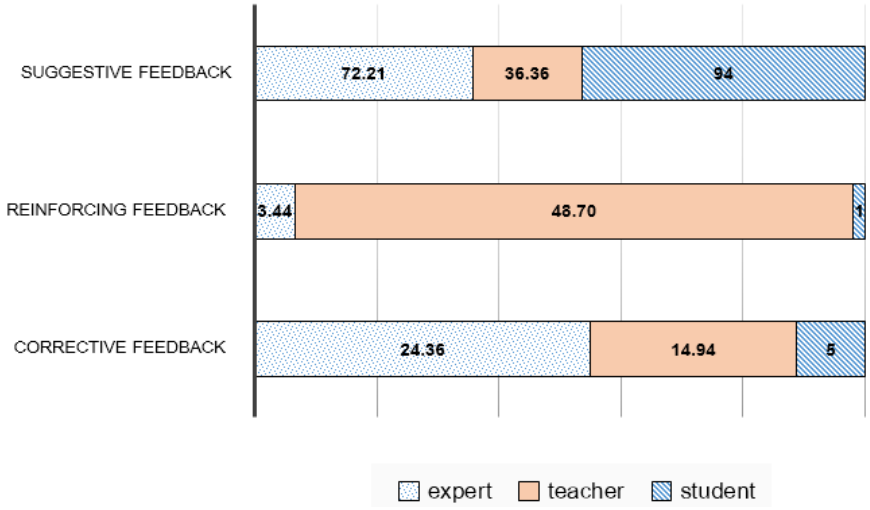


Figure 3: Bar chart displaying percentages of feedback of the teachers, experts, and students

Just under half (48.7%) of the teachers gave reinforcing feedback which helped improve students' projects more than corrective feedback (Tseng and Tsai, 2007). In contrast, only 3.44% of the experts' feedback was reinforcing and 72.21% was suggestive, while 94% of the students' feedback was suggestive (Figure 3).

Samples of students' feedback given for the project 'Ant egg preservation for out of season consumption' in the D4L+P program are shown in Figure 4. Most of students gave intensive, comprehensive, and systematic suggestions and followed the rubric.

These results showed that the researchers had provided guidelines for suggestive feedback in the topic resource and most experts also gave this type of feedback (Wuttiprom et al., 2014). The feedback was very useful for the students in the sample group of this research who had just started working on the first step of the projects (Tseng and Tsai, 2007).

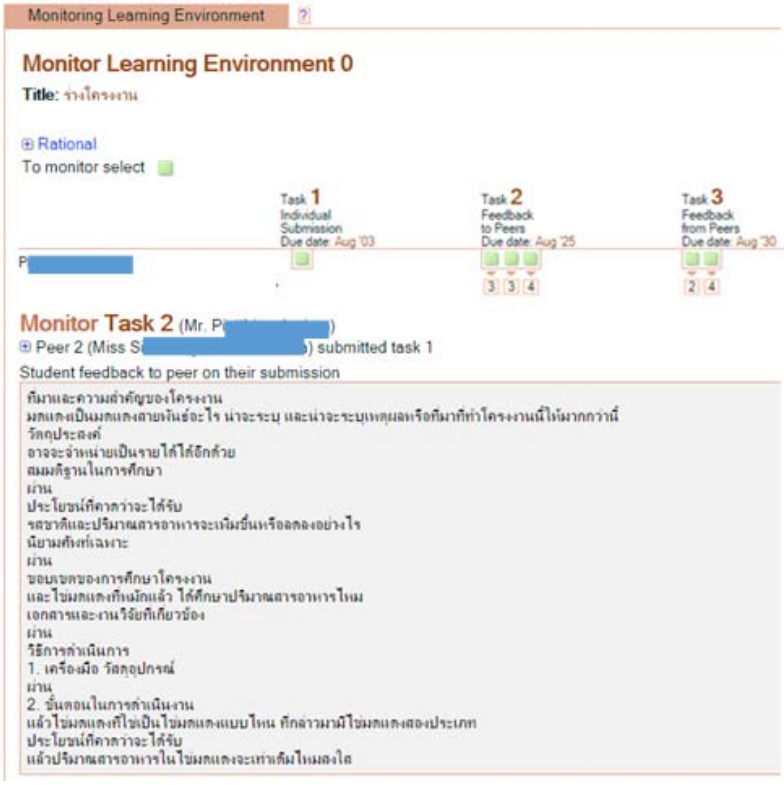


Figure 4: Feedback for Task 2 in D4L+P program for science projects

Cross (1981) stated that providingstudents with opportunities to offer feedback about science projects with the D4L+P program helped them to think as adults. It was found that 5% of students' feedback and 14.94% of teachers' feedback was corrective, which was less the 24.36% made by the experts. This was due to the students' and teachers' lack of experience and fundamental knowledge. However, the 94%of students who gave suggestive feedback was greater than the 72.21% and 36.36% of the experts and teachers respectively.

Advanced feedback might be generated in many ways to improve assessment (Liu, 2013). The marking scheme rubric of the peer assessment system in the D4L+P program decreases teachers' workloads(Rubin, R. F. & Turner, T., 2012) in the provision of suggestive feedback and promotion of skill in the delivery of good feedback.The program may help to solve problems of online peer assessment arising from students' lack of confidence in the performance of peer assessments (Ng, 2016).

The researchers state that the D4L+P program can be incorporated within the T5 learning model. It can also be integrated into the PBL approach when teachers ask their students to practice reflection or give feedback as it provides them with opportunities to criticize others' work and may help improve their own work. The D4L+P program may be an alternative for teachers who use other learning approaches but require students to practice giving feedback online, such as the use the D4L+P program for formative assessment by peers of students' plans or in presentation sessions in STEM education.

CONCLUSION AND FUTURE DIRECTIONS

This article reported the use of the D4L+P program to assist PBL instructional design to enhance academic social interactionin regard to science projects. This was done by thecomparison of the points offered for effort to plan proposals for science projects and the points offered for effort to give feedback, and the analysis of students' reflections in relation to those of teachers and experts.The average scores for making an effort to give feedback and to plan science projects were 3.55 and 2.86 respectively. These scores indicated that the students attempted to give feedback and plan the science projects at high and moderate levels respectively. Data showed that they had confidence in the performance of peer assessments. As evaluators of the science projects, the percentages of students and experts who made reflections that were classified as suggestive feedback were greater than the percentage of teachers. The percentage of students who gave suggestive feedback was more than that of the experts but the percentage of students that gave corrective feedback was less. Results indicated that the marking scheme rubric incorporated with D4L+P program can decrease teachers' workloads in regard to giving suggestive feedback.

This study has a number of limitations. These include thesmall sample size and the problem of generalization of the use of themarking scheme rubric for feedback to other disciplines. In the future, the researchers intend to compare the science process skills of students who provide reinforcing feedback and suggestive feedback.Off-campus users who wish to use the D4L+P program in their classroom may contact the webmaster by e-mail. The program requires further development for use by e-mail, Facebook, or line to inform students of new tasks.

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Inquiry-Based Learning for a Virtual Learning Community to Enhance Problem-Solving Ability of Applied Thai Traditional Medicine Students

Ong-art Chanprasitchai
Technopreneurship and Innovation Management Program, Chulalongkorn University, Bangkok, Thailand
Ongart10800@yahoo.com

Jintavee Khlaisang
Faculty of Education, Chulalongkorn University, Bangkok, Thailand
jinkhlaisang@gmail.com

ABSTRACT
The recent growth in collaborative and interactive virtual learning communities integrating innovative digital technologies and contemporary learning frameworks is contributing enormously to the use of e-learning in higher education in the twenty-first century. The purpose of this study was to describe the development of a virtual learning community system within the Applied Thai Traditional Medicine (ATTM) instruction context. This started with collecting data from ATTM students (n=303) from eight universities in Thailand. In addition, experts (n=30) in various areas of ATTM, educational technology, and assessment participated in semi-structured interviews. Using the information obtained, an online learning community system guided by the Community of Inquiry (COI) framework which incorporated advanced virtual innovations such as inquiry-based learning (IBL) activities was consequently developed. Test score results of students obtained before studying via the ATTM VCOI system showed that the sample group of 39 ATTM students had an average score of ability in problem-solving at 16.87 with standard deviation at 3.25. After studying with the system, they achieved an average score of 18.41 with standard deviation at 3.05. The results indicate that average test scores were statistically different at a 0.05 level of significance ($t = -2.140$, $p = 0.03$). Furthermore, the results also point to efficacy in regards to teaching, social and cognitive presences. The data collected indicates that use of the ATTM VCOI system can lead to a more collaborative community learning environment that can enhance ATTM students' problem-solving ability and improve the effectiveness of online learning in higher education in general and in ATTM instruction in particular.

Keywords: Community of Inquiry, Inquiry-Based Learning, Multi-User Virtual Environment, Problem Solving Ability, Virtual Community of Inquiry

INTRODUCTION
Digital technology-enhanced online learning offers opportunities for both scholars and educators to enrich their learning environments and improve learning ability through the integration of state-of-the art digital technology and a contemporary learning approach which uses the proper theoretical framework. It is not surprising that an increased number of scholars and educators have become interested in designing online learning platforms such as virtual worlds (VWs), three dimensional (3D) environments, or multi-user virtual environments (MUVEs).

To improve online learning, technology-enhanced environments can be blended with an inquiry-based learning (IBL) approach to optimize the design and development of virtual online learning activities since IBL makes it possible for more meaningful and self-regulated learning by motivating learners to generate their own problem-solving procedures (Hwang, Tsai, Chu, Kinshuk, & Chen, 2012). Owing to the richness of virtual multimedia features, learners are able to take advantage of various synchronous and asynchronous communication platforms in order to collaboratively work together and exchange ideas and experiences through IBL procedures within the same 3D virtual learning environment. Recently, there have been attempts to appraise the effectiveness of virtual learning platforms through the Community of Inquiry (COI) framework which has increasingly been adopted to prescribe online learning effectiveness through the interplay of three core components: teaching, social and cognitive presences. The interrelationship among the three presences is most widely influenced by cognitive presence (Kozan & Richardson, 2014). Several studies have been conducted to employ the COI framework in virtual world-oriented activities to provide and promote social and collaborative activities among users through a wide variety of learning situations to yield more positive results (Pellas, 2016; Haynes, 2016; Burgess, Slate, Rojas-LeBouef, & LaPrairie, 2010; Dalgarno & Lee, 2010). Despite several COI models having been developed

for educational use in a wide range of subjects, there remains a need for a virtual COI (VCOI) system which can be used in the teaching and learning of Thai Traditional Medicine (TTM).

TTM has been used to treat the health problems of Thai people for centuries. However, in recent years, TTM has become much more popular among Thai people who turn to it as an alternative to modern medicine as well as those who to preserve its practices. It is widely recognized that the local wisdom and experience in practicing TTM are disappearing and that there has been a substantial inter-generational loss of traditional medical knowledge. As such, many Thai universities now offer Applied Thai Traditional Medicine (ATTM) programs with the aim to produce professional ATTM personnel who possess the essential cognitive and interpersonal skills. As this becomes incorporated into the mainstream educational system, ATTM students will need to have the necessary information and communication technology (ICT) skills to enable them to acquire and share knowledge in the university environment so that they make an accurate diagnosis of health problem in real life. The accuracy of diagnosis is fundamental indication of the quality and standard of TTM which is being offered by Thai health care providers not only to treat Thai patients but as part of the country's mission to become a hub for medical and spa tourism in the South East Asian region (Hunter, 2012).

Research questions:

1. What are the main components and processes necessary for the development of an ATTM VCOI system to be used to enhance Thai Traditional Medicine learners' problem-solving ability?
2. What are the results after implementing the developed ATTM VCOI system as a way to improve of Thai Traditional Medicine learners' problem solving ability?

Objectives:

1. To develop an ATTM VCOI system in order to strengthen the to problem-solving ability of Thai Traditional Medicine learners.
2. To test the developed ATTM VCOI system to enhance the problem-solving ability of the learners of Thai Traditional Medicine.

REVIEW OF THE LITERATURE

Community of Inquiry Framework

The Community of Inquiry (COI) framework developed by Garrison (2011) along with Garrison, Anderson, and Archer (1999) is based on three frameworks, including socio-constructivism, reflective thinking, and practical inquiry. The COI framework also comprises three main components: teaching, social and cognitive presences, based on the premise that learning takes place by way of the interaction. This framework has increasingly embraced the development of online learning environments to guide learners towards collaborative involvement in purposeful critical discourse and reflection on activities that construct personal meaning and ensure mutual understanding. Generally speaking, teaching presence is the ability to organize and monitor learning activities and environment in three respects: design and organization, discourse facilitation, and direct instruction (Stenbom, Hrastinski, & Cleveland-Innes, 2012). Social presence refers to the extent to which learners are able to present themselves socially and emotionally within a learning community by means of open communication, group cohesion, and affective expression (Garrison, Cleveland-Innes, & Fung, 2010). According to Richardson and Ice (2010), cognitive presence is considered the heart of the COI framework and is described through the Practical Inquiry Model of learning that consists of four phases: triggering, exploration, integration, and resolution. The categories and indicators of each of the three presences that form the COI framework are shown in Table 1.

Table 1: Community of inquiry categories and indicators (Garrison, 2011)

Presences	Categories	Indicators
Teaching presence	Design and organization	Setting curriculum and methods
	Facilitating discourse	Shaping constructive exchange
	Direct instruction	Focusing and resolving issues
Social presence	Personal/affective	Self projection/expressing emotions
	Open communication	Learning climate/risk-free expression
	Group cohesion	Group identity/collaboration
Cognitive presence	Triggering event	Sense of puzzlement
	Exploration	Information exchange
	Integration	Connecting ideas

	Resolution	Apply new ideas

There have been a number of different terms used to describe various inquiry activities in recent years, which make the core phases and processes of inquiry-based learning difficult for new designers and instructors to understand (Pedaste et al., 2015). Consequently, as the central learning method, IBL activities are essential developed to provide more authentic tasks or problems to maximize the effectiveness of students' learning. Dabbagh and Dass (2013) pointed out that it is necessary to place students in authentic environments where they can learn meaningfully by connecting their prior knowledge with the real-world events while engaging in learning activities. Such integration of collaboration and appropriately guided inquiry learning are increasingly being incorporated into MUVEs by researchers.

It is evident from the literature that the implementation of the COI framework into online learning has been well-documented. This indicates that the COI framework can serve as a reliable framework for appraising the extent of teaching, social, and cognitive presences in MUVEs (Mouzouri, 2016; Pellas, 2016; Shea & Bidjerano, 2009).

Educational MUVEs

Essentially, 3D educational MUVEs are employed to afford greater interaction among learners as well as other software-based agents, represented by characters called avatars, as part of an open-ended exploratory environment (Erlandson, Nelson, & Savenye, 2010). 3D MUVEs can be beneficial in both teaching and learning due to their various characteristics. As noted by Rahman (Rahman, Yahaya, Halim, & Phon, 2013), they offer a realistic and immersive virtual environment, provide a flexible and persistent environment, support verbal and non-verbal communication, and allow users to create and manipulate their world and virtual objects, including letting them adjust the point of view to see their world from different perspectives.

Furthermore, it is suggested that there are several variables that affect the development of COI-based MUVEs, for instance, computer self-efficacy (Pellas & Kazanidis, 2014), situational interest (Pellas & Kazanidis, 2014), teaching behaviors which increase social presence based on guiding discussion and giving feedback to support interaction and collaboration (Akyol & Garrison, 2011), and technology via the use of media and technology tools to prefigure social presence (Kim, Kwon, & Cho, 2011). Moreover, a number of researchers have proposed providing meaningfully situated learning environments in which students acquire problem-solving abilities and knowledge during their participation in gaming activities (Ata, 2016; Simsek, 2016; Pellas, 2016; Panagiotis, Michael, Chris, & Dennis, 2014; Pellas, 2014).

Problem Solving Ability

Various researchers have identified problem-solving ability as being at the heart of learning and thinking (Gunduz, Alemdag, Yasar & Erdem, 2016; Karyotaki & Drigas, 2016; Yoo & Park, 2014). According to the Qualifications Framework for Higher Education in Applied Thai Traditional Medicine, cognitive skill similarly refers to the ability to analyze scenarios based on proper knowledge and understanding of theories, principles, and processes so as to deal effectively with problems in various clinical situations. In view of this, it is clear that it is important to enhance TTM students' problem-solving ability (Yoo & Park, 2014; Hwang, Wu, & Chen, 2012) through IBL activities which can make learning more meaningful and self-directed by establishing problem-solving procedures. As a result, this study employed a 3D MUVE as the learning method so that learners could interact with various situated objects (including images, sounds, and other multimedia contents) while communicating and collaborating with other learners to diagnose and resolve clinical problems.

RESEARCH METHODOLOGY

Informants and Instruments

As research question one proposed the development of an ATTM VCOI system, this study gathered information from informants using various instruments. The instruments were incorporated into an application used by 303 ATTM students from eight different universities using a survey questionnaire. Other participants were: 15 ATTM experts, 10 educational technology experts, and 5 educational assessment experts, who participated in semi-structured interviews. By using these two main research instruments, this study obtained information which proved adequate for the analysis. The survey questionnaire consisted of both close-ended and open-ended questions focusing on demographic background, ICT background, situational interest, and collaborative style. This approach for evaluation was required to develop an appropriate design for a learning environment which enhances the learners' ability to solve problems. Moreover, the semi-structured interviews served as a way to elicit information from 30 experts regarding: the processes and components of activities to improve problem-solving ability through an ATTM VCOI system, the most suitable technology for the development of the system, and the roles of the system's members. In order to answer research question two, the ATTM VCOI system was tested with 39 third-year undergraduate ATTM students of the faculty of Applied Thai Traditional Medicine at

Mahasarakham University in Thailand, who were enrolled in the Applied Thai Medicine class.

Data Collection and Analysis

The data was collected over a period of two months, October to November 2013, with all questionnaires being delivered to all 303 ATTM students when they attended sport days at Thammasart University. After all participants checked off the closed-ended items, the results were summarized in percentages, as shown in Table 2. Responses to the open-ended questions were analyzed in a qualitative aspect.

Data collected from first to fourth year undergraduate students from eight different universities with programs in Applied Thai Traditional Medicine in Thailand (ATTM), ages from 18-23 years old, was analyzed to categorize the types of information resources appropriate to be used in the ATTM VCOI system. This system also needed to include technology that would encourage the exchange of information and communication of both among learners and between learners and instructors.

The semi-structured interviews were conducted with 30 experts in sessions of approximately two hours each in order to obtain the most accurate data. To better achieve this goal, all participants were recorded, and then all records were transcribed before being analyzed.

Table 2: Characteristics of learners and Need Assessment (n=303) in managing the ATTM VCOI SYSTEM

Characteristics of learners and Need Assessment	n	Percentage
1. Demographic		
Male	67	22.11
Female	236	77.89
2. ICT backgrounds		
Frequency of use of internet services:		
Surfing for information	272	89.77
Viewing images and multimedia content	245	80.86
Chatting	231	76.24
Participating in a Virtual classroom	186	61.39
Playing online games:	235	77.56
Playing role-play games	109	46.38
Playing simulation games	103	43.83
3. Situational interest	155	51.16
Learners' vocation		
Motivated problem-solving thinking & collaborative learning	178	58.75
Exchanged information and discussed in groups	167	55.12
Participated with experts in activities	166	54.79
Information resources suggested by learners to be included in the system:		
Texts		
Research articles	260	85.81
	131	43.23
4. Collaborative styles		
Students were interested in activities in which they were allowed to form their own groups	143	47.19
Instructors played important role in assisting learners during activities	186	61.38
5. Evaluation		
Related personnel in the evaluation:		
Instructors	247	81.52
Self-evaluation/assessment	194	64.03
Peers	130	42.90

The employment the ATTM VCOI system in the classroom was done in accordance with the research methodology suggested by Campbell and Stanley of One Group Pretest-Posttest Design to assess the students' ability before and after participating in the study over a six-week period. Records of pre- and post-tests were compared by means of t-test dependent to determine the development of learners' problem-solving ability. The ATTM VCOI system included a text chat feature so that users would have evidence of their participation. Coding was done based on category indicators for each presence of the COI framework, see [Table 1]. The coding procedure was to code the instructors and students' postings for each of three presences at the message-

level as a unit of analysis.

RESULTS AND DISCUSSION

The research results and discussion are divided into 2 parts according to the research question. The details are as follows:

(1) The input and processes of the VCOI was done by using the results of the survey questionnaire and the semi-structured interviews which were developed and further used for the design of the main process for development of the VCOI system. Then, the system design of ATTM VCOI was developed as a workflow to show the processes to enhance problem-solving ability for learners as shown in Figure 1.

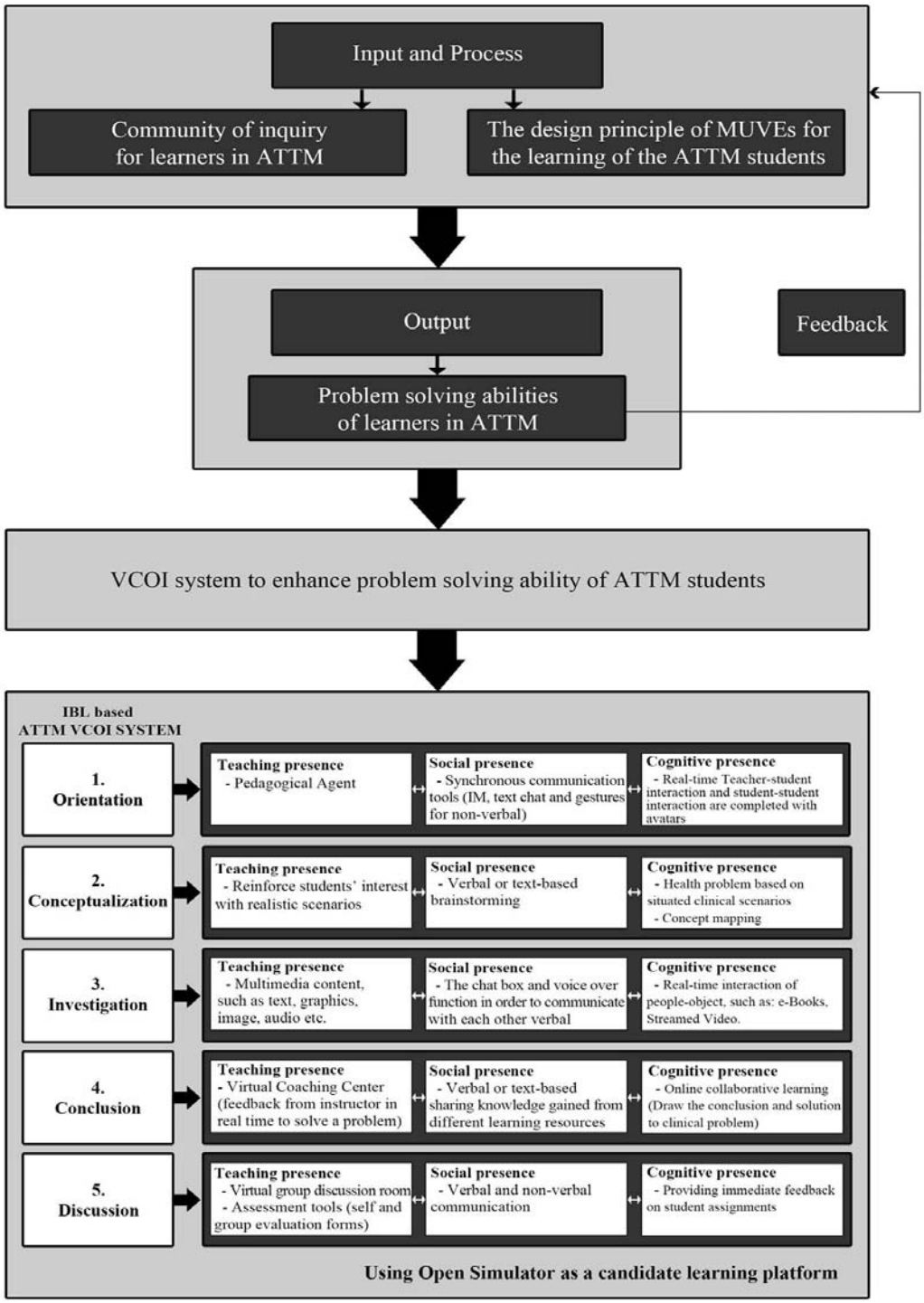

Figure 1: Workflow of the ATTM VCOI system to enhance problem solving ability

The design and development process of ATTM VCOI SYSTEM to enhance problem solving ability and learning

activities included 5 stages: Orientation, Conceptualization, Investigation, Conclusion, and Discussion. Details of each stage were as follows.

Stage1 aims to inform students about the learning method, roles of teachers and students, learning period, and the use of learning resources and communication tools. First of all, students have to create their own avatars, practice the avatars' navigational skills and visit virtual scenes in order to become familiar with the ATTM VCOI environment for effective learning of the ATTM VCOI system. To trigger teaching presence, teachers have to develop curriculum that meet ATTM students' needs and TTM learning objectives and guide students in how to do group collaborative IBL activities in the ATTM VCOI system. To trigger social presence, the ATTM VCOI system allows students to openly express their emotions through their self-representation avatars. When students have questions about the ATTM VCOI system, this will lead to a sense of puzzlement that triggers cognitive presence.

Stage2 is intended to situate clinical activities or events that kindle students' curiosity and motivate them to diagnose and resolve clinical problems. To trigger teaching presence, teachers and students are present in the virtual Inpatient Department (IPD) scene as avatars. Teachers inform students about content and objectives of activities and criteria for evaluating activities and also suggest learning resources. Activities within the virtual ATTM learning classroom should be adapted to students' ability and interest as well as TTM curriculum objectives so that students are more actively engaged in the assigned activities. The virtual ATTM learning classroom triggers social presence by providing richly emulated, real-time interaction among participants through, for example, interactive text or voice communication. To enhance cognitive presence, teachers can encourage students to connect their knowledge and experience gained in situated clinical scenarios in the ATTM VCOI system. In this stage, students formulate all possible hypotheses about health problems based on situated clinical scenarios. To generate the social presence, students can express and brainstorm opinions to explain situated clinical problem scenarios and the best opinion will be acknowledged and praised by group members. To trigger the teaching presence, teachers can give positive feedback to students to encourage them to do challenging activities and the virtual ATTM learning environment has enough places, such as group discussion rooms for students to chat, interact, and discuss clinical problems together in group. Teachers can recommend learning resources, such as concept mapping, for students to seek information to make hypotheses and form group ideas regarding identifying problems and causes.

Stage3, after students form possible hypotheses about clinical problems, they will seek further information to support their hypotheses. To promote teaching presence, teachers guide students to discover and construct knowledge on their own through group work within the ATTM VCOI system that offers not only knowledge but entertainment as well. In each clinical scenario, students are asked if they understand the scenario. When students answer correctly, teachers reward them to enhance students' leaning motivation. To promote social presence, students can share knowledge gained from different learning resources to reach mutual agreement among group members. Students can refer to those information resources when they raise questions or respond to questions. To promote cognitive presence, teachers can promote students' self-regulation by encouraging students to successfully solve problems on their own instead of providing them with answers. In this way, students have to the opportunity to ponder and reflect on the problems with group members.

Stage4, after gathering information, students use the information to justify their hypotheses in the conclusion-drawing stage. To promote teaching presence, students draw a conclusion based on collected information to support the hypotheses. Teachers can provide more knowledge from various resources and set up a coaching center where students can ask for advice from experts. To promote social presence, students can consult teachers about possible solutions to clinical problems. To promote cognitive presence, students discuss advice received from experts for further clarification and then draw conclusions and propose solutions to clinical problems.

Stage5, the ATTM VCOI system can promote teaching presence when teachers encourage students to criticize, question, and express opinions between presenters and audience. Social presence can be enhanced through authentic, formative and summative assessment in the ATTM VCOI system. It is also important to assess to what extent students learn and use IBL processes. Each group can present its work and answer questions in a virtual exhibition scene in the ATTM VCOI system. This helps students in each group exchange ideas and knowledge. To promote cognitive presence, students explain and demonstrate problem-solving steps derived from principles and ideas that connect what they learn with what they will face in real life situations.

The ATTM VCOI system was designed based on the contemporary COI framework and uses Open Simulator software and the IBL approach to assist in virtual online learning for the purpose of increasing learners' problem-solving ability. Drawing upon the COI framework, the ATTM VCOI system allowed collaboration

among learners through all five stages of IBL procedures in the virtual 3D interactive learning environment. The collaboration consequently triggered the presence of COI and eventually led to the enhancement of learners' expected ability.

The activities focus on not only problem-solving ability, but also collaboration skills. Virtual scenes, such as an herb garden, discussion room, virtual Inpatient Department, etc. and some collaboration tools are shown in Figures 2-5.

Figure 2: ATTM VCOI system developed by using Open Simulator showing a mini map of an island and an herb garden

Figure 3: ATTM VCOI system developed by using Open Simulator showing the avatar of students while discussing in a discussion room

Figure 4: ATTM VCOI system developed by using Open Simulator showing the avatar of students while diagnosing and resolving clinical problems

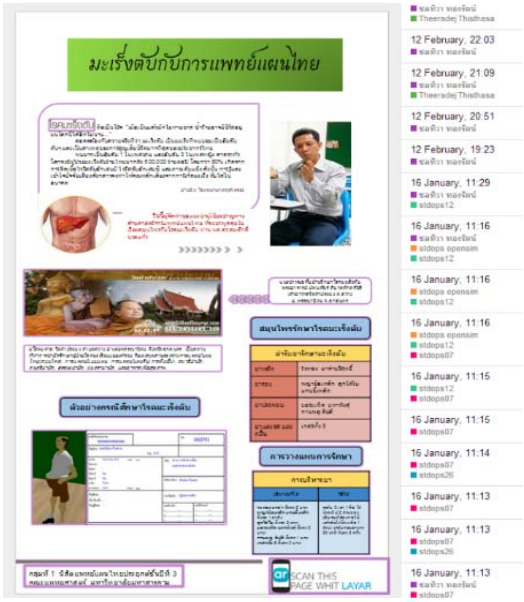

Figure 5: Collaboration tools such as Google Drawing to form hypotheses and group ideas

Notably, the results from previous case studies (Pellas, 2016; Berns, Gonzalez-Pardo, & Camacho, 2013; Vosinakis & Koutsabasis, 2012) show that virtual world open code is suitable for supporting various types of educational activities and raising interaction and motivation in learners as well as enhancing problem-solving ability. A number of studies (Pellas, 2016; Khlaisang & Mingsiritham, 2016; Pellas, 2014; Rico, Martínez, Alaman, Camacho, & Pulido, 2011) have indicated that Open Simulator, one of the most commonly used open source VWs which is equipped with necessary multimedia tools to accommodate learners in group-based activities. This ATTM VCOI system was developed using Open Simulator is open source software that allows users to develop and use programs (the developer prepared the program, including Imprudence 1.3.2, OpenSim0.731, using C# language and ran it on Mono or Microsoft.NET using MySQL database). The program development incorporated the concept that learning occurs in the interaction between learners and learning environment or other learners. The system provides more visual and realistic situations according to the different learning models such as classrooms, libraries, discussion areas, etc.; it also allows for different forms of expression according to the different learning resources, such as video clips, e-books, images, texts, etc. Learners are able to have cognitive experience which is similar to the real world and understand issues more easily. The system encourages students to explore dangerous health problems which are unable to be recreated in the classroom. In this, learners can obtain cognitive and emotional experience by participating in inquiry activities. In the ATTM VCOI system, there are many virtual characters, including instructors, peers and experts, and students can learn and practice in a natural and friendly atmosphere. In addition, the system provides opportunities for students to learn through collaboration and allows them to study together by completing collaborative IBL activities in a virtual environment at different times and from different locations. To this end, the development of an ATTM VCOI system to enhance problem-solving ability should consist of various learning activities with various forms of supporting media. Students will learn by active participation via modern digital media which will not only improve their communication and collaboration skills, but also enhance cognitive skills and learning achievement which can be promote their lifelong learning throughout the learning system similarly to the study of Khlaisang and Mingsiritham (2016).

(2) A comparison of problem solving ability test results before and after studying through the designed ATTM VCOI system was done to examine the effectiveness of the system. The results of the pre-test showed that the sample group of 39 students had average scores of problem-solving ability at 16.87 with standard deviation at 3.25. After studying, they had an average score of 18.41 with standard deviation at 3.05. The results of the test before and after studying with the ATTM VCOI system using independent t-test indicated that the average problem-solving ability test score had a statistical difference at a 0.05 level of significance ($t = -2.140$, $p = 0.03$) as shown in Table 3.

Table 3: The difference between pre and post scores of problem solving ability

Assessment	n	$\bar{x}$	S.D.	t	P
Pre-test	39	16.87	3.25	-2.140	0.03
Post-test	39	18.41	3.05		

*p<0.05

Such results are congruent with the literature indicating that the use of 3D virtual world to enhance the cognitive skills of higher education learners, self-paced learning, and lifelong learning in Thailand's education context (Songkram, Khlaisang, Puthaseranee, & Likhitdamrongkiat, 2015; Songkram & Puthaseranee, 2015).

Each IBL procedure in the ATTM VCOI system supports teaching, social, and cognitive presences of the COI framework through evidence that can be traced back as it appeared in key words, phrases, paragraphs and concepts. Table 4 illustrates the coding scheme for each presence.

Table 4: Coding scheme for each presence of the COI framework

The COI Presences	Indicators	Examples
Teaching presence	Design and organization Facilitating discourse Direct instruction	"Learner 1 asked a staff member whether he/she could answer a question posted in front of an herb garden. Then, the staff member allowed them to do so with the promise of a reward for the correct answer. Simultaneously, learner 1 came up with 'ginger,' whereas learner 2's answer was 'garlic'.
Social presence	Personal/affective Open communication Group cohesion	"Learner A voted X as a nominee for president and Y as a nominee for secretary. Learner Z agreed with the nominee X but B as a nominee for secretary and learner Z asked for others' opinions to agree on her vote. Learner Y agreed with learner Z"
Cognitive presence	Triggering event Exploration Integration Resolution	"Learner 1 was diagnosing one patient, 'what seemed to be the problem?' The patient told learner 1 that he had been suffering from left rib pain. Learner 2 jumped in to ask about how serious was it"

Such evidence also appeared in previous studies of ATTM VCOI systems (McKerlich, Riis, Anderson, & Eastman, 2011), in which the existence of three COI presences were observed and it was concluded that the COI model was suitable for evaluating educational events in MUVEs. Overall, the COI presences are considered to be key for students' engagement in the course discourse and activities (Mouzouri, 2016).

CONCLUSION

This study aimed to develop a virtual Community of Inquiry system based on the COI framework. The Open Simulator software and IBL approach were also employed to further the development of the tool used in the study—the ATTM VCOI system. The results from this study showed that the main components necessary for the development of an ATTM VCOI system include (1) the components of teaching and learning management (learner's role, instructor's role, learning environment, learning resources, reinforcement and motivation); (2) the components of tools for teaching and learning management (virtual learning environment, learning management system, e-books, streaming video, communication and collaboration tools); (3) the components of problem-solving ability (learner's skill of identifying, hypothesizing, gathering and concluding the problems); and (4) the components of feedback (formative and summative assessment). In addition, this study also found five IBL main stages: Orientation, Conceptualization, Investigation, Conclusion, and Discussion with seven sub-stages: Questioning, Hypothesis Generation, Exploration, Experimentation, Data Interpretation, Communication, and Reflection that are necessary for the development of an ATTM VCOI system. Each main and sub-stage had trigger teaching presence, social presence and cognitive presence of every testing subjects in this study.

In this study, the results showed that the Applied Thai Traditional Medicine learners had significantly improved in problem-solving ability by comparing the scores of problem-solving ability test prior and after implementing the developed ATTM VCOI system. Furthermore, after implementing the developed ATTM VCOI system, the results had also shown the evidence that the system is able to trigger teaching presence, social presence and cognitive presence similar to the studies of Mouzouri (2016), Gutierrez-Santiuste and Gallego-Arrufat (2014). As a result, the developed ATTM VCOI system was used as a supplementary online learning platform for courses related to TTM focusing on the enhancement of learners' problem-solving ability. The ATTM VCOI system also resulted in a collaborative community learning environment that not only improved learner's problem-solving ability, but also optimized the effectiveness of online learning in an ATTM higher education setting.

LIMITATIONS AND RECOMMENDATIONS

There are several limitations and recommendations in this study. First, the participants in this study included only undergraduate students and all of them have registered as full-time. It is recommended that further study

should be conducted with participants who are not full-time students as these students in this study were very accustomed to the test-based environment. It is anticipated that those not accustomed to such an environment may demonstrate a greater increase in statistic means. Next, the time-frame to collect data in this study was only six-week period between pre- and post- test. Further study might investigate the effects of the implementing ATTM VCOI system on the learner's ability in a longer time-frame period in order to have a better understanding of the system. Last, the participants in this research were only Applied Thai Traditional Medicine students. In this, Thai culture might affect the study results since Thai teaching culture does not allow students to have much participation in the class comparing to those western countries' teaching styles. Therefore, further study should include participants from various countries in order to get the overall perspectives of the VCOI system.

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The Effect of Data-Based Translation Program Used in Foreign Language Education on the Correct Use of Language

Yasemin DARANCIK
Faculty of Education, Çukurova University, Turkey
ydarancik@cu.edu.tr

ABSTRACT
It has been observed that data-based translation programs are often used both in and outside the class unconsciously and thus there occurs many problems in foreign language learning and teaching. To draw attention to this problem, with this study, whether the program has satisfactory results or not has been revealed by making translations from German to Turkish, German to English, Turkish to German, Turkish to English, English to German and English to Turkish by the help of Google Translate program and the effects of the results on the education have been discussed by analyzing them according to the word, syntax, semantics and grammar. In this study, although Google Translate program has been considered as the basic translation program, here what is really meant is that all the data-based translation programs show the same result.It would be wrong to say this type of translation programs are totally negative; however it is a fact that it can mislead the new learners of a foreign language and push them to laziness. For this reason, in this study the errors of the translation programs and the points that foreign language learners should pay attention have been mentioned and the necessity that they should review the translations they make again and again has been revealed.

Keywords: Data-Based Translation Program, Foreign Language Learning, Education, Google Translate

INTRODUCTION

The human beings have being done translation from one language to another within the framework of political, vocational and special topics for ages."Translation is not merely an interlinguistic process. It is more complex than replacing source language text with target language text and includes cultural and educational nuances that can shape the options and attitudes of recipients. Translations are never produced in a cultural or political vacuum and cannot be isolated from the context in which the texts are embedded" (Dingwaney and Maier, 1995:3). It is obvious that the translationhas played a crucial role in bringing new learning and wider understanding of a target language. At this point, in foreign language education, Grammar-Translation method emerged in the 19th century and has gained great importance since then (Neuner & Hunfeld, 1993, 19). The purpose of this method is to use the grammar rules in the translation exercises. Despite the development of different traditional and alternative methods in line with the criticisms of the mentioned method, the translations exercises have become inevitable to be indispensable for the foreign language courses. It has been indicated that the translation process has developed the language skills in foreign language teaching and it has begun to be recognized as the 5th skill as well as the four basic skills in foreign language education (opposed. Königs, 2000, 6). The students refer to the translation process in order to do translation exercises as well as to try to understand the certain words, sentences or texts.

Although the only aid for translation has been the printed dictionary for many years, the translation process has begun to be done by machines with the development of technology. "On a basic level, machine translation performs simple substitution of words in one language for words in another, but that alone usually cannot produce a good translation of a text because recognition of whole phrases and their closest counterparts in the target language is needed. Solving this problem with corpus and statistical techniques is a rapidly growing field that is leading to better translations, handling differences in linguistic typology, translation of idioms, and the isolation of anomalies. " (Albat, 2012).

In a study of the writings of a group of beginner learners with low language proficiency Garcia & Pena (2011) foundthat the students could benefit from using machine translation more than the high proficiency learners and there wasevidence that they preferred to use it even against the will of their instructors. Interestingly, they discovered that using machine translation also helps beginner learners to better communicate among themselves. However, the studies have although showed that this communication isn't always healty.

Current machine translation software often allows for customization by domain or profession (such as weather reports), improving output by limiting the scope of allowable substitutions. Machine translation has proven useful as a tool to assist human translators and, in a very limited number of cases, can even produce output that can be used as is (e.g., weather reports).One of the application making instant translation at real time (Şahin, 2014,84) and the most significant reflection of the work done in this area is the translation engine, Google Translate (Kuşçu, 2015, 55). The Google Translate, created by the Google Company in 2006, can translate the word, sentence or even an entire book automatically to different languages. "Google Translate is a free machine translation service made available by the Google Company for translating texts and messages from one language into another. Currently it is accessible through a web interface along with smart phone apps/interfaces and application programming interfaces (APIs) that can fit into new software. Google Translate is based on Statistical Machine Translation, which works by analyzing hundreds of millions of natural bilingual text pairs (Koehn, 2009). These natural pairs can serve as authentic examples of language use from the languages involved." (Bahri & Mahdi, 2016, 157). Josefsson (2011) studied the strategies and attitudes of some vocational training students towards translation in language learning. It has been indicated that, as a supporting tool, mobile phones, Google Translate performed better than the traditional dictionaries with its higher speed and accuracy particularly for translation of collocations, phrases, and technical words. In this research, the results of this mentioned study will be tried to be revealed.

Another research by Jin & Deifell (2013) showed that as an online dictionary, Google Translate was the second most widely used online tool by language learners because of its convenience. Still, they concluded that learners generally used Google Translate as a supplementary tool to online dictionaries due to its lack of grammatical explanation. The findings of their study confirms that the students believe the use of online tools such as Google Translate accelerates their reading and writing skills in the foreign language while reducing their learning anxiety. However, the researchers treat the new findings with caution as online dictionaries fail to provide the students with clear explanations and generally ignore the contexts. Most recently Groves & Mundt (2015) stressed the implications of using machine translation technologies like Google Translate for doing tasks and assignments in second language learning. Moreover, it is a fact that, Google Translate can have a great influence on the teaching of Languages for Academic Purposes for both the students and their teachers; hence instructors in the field of language teaching need to work with, not against, these technologies.

Though Google Translate is a widely used translation program, it has led to many problems associated with itself. In fact, Google Translate is aware of this fact, and it requests the users to make the right corrections for the errors. As a matter of fact, the one who can make the correct translation doesn't refer to the translation program; the one who doesn't know the language needs the translation program and in this case he/she can face wrong translation. It would be wrong to say this type of translation programs are totally negative; however it is a fact that it can mislead the new learners of a foreign language and push them to laziness. For this reason, in this study the errors of the translation programs and the points that foreign language learners should pay attention have been mentioned and the necessity that they should review the translations they make again and again has been revealed(see. Medvedev, 2016, 183). Many studies have been done about the translation problems of how a correct translation should be (Benjamin, 1972). Today, whether the data-based translation programs responseto the expectations or not and whether an accurate translation takes place or not is of major importance.

THE STUDY

The reason of this studyis that the students studying at foreign languages departments often refer to such programs and they face different problems. The target group in this study will be university students; because unlike the students participating in foreign language courses, the homework and note concern for the university students cause them to resort to such translation programs much more and fulfilling the task as soon as possible no matter in what form the task should be, either right or wrong, has become their objective. In fact, today we face with unconscious student profile having no concern for questioning and researching. The student uses what is offered there without questioning by using such programs. At the same time, if there is an error in the sentence he/she adopts them and thus wrong learning takes place. Therefore, the lecturers' job becomes more difficult and their work doesn't reach its goals."However, in order to eliminate the problems mentioned by the participants of the study further research is required to provide a tangible and practical framework within which the mechanism and methodology for integrating new language learning technologies, including Google Translate, can be implemented into the course curriculum." (Bahri & Mahdi, 2016, 165). To draw attention to this problem, with this study, whether the program has satisfactory results or not has been revealed by making translations from German to Turkish, German to English, Turkish to German, Turkish to English, English to German and English to Turkish by the help of Google Translate program and the effects of the results on the education have been discussed by analyzing them according to the word, syntax, semantics and grammar.

This study has been limited to foreign language learning and teaching. Therefore, a collection of sentences has been made in the course book of Lagune 1-2-3, prepared by Hueber publishing house for German as a foreign language; the sentences have been selected from simple to difficult and their translations have been made by both a competent translator and Google translate program. Thus, the degree of accuracy of the google translation has been revealed by comparing the google translations with the ones made by the competent person. During the research, German sentences have been taken as output sentences and they are translated individually to Turkish and English, and then these German, Turkish and English sentences are translated by Google Translate Program separately and the results of these three languages have been evaluated. The data obtained has been visualized. The first column in the table shows manual translation and the second one shows the machine translation. Foreign language course books are generally designed from simple to difficult; in other words they are edited from short sentences to long ones, simple grammatical structures to more complex forms. Foreign language textbooks have been seen suitable to be used in order to be objective in this study.

FINDINGS

The first parts of English language course books usually consists of sections of greetings and introducing oneself. The first unit of the book, Lagune 1, has also been formed in this direction and a farewell subject occuring at the railway station is held in the reading section. The man is waving to his love in this text. When this sentence in the text is entered in Google Translate program there comes such a result as shown in the table and the difference between the translation made by a person and a machine becomes clear.

Table 1: Manual and Machine Translation of the Sentencein the Book Lagune1 (2012), page 13

Manual Translation	Machine Translation
Der Mann winkt. (ger.)	**Adam çağırıyor. (tur.)**
	The man waves.(eng.)
Adam el sallıyor. (tur.)	**The man is waving. (eng.)**
	Der Mann winkt. (ger.)
The man waves. (eng.)	**Adam dalgalar. (tur.)**
	Der Mann Wellen. (ger.)

As it has been shown in the Table 1, the sentence ‘Der Mann winkt.’ in German is translated to Turkish as ‘Adam çağırıyor.’by the machine. The sentence translated in this way leads students to learn a foreign language wrong. When we analyze the verbs ‘winken’ and ‘çağırmak’ there will be seen no semantic relationship between these two verbs. However, the student will place the verb ‘winken’ as ‘çağırmak’ in his/her memory. Actually, by looking at the unity of the text the student can perceive this word correctly with the logic of the man doesn’t wave to his love but calls her; because the integrity of the meaning of the sentence isn’t spoiled. Moreover, it is possible that the verb ‘çağırmak’ is used because of the meaning, ‘el işareti ile çağırmak’. The person making the translation done wouldn’t think these details; eventually we should keep in mind that the person making the translation done doesn’t know the target language well and thus he/she won’t consider the possible usages of the words. At this point, it becomes clear that the printed dictionary gives more detailed information. The verb ‘winken’ is defined in the German dictionary as follows:“1. (Zeichen geben) işaret vermek, işmar etmek, sinyal vermek; mit der Hand/einem Taschentuch~ el/mendik sallamak; 2. (erwarten) jdm winkt etw birinin bir şey beklemek, birine bir şey görünmek; *vt*. jdn zu sich *dat*~ el işaretiyle birini çağırmak; […]” (Pons, 2009, 1367; bkz. Steuerwald, 1974, 638) (“1. (Zeichen geben) to give a sign, to signal, to nod; mit der Hand/einem Taschentuch~ wave hand; 2. (erwarten) jdm winkt etw expect something from someone; *vt*. jdn zu sich *dat*~ call someone with a hand sing; […]” (Pons, 2009, 1367; bkz. Steuerwald, 1974, 638; translation: Y.D.) The verb ‘çağırmak’ is mentioned in this definition; however it has no relation with the usage of German original sentence. In this case, it’s obvious that the translation program translate the verb ‘winken’ in this way by taking into account the phrase ‘jemanden zu sich winken’ among the hundreds of thousands of data; because the verb ‘winken’ can have the meaning of calling someone with a hand sing or can be translated like this only when German sentence should be ‘Der Mann winkt sie/ihn zu sich’. At this point, we can reach the following conclusion; the translation program uses the first perceived word for translation. Figure 1 shows that when we try to translate only the verb ‘winken’ in Google Translate program the verb ‘işaret etmek’ (to point) is found, but the desired result can be reached with the printed dictionary.

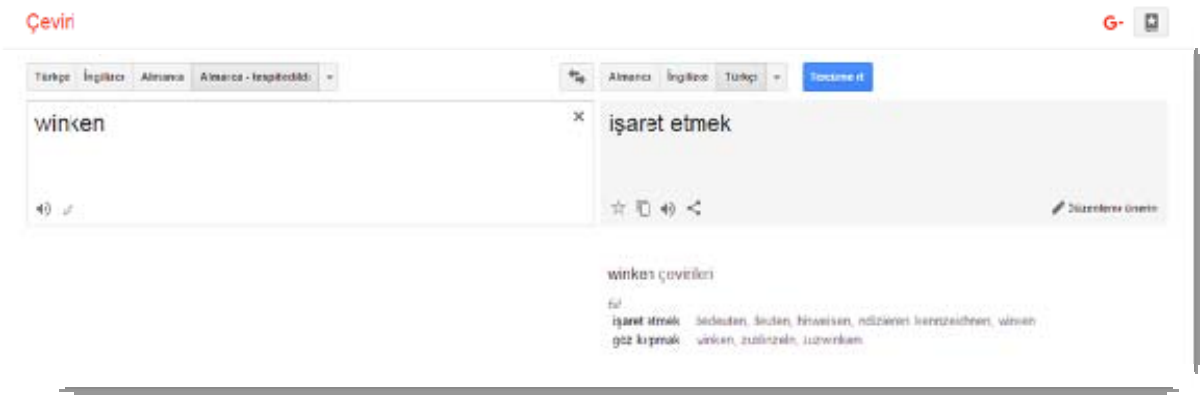

Figure 1: A sample from Google Translate

On the other hand, when the Turkish sentence 'Adam el sallıyor' is translated into German an interesting situation arises. The German sentence 'Der Mann winkt' is translated correctly, because the verb 'el sallamak' doesn't have any other meaning, it isn't possible for the machine to detect its 2nd or 3rd meaning in Turkish (Steuerwald, 1974, 264). When the sentences translated from German and Turkish to English are analyzed, 'The man waves' occurs from German to English and 'The man is waving' is formed from Turkish to English. The emergence of different grammatical tenses creates confusion. Although the sentence should be 'The man waves' it has a very different meaning when it is translated into German and Turkish as shown in the table above. The sentence is translated into German and Turkish correctly when it is written in the form of Present Continuous tense.

Table 2: Machine Translationof an English sentence

The man is waving. (eng.)	Adam el sallıyor. (tur.)
	Der Mann winkt.(ger.)

Moreover, different grammatical structures of the sentence have led to the emergence of different meanings. In the 2nd table it is clearly seen that while the English word 'to wave' in the Present Continous form means 'el sallamak' in Turkish and 'winken' in German, the same verb in the Simple Present Tense form means 'dalgalar' in Turkish and 'Wellen' in German. By Looking at the Pons English-German dictionary we see that the first meaning of the verb 'to wave' is the wave as a noun '(of water) Welle' and the fourth meaning is 'to wave' as a verb 'winken' (Pons, 2006, 904).

Table 3: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 27

Manual Translation	**Machine Translation**
Heute ist Sonntag und ich bin in Wien. (ger.)	Bugün Pazar ve ben Viyana'da yaşıyorum. (tur.)
	Today is Sunday and I'm in Vienna. (eng.)
Bugün pazar ve ben Viyana'dayım. (tur.)	Auf dem heutigen Markt, und ich bin Viyanad. (ger.)
	In today's market, and I am Viyanad. (eng.)
Today is Sunday and I'm in Vienna. (eng.)	Bugün Pazar ve ben Viyana'da yaşıyorum. (tur.)
	Heute ist Sonntag und ich bin in Wien. (ger.)

Different problems in the next example hinders learning. No error is encountered with the translation from German to English. In the Turkish translation, although the sentence should be 'Bugün Pazar ve ben Viyana'dayım' it is translated wrong as 'Bugün Pazar ve ben Viyana'da yaşıyorum' which is seen in the 3rd table . The verb, 'sein' (to be in English) in German sentence has been translated as 'leben' (to live). The reason of this error is that German people use the sentence 'Ich bin aus Berlin' to show the person lives there in the daily usage of the language and the system perceives the verb 'sein' as 'to live'. Here the verb 'to live' can be appropriate as the preposition of 'aus' is used, but the example in the table shows that the verb 'to live' isn't suitable in any grammatical terms because of the preposition of 'in'. In this case, it has become clear that the program makes translation by creating a collection of data and finding the nearest expression. In addition, to this, when the German sentence 'Ich bin aus Berlin' is written in the translation program again the person faces with a different result. While the German sentence is translated to Turkish wrong as 'Ben Berlin'e geliyorum', the same sentence is translated to English right as 'I am from Berlin.' The main reason of this is the relationship which

includes the similarities and differences between the translated languages and this important issue should be discussed as well. Due to the fact that German and English languages come from the same family, both the translation can be made easier and the number of errors can be minimized (Arak, 2010, 1434). This significant detail can be seen in the other instances.

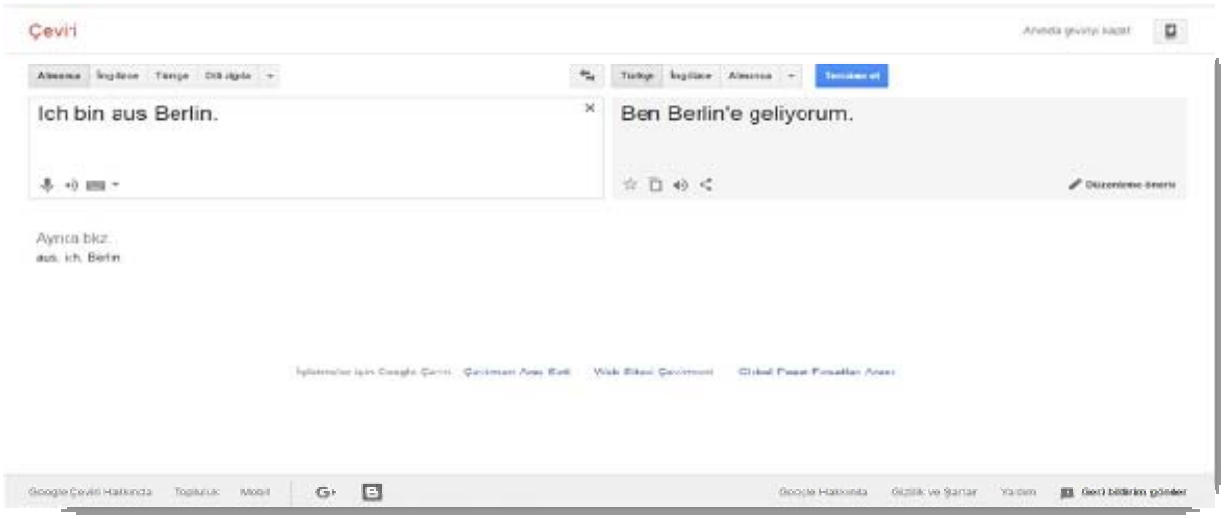

Figure 2: A Sample from Google Translate

There is another interesting point that is clearly indicated in Figure 2. When the same sentence is translated from Turkish to Germen and English, the word 'Viyana'dayım' can't be translated as 'Wien' in German and 'Vienna' in English; namely the program produces a completely meaningless word. Such programs reflect back the same word, not recorded the memory. Therefore, the program makes an error by reflecting back the word 'Viyana'dayım' as 'Viyanad' despite separating the word with brackets.

Figure 3: A Sample from Google Translate

The sentences specified with brackets like 'Ben Köln'deyim' have been tested and the same conclusion has been seen. Another interesting point which is shown in the Figure 3 is that when the sentence is expressed differently like 'Ben Köln'de bulunmaktayım' it is translated as 'Ich bin der Bank ist Köln'. Although it's said that Google Translate depends on the Google database, it's hard to understand how the word 'Viyana' is translated as 'Viyanad'. Examining Google database, it's clear that there's no way that such a word exists. So, how this word existsthere. As a result, Google Translate reflects back the same word, if it isn't translated, so the word 'Viyana'dayım' should have been reflected back in the same way; however this word has neither been reflected back exactly nor has been translated truely by taking the word with brackets into consideration.

During the research, another point to pay attention is that the use of small and capital letters should be considered carefully while using the Google Translate program. For instance, when the word ‘pazar’ in Turkish sentence ‘Bugün pazar ve ben Viyana’dayım’ is written with small letters it means the place where people go for shopping and the sentence is translated to German as ‘Auf dem heutigen Markt, und ich bin Viyanad.’ On the other hand, if the word ‘Pazar’ is written with capital letters it’s translated to German and English as ‘Sonntag-Sunday’; this time it’s translated as name of the day. In Turkish, the word ‘pazar’ is written with small letters for both the day and the place where people go for shopping. As it can be understood in the Table 4, only the first letter of the word ‘Pazar’ is written with capital letter when it shows a specific date together with the name of the month and the day. For instance, Okulumuzda 29 Ekim 2015 Pazar günü büyük bir tören yapıldı.(There was a great ceremony in our school on Sunday, 29 October 2015.)

Tablo 4: An alternative sentence for the word beginning with a capital letter.

Bugün Pazar (büyük yazılırsa) ve ben Viyana’dayım. (tur.)	Heute ist Sonntag und ich bin Viyanad. (ger.)
	Today is Sunday and I'm Viyanad. (eng.)

Different from Turkish and English, there are rules about writing with small and capital letters in German and therefore some problems are seen. While all the names are written with capital letters in German, it’s not the case in Turkish and English. A Turkish student learning German may not pay attention to this and he/she can face the following situation. For example, the German sentence ‘Der Weg ist schmal.’ (The road is narrow) is translated to Turkish as ‘Yol dardır’ by machine and the words have been translated correctly although the sentence is grammatically wrong as it is seen in the Figure 4. When the sentence completely written with small letters ‘der weg ist schmal’, it is translated to Turkish as ‘kapalı dar’ (closed narrow). At this point, we face with many contradictions.

Figure 4: A Sample from Goole Translate.

When the first word of the sentence is written with a capital letter as a routine we encounter a different translation. As seen in the example shown in the Figure 5, as the sentence begins with a capital letter it’s translated as ‘uzak dar’(remote narrow). In this case, the student can’t determine which Turkish word is equivalent to which German word. Therefore, the users of Google Translate program should be very careful about writing the sentence in the system; otherwise it’s inevitable to encounter with an incorrect translation. The correct translation of the sentence ‘Der Weg ist schmal’ is ‘Yol dardır.’

Figure 5: A Sample from Google Translate

The sentences with different senses and structures have been selected especially for the compilation of the sentences in order to reveal the problems of the Google Translate program clearly; thus it has been tried to pay attention to different situations by revealing the inconsistencies in the translations.

Table 5: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 42

Manual Translation	Machine Translation
Jan ist 5 Jahre alt und heißt mit Nachnamen Peter. (ger.)	5 Ocak yaşındaki ve soyadlı Peter. (tur.)
	Jan is 5 year old and is surnamed Peter. (eng.)
Jan 5 yaşında ve soyadı Peter.(tur.)	5. Januar Jahre alt und Nachnamen, Peter. (ger.)
	Jan 5 years old and last name, Peter. (eng.)
Jan is 5 years old and his surname is called Peter. (eng.)	5. Januar Jahre alt und sein Nachname ist Peter genannt. (ger.)
	5 Ocak yaşında ve onun soyadı Peter aradı. (tur.)
Jan is 5 years old and his surname is Peter. (eng.)	Jan ist 5 Jahre alt und sein Nachname ist Peter. (ger.)
	5 Ocak yaşında ve onun soyadı Peter. (tur.)

We face with a different problem in the sample sentence shown in the Table 5. The word 'Jan' is used as a private name in this sentence, at the same time 'Jan' is used as the abbreviation of 'Januar' in German (Ocak in Turkish; January in English). Therefore, the word 'Jan' hasn't been perceived as a private name, it has been translated as the month of January. However, as it is known when there is a full stop at the end of the abbreviation a person knows it's an abbreviation. In this case, the translation program perceives this word as the month of January although there isn't a full stop at the end of the name. The student will certainly realize that the translations aren't syntactically correct and in this circumstance the game of guessing will be used in translation. Well, is the forecast always going to be true?

Table 6: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 50

Manual Translation	Machine Translation
Ich glaube, du spielst gern Schach. (ger.)	Ben satranç oynamak ister düşünüyorum. (tur.)
	I think you like to play chess. (eng.)
Senin severek satranç oynadığına inanıyorum. (tur.)	Ich glaube, Sie lieben Schach zu spielen. (ger.)
	I think you love to play chess. (eng.)
I think you like to play chess. (eng.)	Ich glaube, Sie mögen Schach zu spielen. (ger.)
	Ben satranç oynamak ister düşünüyorum. (tur.)

The structure of this sentence is a clause. The sentence translated by Google Translate consists of semantic and syntactic errors. Both German and English sentences are translated to Turkish without adhering to a specific syntactic rule as shown in the Table 6. At the same time the word 'Du' (in Turkish: sen; in English: you) hasn't been taken into account in the German sentence, the word 'sen' in the Turkish sentence has been translated to German as 'Siz' (In English 'you' as respect). In English, the pronoun 'you' is used both for saying you as a person and indicating respect as an individual. For this reason, while translating from English to German the program has two buttons as formal and informal and this pronoun is translated according to this; however there

aren't such buttons when translating English to Turkish. In fact, the pronoun 'you' in English is divided into two as 'sen' or 'siz' in Turkish as it has been explained in Figure 5.

Figure 5: A Sample from Google Translate

The exercise on page 57 in the foreign language course book Lagune 1 has ben created to teach the words here/there and none.

Table 7: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 57

Manual Translation	Machine Translation
Der Topf ist da, aber der Deckel ist weg. (ger.)	Pot var, ama kapak kapalıdır. (tur.)
	The pot is there, but the lid is off.(eng.)
Tencere orada, fakat kapak yok.(tur.)	Töpfe gibt, aber es gibt keinen Deckel. (ger.)
	Pots there, but there's no cover. (eng.)
The pot is there, but the lid is not.(eng.)	pot var, ancak kapak değil. (tur.)
	Der Topf ist da, aber der Deckel nicht. (ger.)

In the Table 7 in it seen that the word 'weg' in this sentence has led the students to a big mistake with the meaning of closed. The word 'der Topf' in German sentence and 'tencere' in Turkish has also been translated wrong. 'Topf' has been translated to Turkish as 'pot', but 'pot' is an English word. In Turkish, it means "1. The shrinkage and folds formed in the fabric due to poor stitching, 2. The equal amount of money or vouches put out by all of the players in the games of Poker etc., 3. Inaccuracy, error blunder." (TDK, 2011, 1941-1942). In any case, this sentence doesn't have a link to this word. The studies have shown that if the punctuation isn't placed correctly, the sentence has a different meaning as seen in the example given in the Table 8.

Table 8: Manual and Machine Translation of the Sentence absence of punctuationin the Book Lagune 1, page 57

Manual Translation	Machine Translation
Der Topf ist da aber der Deckel ist weg (ger.)	Pot var ama kapak kapalı (tur.)
	The pot is there but the lid is off (eng.)
Tencere orada fakat kapak yok (tur.)	Aber es gibt keine Abdeckung Töpfe (ger.)
	But there is no cover pots (eng.)
The pot is there but the lid is not (eng.)	pot var ama kapak değil (tur.)
	Der Topf ist da, aber der Deckel ist nicht (ger.)

The differences aren't seen in the translations between German and English in the absence of punctuation; but the differences draw attention in the translations from Turkish to these two languages. This situation stems from the fact that the languages of German and English come from the same language family.

Table 9: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 65

Manual Translation	Machine Translation
Peter studiert Matematik und Biologie. (ger.)	Peter matematik ve biyoloji okudu. (tr.)
	Peter studied mathematics and biology. (eng.)
Peter matematik ve biyoloji okuyor. (tur.)	Peter is studying mathematics and biology. (eng.)
	Peter studiert Mathematik und Biologie. (ger.)
Peter is studying mathematics and biology. (eng.)	Peter studiert Mathematik und Biologie. (ger.)
	Peter matematik ve biyoloji okuyor. (tur.)

In this study, it hasn't been tried to choose difficult sentences in order to find error, the aim is to show the students what kind of errors can occur when using the data-based translation programs. In the German sentence mentioned in the Table 9, there are errors in the translations of both Turkish and English. As the universal words like 'Math and Biology' are in the sentence the number of errors has reduced and the German sentence with present tense has been translated to English and Turkish with past tense. The experiences have shown that the students have perceived the word 'studiert' (in English: study) with past tense and they have converted the word 'studier' to present time by deriving the word on their own; thus they have created new grammatical rules. The problem is that these errors place in the brains of the students with this form in language learning.This case has been confirmed by using a different verb as the German sentence 'Der Mann informiert die Touristen.' (The man informs the tourists) is translated to Turkish as 'Adam turist bilgilendirdi.' by the machine, the students face with the same problem. In German, the same problem is seen with almost all the verbs with the infinitive '-ieren' and sometimes even the most known verbs are translated wrong as in the example seen in Figure 6.

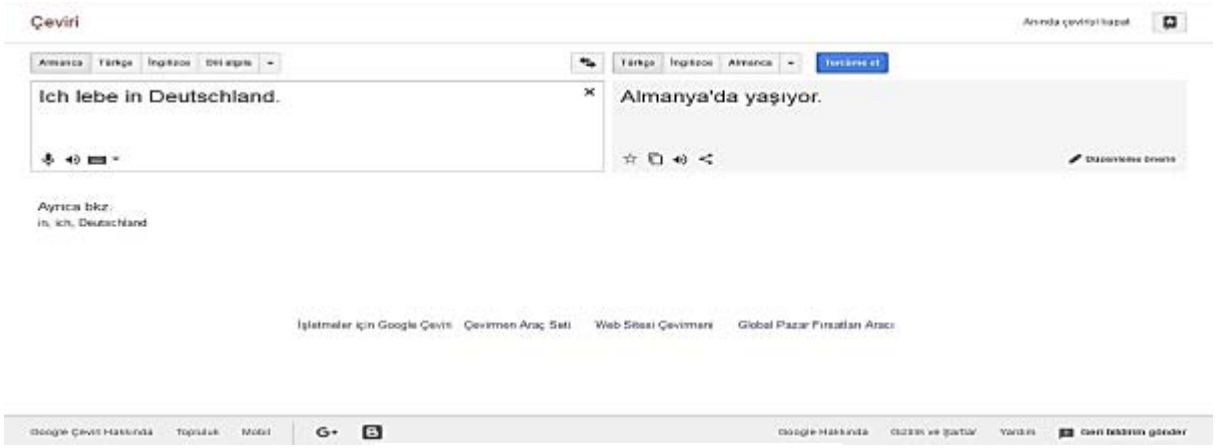

Figure 6: A Sample from Google Translate

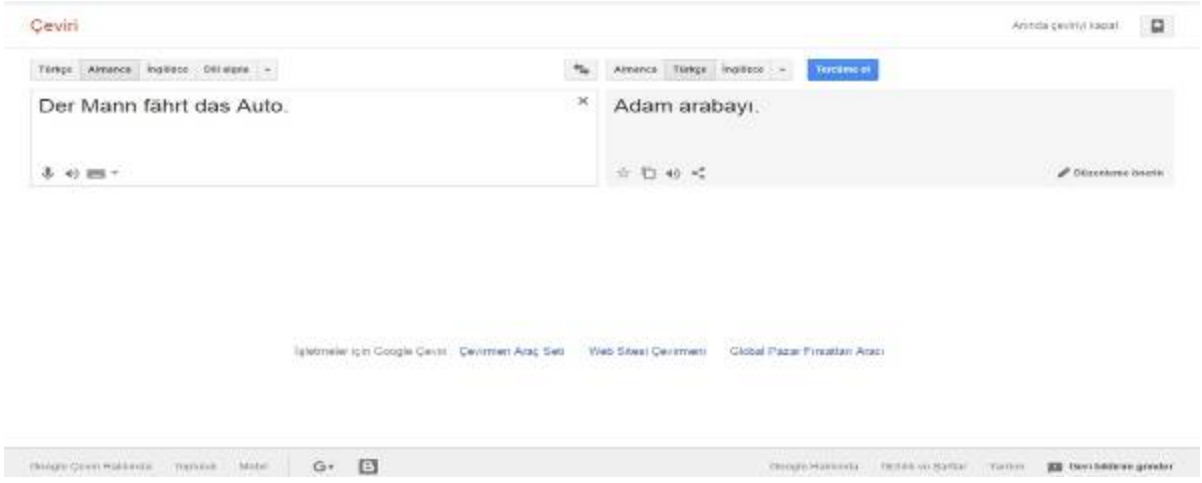

Figure 7: A Sample from Google Translate

The research has been done according to sentences with different structures and grammatical rules in this study. When choosing these grammatical rules, the endpoints haven't been referred is it can be seen in the Figure 7. The emphasis has been on the structures that the students can meet in daily life while learning German.

Table 10: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 99

Manual Translation	Machine Translation
Herr Brösel soll alle Termine absagen und die Anrufe notieren. (ger.)	Sayın Kırıntı tüm randevuları iptal ve aramaları kayıt etmektir. (tur.)
	Mr. Crumb is to cancel all appointments and record the calls. (eng.)

Bay Brösel tüm randevuları iptal etmeli ve aramaları not etmeli. (tur.)	Mr. Brösel muss alle Termine absagen und Suche zu beachten. (ger.)
	Mr. Brösel must cancel all appointments and search should be noted. (eng.)
Mr. Brösel should cancel all the appointments and record the phone calls. (eng.)	Herr Brösel sollten alle Termine absagen und die Telefongespräche aufzeichnen. (ger.)
	Sayın Brösel tüm randevuları iptal ve telefon görüşmeleri kayıt altına geralıdır. (tur.)

One of the problems that the students often meet is the usage of German modal verbs. In the example seen in the Table 10, 'sollen' (requested to do, to be necessary, -meli, -malı) has been used, but this verb hasn't been taken into consideration in translation. While the modal verb hasn't been used in the sentence translated to Turkish, 'should' has been used for the word 'sollen' in the sentences translated to English; here the German sentence has been translated to English as 'is to V1' and this is a right usage. Again, the advantage of coming from the same language family has been seen in two languages. If the languages in this study are to be compared, it can be said that the syntax of German and English is the same, there is an article called definiteness in the two languages in spite of the differences, the third singular person is exactly the same and there are similarities about the tenses. The grammatical structure of Turkish is different from these two languages (Arak, 2010). Such similarities in the languages inevitably minimize the number of errors in translation.

Table 11: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 109

Manual Translation	Machine Translation
Er fährt mit dem Auto zur Apotheke. (ger.)	O araba ile eczaneye gider. (tur.)
	He goes to the pharmacy by car. (eng.)
O araba ile eczaneye gidiyor. (tur.)	Er geht in die Apotheke mit dem Auto. (ger.)
	He goes to the pharmacy by car. (eng.)
O arabayla eczaneye gidiyor. (tur.)	Er geht in die Apotheke zu fahren. (ger.)
	He's going to drive to the pharmacy. (eng.)
He goes to the pharmacy by car. (eng.)	Er geht in die Apotheke mit dem Auto. (ger.)
	O araba ile eczaneye gider. (tur.)
He is going to the pharmacy by car. (eng.)	Er ist mit dem Auto in die Apotheke gehen.(ger.)
	O arabayla eczaneye gidiyor. (tur.)

In the Table 11 it has been tried to be explained that in German while the word 'fahren' (to drive) is used for going somewhere by car, bicycle, train etc., the word 'gehen' is used for going somewhere without transportation vehicles. This distinction doesn't exist in Turkish, that is the sentence is written with the verb 'gitmek' (to go) for both cases either by using a vehicle or not. For instance, 'I'm going to Ankara by car.' or 'I'm going to school on foot.' In this case, the German sentence has been translated into Turkish right as this distinction doesn't exist in Turkish; however when the translation is done from Turkish to German the student comes up against a wrong result. Even when the verb 'fahren' (compare on the page) taught in during the first unit of the lessons is written alone, an error is encountered; the word 'fahren' is translated as a driver. In fact, the sentence 'Ich fahre ein Auto', 'I'm driving a car' emerges as follows without taking the verb into account as seen in Figure 8.

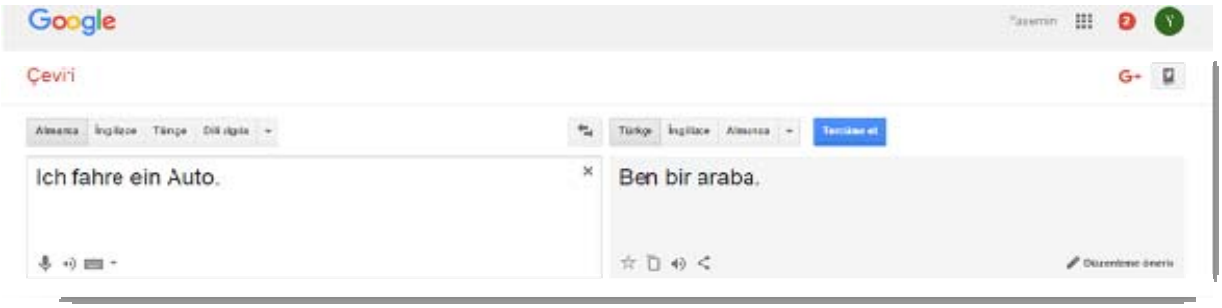

Figure 8: A Sample from Google Translate

It has been revealed that the question forms should be taken into account during the screening of the foreign language textbooks and the examination of the translation program and how such sentences are translated aroused curiosity.

Table 12: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 112

Manual Translation	Machine Translation
Können Sie bitte einen Salat mitbringen? (ger.)	Bir salata getirmek misiniz? (tur.)
	Can you please bring a salad? (eng.)
Bir salata getirebilir misiniz, lütfen? (tur.)	Können Sie mir einen Salat zu bekommen, bitte? (ger.)
	Can you get me a salad, please? (eng.)
Can you please bring a salad? (eng.)	Bir salata getirmek misiniz? (tur.)
	Können Sie bitte einen Salat mitbringen? (ger.)

An accurate translation hasn't been done in the sentence given in the Table 12. Here, another important point to be considered is the significance of punctuation in the sentences to be translated. The sentence to be translated should be entered into the database with appropriate punctuation, otherwise the translation may be different. As seen in the examples, there is a serious difference between thetranslation of the sentence with a question mark and the one without a question mark.

Table 13: Machine Translation of the above Sentence without Question Mark

Können Sie bitte einen Salat mitbringen (without question mark – ger.)	Eğer bir salata getir misiniz (tur.)
	Can you please bring a salad (eng.)

The sentence, in the Table 13, without a question mark has transferred to a sentence stating a conditional statement. In this case, the student may perceive the model verb 'können' as a word of condition 'eğer' and this case places as a big mistake in the learning process. The condition mode 'Eğer' in Turkish means in Enlish 'If'.

Table 14: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 128

Manual Translation	Machine Translation
Er hat geputzt. (ger.)	O temizlenmiş (tr.)
	He has cleaned. (eng.)
O temizlik yaptı. (tur.)	Sie tat die Reinigung. (ger.)
	She did the cleaning. (eng.)
He has cleaned. (eng.)	Er hat gereinigt. (ger.)
	O temizlenmiş. (tur.)

The German sentence in the Table 14 is a sentence written by Perfekt (-dili geçmiş zaman). When it's translated to Turkish it emerges as indirect speech; in fact a situation in which the person is affected by the action has arisen while doing the action as a result of the wrong translation. Many options have been tried in order to achieve the correct translation from Turkish to German. German verb 'putzen' (clean) hasn't been given for neither the sentence 'O temizlik yaptı' nor the sentence 'O temizledi.' In order to try the opposite, when the German verb 'putzen' is written alone in the program to be translated to Turkish, the word 'fırça' (eng. brush) is given. Then, the words 'fırça, temizlemek, silmek, ovmak' are translated by the program but any Turkish word doesn't mean the verb 'putzen' in German.In addition, being different from German and English there is a hidden subject in Turkish. Namely, we don't have to use the third person singular pronoun 'o' and the sentence 'O temizlik yaptı.' can be said as 'Temizlik yaptı' as it can be seen in the Table 15.

Table 15: Machine Translation of an alternative Sentence

Temizlik yaptı. (tur.)	Die Zimmermädchen haben. (ger.)
	Housekeeping did. (eng.)

In this case, after the Turkish sentence has been translated to German and English a very different conclusion has been seen. The word 'Temizlik' (cleaning) and 'yaptı' (did) have been translated as single words and this translation is wrong. The word 'temizlik' has been translated as 'Zimmermädchen' and 'housekeeping'. Thus, this word has been seen equal with the word 'Temizlikçi' and it is seen that it has been perceived in this way. When it is taken from a different angle and the word 'Temizlikçi' is written in the program, the word 'Reiniger' in German and the word 'cleaner' in English is given. In the following table, this situation has been tried to be

clarified by using a similar structure. In the example, the correct translation has been tried to be achieved by using different alternatives. The German sentence 'Er hat gekocht' (He has cooked) has been tried as 'Er hat das Essen gekocht'(He has cooked the meal). At the same time, a test has been made by addressing only the verb 'kochen' (English: cooking, Turkish: yemek pişirmek) and while the word 'Kochen' with a capital letter means the act of cooking, the word 'kochen' with small letters means the cook. Even in this case the program has given us wrong data, as a matter of fact the German word that means the cook should be 'der Koch' and not 'kochen'as it is given in the Table 16. Such a case is out of question in the translation from German to English.

Table 16: The difference between the word with capital and small letterstranslated byMachine

Kochen / kochen (ger.)	Yemek pişirme / aşçı (tur.)
Kochen / kochen (ger.)	Cooking (eng.)

Consequently, it seems impossible to give the students instructions on how they can use this program correctly.

Table 17: Manual and Machine Translation of the Sentence in the Book Lagune 1 (2012), page 128

Manual Translation	Machine Translation
Er hat gekocht. (ger.)	O pişmiş oldu (tur.)
	He has cooked (eng.)
Er hat das Essen gekocht. (ger.)	O pişmiş gıda oldu. (tur.)
	He has cooked the food. (eng.)
O yemek pişirdi. (tur.)	Sie kochte Abendessen. (ger.)
	She was cooking dinner. (eng.)
Yemek pişirdi. (tur.) (hidden subject)	Essen gekocht. (ger.)
	Food cooked. (eng.)
He has cooked. (eng.)	Er hat gekocht (ger.)
	O pişmiş oldu (tur.)

In this study, it isn't intended to reach a conclusion only by sorting out the errors; at the same time it has been tried to show that the users of this program should be careful and they shouldn't trust all the data they get.

Except for the errors, it is noteworthy that data-based translation program has adopted gender inequality; rather, it has been programmed accordingly. As it can be seen in the Table 17 while the program translates the actions like cleaning, cooking as 'sie/she', it translates the actions like reading books, watching television as 'er/he'. The main reason for this is that the entries have been made by the users accordingly and the program does the translation by using these statements from the millions of data. This is the reflection of the thinking about the distribution of roles.

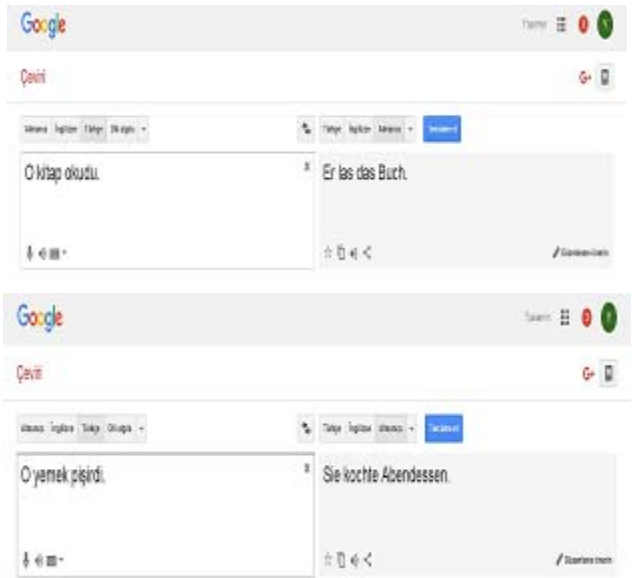

Figure 9: Two Samples from Google Translate

Apart from this remarkable point, the sentences are incorrect syntactically, grammatically and in terms of integrity.

At the same time, when the Turkish translation of the German sentence is analyzed, it's obvious that 'Perfekt' (past tense) has been translated as indirect speech, so the sentence emerges as 'It was cooked' although it ought to be as 'He cooked'as it seen in the Figure 9. In Turkish, unlike German and English, there's a rule of hidden subject (see the related page). Namely, we don't have to use the third person singular pronoun in Turkish and in this case the sentence 'O yemek pişirdi' can be used as 'Yemek pişirdi.' At this point, the Turkish sentence is translated to German and English in a passive form. The meal, unknown for which period of the day, in the sentence 'O yemek pişirdi' has been translated to German as dinner and this is an indication that the word 'meal' as 'Abendessen' is often entered in terms of data.

Table 18: Manual and Machine Translation of the Idioms and Proverbsin the Book Lagune 2 (2012), pages 86, 98

Manual Translation	Machine Translation
Über Geschmack kann man nicht streiten. (ger.)	Tat onunla iddia edemez. (tr.)
	Taste can not argue with it. (eng.)
Zevkler ve renkler tartışılmaz. (tur.)	Es gibt keine Rechnungslegung für Geschmack. (ger.)
	There is no accounting for tastes. (eng.)
There's no accounting for taste (eng.)	Es gibt keine Rechnungslegung für Geschmack. (ger.)
	Tat için muhasebe var. (tur.)
Manual Translation	**Machine Translation**
Wer anderen eine Grube gräbt, fällt selbst hinein. (ger.)	Diğerleri için bir çukur kazar O, kendisi içine düşer. (tur.)
	He who digs a pit for others, falls into it himself. (eng.)
Harm set, harm get! (eng.)	Zarardan seti, zarar olsun! (tur.)
	Harm set, Schaden zu erhalten! (ger.)
El için kuyu kazan, evvela kendi düşer! (tur.)	Pro-Kopf-Einkommen in der benachbarten Lachen! (ger.)
	Per capita income in the neighboring laugh! (eng.)

Almost in all foreign language course books, the idioms and the proverbs of the target language are included. There are idioms and proverbs in the mentioned course book Lagune. When the students enter these sentences, seen

In the Table 18, in the program they can't encounter a meaningful sentence. This is normal because the idioms and the proverbs of each country can't be translated verbatim. Therefore, such data-based translation programs must be programmed like that. Generally, the sentences aren't perceived as a whole form, the words in the sentence are dealt with and translated one by one.

Table 19: Manual and Machine Translation of the Sentence in the Book Lagune 2 (2012), page 156

Manual Translation	Machine Translation
Der Kölner Dom, dessen Türme 157 Meter hoch sind, war für kurze Zeit das höchste Gebäude der Welt. (ger.)	Kimin kuleler 157 metre yüksekliğindeki olan Köln Katedrali, kısa bir süre için dünyanın en yüksek binası oldu. (tur.)
	The Cologne cathedral, whose towers are 157 meters high, was the tallest building in the world for a short time. (eng.)
Kuleleri 157 metre yüksekliğinde olan Köln Katedrali, kısa bir süre için dünyanın en yüksek binasıydı. (tur.)	Turmhöhe von 157 Metern am Kölner Dom war das höchste Gebäude in der Welt für eine kurze Zeit. (ger.)
	Tower height of 157 meters at Cologne Cathedral was the tallest building in the world for a short time. (eng.)
The Cologne cathedral, whose towers are 157 meters high, was the tallest building in the world for a short time. (eng.)	Der Kölner Dom, dessen Türme sind 157 Meter hoch, war das höchste Gebäude in der Welt für eine kurze Zeit. (ger.)
	Kimin kuleler 157 metre yüksekliğindeki olan Köln Katedrali, kısa bir süre için dünyanın en yüksek binası oldu. (tur.)

The remarkable point in this sentence, in the Table 19, is that a very complex translation has emerged although the sentence is very long. Surprisingly, correct statements are seen in spite of syntactical errors. Despite the fact

that there are seen simple errors in the translation of even more simple German sentences to English, there occurs any errors in a longer and more difficult sentence after it has been translated to English. Because in this sentence accurate information about a historical structure is stated and this information is the same as in many written sources. One of the main reasons for this is the international programs like 'Wikipedia' and objective judgments or information. Millions information is available on this website and all this information can be translated to 292 different languages on the website of 'Wikipedia'. As the 'Wikipedia' exists in the available data base of Google Translate program, the sentences entered into the program are translated correctly by scanning these resources.

Table 20: Manual and Machine Translation of the Sentence in the Book Lagune 3 (2012), page 10

Manual Translation	Machine Translation
Wenn er Geld hätte, könnte er eine Auto kaufen. (ger.)	O param olsaydı, o bir araba alabilirdik. (tur.)
	If he had money, he could buy a car. (eng.)
Eğer parası olsaydı, araba alabilirdi. (tur.)	Wenn ich das Geld hätte, könnte es ein Auto sein. (ger.)
	If I had the money, it could be a car. (eng.)
If he had money, he could buy a car. (eng.)	Wenn er Geld hat, könnte er ein Auto kaufen. (ger.)
	Parayı varsa, o bir araba alabilirdik. (tur.)

In this translation, although the structure of conditional sentence 'wenn' has been taken into account, the pronoun hasn't been paid attention to and who has the money, who buys the car isn't clear. This stems from the fact that Turkish has a different ordering for sentence directories when compared with German and English and again the rule of hidden subject in Turkish has an impact on the translation. As it seen in Table 20, the translation of the sentence '……., araba alabilirdi' in Turkish main clause to German as '…….., ein Auto sein' and to English as '……, it could be a car' is a separate question mark. So, why the verb in Turkish 'almak' (German: nehmen; English: take) is encountered as 'sein' in German (Turkish: olmak; English: to be) and there's no sense of relationship between these two verbs. The only reason that comes to mind in this case, the word 'alabilirdi' is perceived as 'olabilirdi' and this may be caused by the fact that the system finds that as the most convenient word in the case of a single letter change when examining the words. When the sentence 'Eğer parası olsaydı, araba satın alabilirdi.' is changed by adding the verb 'satın almak', the program reflects back the verb 'kaufen'. It's impossible for a person learning a foreign language newly to think about this.

Table 21: Manual and Machine Translation of the Sentence in the Book Lagune 3 (2012), page 84

Manual Translation	Machine Translation
Als sie brav ihre kleine Strafe bezahlt hatte, nahm sie ihr Rad und schob es weiter, wie es Vorschrift war. (ger.)	O aldatılan onun küçük ceza ödemişti zaman, ona bisiklet aldı ve karşılık olarak, daha da itti. (tur.)
	When she had dutifully paid her little punishment, she took her bike and pushed it further, as was provision. (eng.)
İtaatle küçük cezasını ödedikten sonra, bisikletini aldı ve kanuna uygun itmeye devam etti. (tur.)	Nachdem eine kleine Strafe Gehorsam zahlen, setzte er das Motorrad und nahm entsprechende Gesetze zu schieben. (ger.)
	After paying a small penalty obedience, he continued to push the bike and took appropriate laws. (eng.)
When she had dutifully paid her little penalty, she took her bike and pushed it further, as was provision. (eng.)	Als sie ihre kleine Strafe pflichtgemäß bezahlt hatte, nahm sie ihr Fahrrad und schob es weiter, als Bestimmung war. (ger.)
	O aldatılan onun küçük ceza ödemişti zaman, ona bisiklet aldı ve karşılık olarak, daha da itti. (tur.)

This statement is a sentence taken from a short text giving information for the language learners about the traffic rules in Germany. As a female was riding a bike on the pedestrian path, she was stopped by the police and given fine; after she paid the fine for her false she pushed her bike. When examining the translation of the sentence, in the Table 21, from German to Turkish, the word deceive is seen in the sentence as shown in the table and this inevitably confuses the students' minds. When the word 'brav' (dutifully) is written in the Google Translate program alone, we see many alternative words.

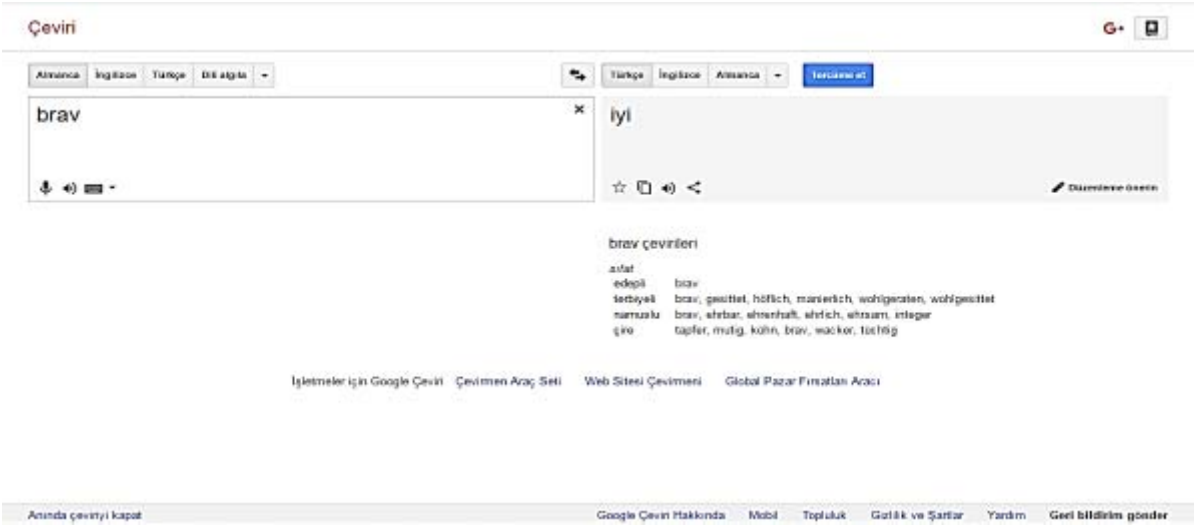

Figure 10: A Sample from Google Translate

As seen among the Figure 10 results, there is neither a verb deceive exactly, nor is there a word similar in meaning to this word. During the research, different ideas have been issued no to make mistakes in translations; because there are many alternatives for statement in a language. English sentence has been entered into Google Translate program by considering different proposals for the sentence, in the Figure 11, and this time it has been recognized that the word 'dutifully' hasn't been translated.

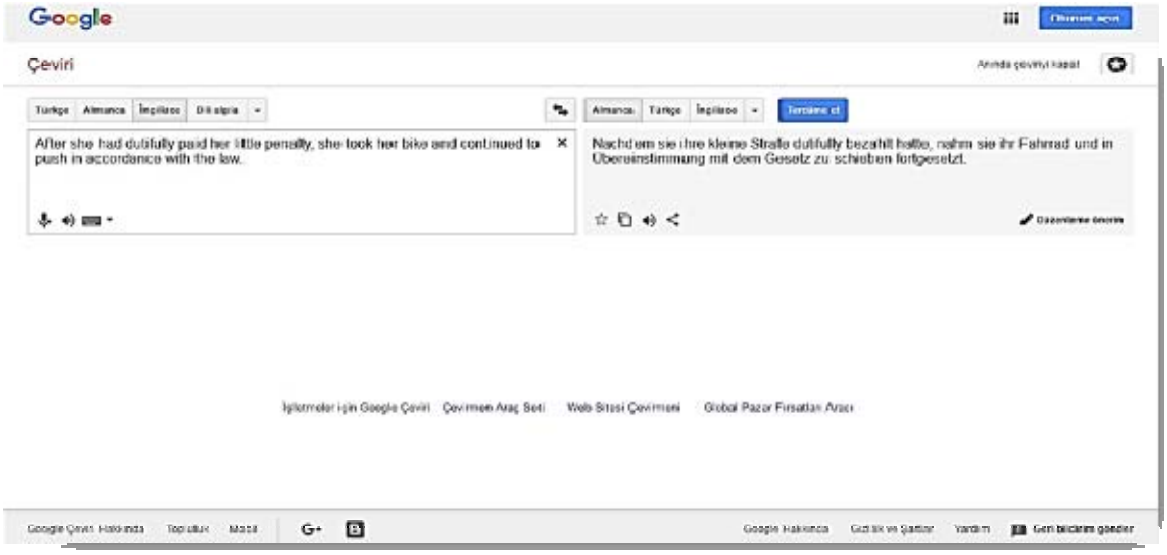

Figure 11: A Sample from Google Translate

Table 22: Manual and Machine Translation of the Sentence in the Book Lagune 3 (2012), page 115

Manual Translation	Machine Translation
Die Politiker sind so alt, dass sie die Probleme der jungen Leute nicht verstehen. (ger.)	Politikacılar da gençlerin sorunları anlamak kalmamak için eski. (tr.)
	Politicians are so old that they do not understand the problems of young people. (ing.)
Politikacılar o kadar yaşlı ki, gençlerin sorunlarını anlamıyorlar. (tr.)	Politiker sind so alt, sie haben nicht die Probleme der jungen Menschen zu verstehen. (ger.)
	Politicians are so old, they do not understand the problems of young people. (ing.)
The politicians are so old that they don't understand	Die Politiker sind so alt, dass sie die jungen

the young people's problems. (ing.)	Menschen, die Probleme nicht verstehen. (ger.)
	siyasetçiler gençlerin sorunlarını anlamıyorum o kadar eski. (tr.)

In the German example given in the Table 22, the connector 'dass' commonly used for connecting more than one sentence is shown as an example. 'Dass' as being a connector means –ki, -diği, -diğini, - eceği, -meyi in Turkish (Zengin, 2005, 402). Different from German, this connector in Turkish isn't a word alone and it is added to verbs.

For instance; Ich glaube, dass er ein guter Mensch ist. (German)
Onun iyi bir insan olduğunu düşünüyorum. (Turkish)
I think that he is a good human (English)

Therefore, the errors are often seen in the translations made with 'dass' from German to Turkish. On the contrary, there is almost no mistake in the translations made with 'dass' from German to English; because in English there is an exact equivalence, that for the connector 'dass'.

Table 23: Manual and Machine Translation of the Sentence in the Book Lagune 3 (2012), page 155

Manual Translation	Machine Translation
Sie sind auf einer Feier eingeladen und sehen dort zufällig eine Person, die sie kennen und schon länger nicht mehr getroffen haben. Wenn Sie zu ihr gehen, können Sie sagen: "Das ist ja eine Überraschung!" (ger.)	Bir partiye davet ve bildikleri ve bir süre bir araya geldi değil bir kişi olması umulur, bkz. Ona gitmek, "Bu bir sürpriz!" Diyebilirsiniz (tur.)
	You are invited to a party and see there happens to be a person they know and have not met for some time. If you go to her, you can say, "That's a surprise!" (eng.)
Bir kutlamaya davetlisiniz ve orada tanıdığınız ve uzun bir zamandan beri karşılaşmadığınız bir kişiyi tesadüfen görüyorsunuz. Yanına giderseniz, şöyle diyebilirsiniz: " Ne büyük sürpriz!" (tur.)	Sie sind zu einer Party eingeladen, und Sie wissen, dass Sie da sind und Sie eine Person durch Zufall Sie nicht für eine lange Zeit gesehen haben, sehen. Wenn Sie ging an, könnte man sagen: "Was für eine tolle Überraschung!" (ger.)
	You are invited to a celebration and you see people you know, and there's a chance you encounter a long time. If you went to, you might say: "What a great surprise!" (eng.)
You are invited to a celebration and coincidentally you see that there is a person you know and you haven't met with her for some time. If you go to her, you can say: "What a suprise!" (eng.)	Sie sind zu einer Feier eingeladen und zufällig sehen, dass es eine Person ist, Sie wissen, und Sie haben nicht mit ihr seit einiger Zeit traf. Wenn Sie zu ihr gehen, können Sie sagen: "Was für eine Überraschung!"(ger.)
	Bir kutlama için davet edilir ve tesadüfen orada bildiğiniz bir kişi olduğunu ve bir süre onunla tanışmadım görüyoruz. Ona gitmek, şunları söyleyebilirsiniz: "Ne bir sürpriz!" (tur.)

As the sentences get longer the translations also become complicated as it can bee seen in the Table 23. It has been stated that Google Translate program can even translate a book, but as a result of studies it's possible to say that it's unlikely to have a true translation and the content will be filled with errors after the translation of a book which will be held in this way and even the topic in the book may change.

The reason of this study stems from the fact that the students get the sentences from such programs for their homework, projects or presentations and thus the students' works entirely consists of errors. Moreover, they present their work to the person who taught them without revising or correcting, and in this case the instructor is unable to work through those works and he/she can't correct them. If the student tries on his/her own, the instructor can analyze the errors well with the students. At this point, even a discussion with the students about their mistakes can't be made as there isn't an individual effort, a research or an attempt and a conscious work in their individual studies in spite of errors; because the students don't know neither what they do, nor what they want to say as they don't make these sentences on their own. How to correct the sentence above is a total mess, because the specific words like 'einladen'(to invite) have never been translated and they haven't even been in the sentence. Some translated words like 'bkz.' (to see) in the translated sentences from German to Turkish aren't

known how they have been translated like this. The word ‘bkz’ is the abbreviation of the word ‘bakınız’ in Turkish, and in this case the word ‘sehen’ (see) in German has been translated as ‘bakınız’. If the student translate this sentence by the help of a printed dictionary on his/her own, he/she will both make less error and spend less time and most importantly effective learning will take place. In fact, the experiences show that the instructor understands that the students haven’t done those on their own as he/she know their level and thus the teacher doesn’t want to correct them. It’s a fact that this case reduces both the teacher’s and the student’s motivation.

Table 24: Manual and Machine Translation of the Sentence in the Book Lagune 3 (2012), page 161

Manual Translation	Machine Translation
Weil ich gerade Spanisch lerne, habe ich mir im Fernsehen einen spanischen Sender gesucht, der viel Werbung zeigt. Da habe ich schon viel gelernt, weil die Sätze kurz sind und Wörter oft wiederholt werden. (ger.)	İspanyolca öğreniyorum çünkü ben reklam bir çok gösterir TV üzerinde bir İspanyol kanalları istemişimdir. Zaten cümleler kısa olduğundan, çok şey öğrendim ve gibi kelimeleri sık sık tekrarlanır. (tr.)
	Because I'm learning Spanish, I've wanted a Spanish channels on the TV, which shows a lot of advertising. As I have already learned a lot, because the sentences are short and the words are often repeated. (ing.)
Şu an İspanyolca öğrendiğim için, televizyonda bol reklam gösteren İspanyolca bir kanal aradım. Orada çok şey öğrendim, çünkü cümleler kısa ve kelimeler çok sık tekrarlanıyor. (tr.)	Im Moment habe ich gelernt, Spanisch, viel Fernsehwerbung auf Spanisch zeigt einen Kanal genannt. Ich erfuhr, dass es eine Menge, weil sehr oft Wörter und kurze Sätze wiederholt. (ger.)
	For the moment I learned Spanish, showing plenty of television advertising in Spanish called a channel. I learned a lot there, because very often repeats words and short sentences. (ing.)
As I am learning Spanish now, I have searched a Spanish channel on the TV which shows lots of commercials. There I have learned much, because the sentences are short and the words are repeated often. (ing.)	Da ich Spanisch jetzt lerne, habe ich einen spanischen Kanal auf dem TV gesucht, die viele Werbespots zeigt. Dort habe ich viel gelernt, weil die Sätze oft kurz und die Worte wiederholt werden. (ger.)
	Şimdi İspanyolca öğrenme yaşıyorum, ben reklam çok gösteren TV'de İspanyol kanalı arandı. cümleler kısa ve kelimeleri sık sık tekrarlanan, çünkü orada ben çok şey öğrendim. (tr.)

The last sentence is an example in which the connectors have been used too much. As seen in the Table 24, the connector ‘weil’ (as, because) hasn’t been taken into account, and so the sentence has become wrong in terms of syntactically, semantically and grammatically; that is it consists of errors. A student learning German newly both can’t perform an accurate learning and have a high motivation level. As known, the motivation has a great role on language learning. Lower level of motivation leads the students to be reluctant for language learning and thus the learning will be affected negatively.

CONCLUSIONS

The translation process is of great importance, as well as speaking, listening, reading and writing skills, both for its contributions to other language skills and vocabulary learning in foreign language education. The students have been using data-based translation programs, such as Google Translate, widespread in both curricular and extracurricular cases in order to fulfill all the skills. Today, data based translation programs like Google Translate are used widespread in both curricular and extracurricular cases. In this study, the effect of this program in the context of foreign language lessons has been tried to be explained. Many researches related to this field have tries to draw attention to both positive and negative aspects of such programs; yet the fact that data-based translation programs hinders the right and effective language learning in foreing language education has been revealed. By using this translation program in the study, German-Turkish-English sentences have been translated as mutual and the error analysis has been conducted. According to the results of error analysis, it has been found that the translations made by Google Translate are generally full of mistakes and some of which have nothing to do with the original sentences.The fact that this study is limited to these three languages doesn’t mean the absence of translation errors in other languages. As it has been mentioned in many studies, there are the same or similar mistakes in other languages. (opposed. İsmail &Hartono, 2016; Ghasemi and Hashemian, 2016)

The starting point of this study is that the new generation's approach towards learnings is to get everything ready without investigating and inquiring; so foreign language learners use data-based translation programs for their homework and individual studies and they bring those to their teachers without questioning. It's worth noting that, besides foreign language learners there are also people who often use such programs and put into practice without questioning for both professional and commercial purposes.As a result of this, an unhealthy communication and a poor language learning can take place in different areas.The aim of this study is not to denigrate the program. In fact, the translations done by these programs aren't carried out by a roomful of people who know more than one language. Such programs implement a process called 'statistical machine translation'. 'Statistical machine translation' is a machine translation approach by which parameters are used obtained from bilingual text compilation containing statistical models (Tantuğ, 2007; Yıldız, 2014). Google translate program searches the patterns among the hundreds of millions of documents that will help it to decide on the best translation for you while generating a translation. The more accurate information is installed in the Google Translate database existing in the Group of Google, the more likely the accuracy and the quality of translation will increase as it's stated.

What kinds of problems the students will encounter have been revealed in the analysis of the translations done in the study and in this regard the issues both the teachers and the students should pay attention to have been focused on; otherwise it's not possible to actualize an accurate language learning; otherwise the realization of a true language learning in not possible when considering the experiences. Another issue that should be mentioned here is that the errors in the translations between German and English are less than in Turkish due to the fact that these two languages come from the same language family (Zengin, 2013, 72; Özcimbit, 2011). The challenge of making translation between languages belonging the completely different language families has been stated by M. Nagao (1984) by the following words: "There is a common base among European languages, so when doing translation among these languages the statements don't undergo major structural changes. However, there are many challenges to do translation between completely different languages like English and Japanese [Turkish]. Sometimes the same meaning is expressed by a completely different structure. In both languages, a correct match for the provision of these structures can't always be found." Under the light of this statement, it's a fact that the translation between the languages coming from the same language family is easier both for the individual and the machines.

Finally, the last point to be addressed is that the results of the translations sometimes differ after entering the sentences several times in the translation program in order to confirm the sentences during the examination of the statements, and the reason for this stems from the fact that the continuous new data is entered in the data base. However, this situationwill only confuse the students' mind during the language learning process and thus their motivation level will reduce. In the end, it is necessary to raise foreign language students' awareness about the use of this type of programs and place the lessons that cover the data-based translation programs in the curriculum. Therefore, the ultimate aim should be to teach the right usage by discussing the right and wrong aspects of the programs. The content of the course should cover the talk on the incorrect translations of such programs and their comparison with the correct translations. In this way, the resolution of the foreign language accurately can be ensured by the help of such data-based programs. The incorrect usages can be discussed with the students in practice and long lasting learning can take place.

According to Weller (1994, 185), the translation has four different contributions to language learning: 1. The solution of the semantic problems, 2. Economic learning success, 3. The implementation of linguistic (lexical, grammatical) structures/ raising awareness, 4. Language comparison. In this regard, the process of applying the right resources has great importance in order to make correct translation. The right translation tool brings together the accurate and permanent language learning.

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The Effect of Online Learning Environment Based on Caricature Animation Used in Science and Technology Course on the Success and Attitude of the Student for Humor

Uğur Başarmak
Ahi Evran University, Faculty of Education, Computer Education and Instructional Technologies Department,
ugurbasarmak@ahievran.edu.tr

Ahmet Mahiroğlu
Gazi University, Faculty of Education, Department of Educational Sciences,
amahir@gazi.edu.tr

ABSTRACT
The purpose in this study is to examine the effect of "Online Learning Environment based of Caricature Animation" which is prepared for "Human and Environment" and "Sun and Space" units in the secondary school 7th Grade Science and Technology course, on the success and attitude of the students for humor. The participants consist of 7th grade students who take Science and Technology course and study in Kırşehir State Secondary School. Online learning environment has two sub-level according to the situation of existence or nonexistence of caricature animation. The implementation stage is actualized with the participation of 46 students; 23 students in experiment group and 23 students in control group. Success test and attitude scale is used for both groups before and after the implementation. At the end of the study, it is observed that the successes of the students studying in online learning environment with caricature animation are higher in significant level than the students studying in online learning environment without caricature animations.

Keywords: Online Learning, Caricature Animation, Science and Technology, Success, Attitude

INTRODUCTION
To try to develop themselves against the fast developing and changing information in present information age becomes a necessity and the individuals try to meet this obligatory need in different forms and in different learning environment. " When the needs and the opportunities of the educational institutions are considered, it is observed that the individuals who want to receive education, face with the educational problems due to their ages, occupation and regional position" (Mahiroğlu and Çoşar, 2008).

Recently, online courses are developed and used for the non-profit organizations and higher education institutions. The care given to the lifelong learning and online education by the individuals, makes the needed education important for being used in online environment. According to White (2003), the online learning is an approach where the online learning, teaching and learning process is actualized with the internet technology. Internet technology does not only reach the information but also turns into interactive environments where the information production is actualized and shared. These specifications of internet are an important potential in transferring the learning process to online environments (Yaşar, 2012). Since all opportunities provided by internet constitute resource for online learning environment, they offer convenience in terms of accessibility and richness in terms of material variability (Kalelioğlu, Arda and Çetin, 2016).

Online learning environments are classified under four titles of Learning Management Systems (LMS), Learning Content Management Systems (LCMS), Course Management Systems (CrMS) and Virtual Learning Environments (VLE) (Berking and Gallagher, 2013). The online learning is a student-centered environment which includes the distance learning and programs within itself, can be extended and organized easily, facilitates the evaluation and encourages the individual learning. (Cook and Dupras, 2004). Online learning environments use single or multiple technologies to support simultaneous or non-simultaneous interaction between teacher and students in a regular and constant order (Allen, Seaman, Poulin and Straut, 2016). The online learning systems must involve whole learning fields from pre-school to higher education, informal learning in society, house or business, the courses in industry and educational courses for adults. This concept may be seen as inefficacious by itself however its need for the cooperation-based learning environment which determines the negative interruption between the different learning stages or environments and removes these interruptions in systematic form, is emphasized (Sadeghi and Moslehpour, 2007).

When the present education model which is equipped with changing and new technologies, is compared with the course given by the traditional methods, implementation of different strategies is required in education besides using the technology for only the works (Baturay and Türel, 2013). Online learning may not be appropriate for all students. Determination of special qualifications could be helpful to contribute into estimation of potential learning outputs against failure (Kauffman, 2015). Studies concentrated on learning process of an individual suggest that each individual follows different ways and strategies in learning (Ünlü and Karataş, 2016). The today's technological developments imply the different techniques and strategies which are appropriate for each individuals. The online learning environment must include various activities for meeting the individual needs and reaching the learning outcomes (Ally, 2008). Supporting online learning environments through various animations, games and visual objects, attention of students and persistence of learning could be acquired (Akca, Barut and Önder, 2014). However, in a face-to-face education environment, success displayed by student does not mean that it would happen similarly in an online environment (Kalelioğlu and Baturay, 2014). Appropriate strategies must be used for an efficient learning in online environment.

The humor which create variation in emotions and understandings of the individuals, helps in presenting the creative products (İnam, 1994). Even it is in different style and understanding, the caricature which is an efficient humor type in our era, provides the humor by presenting an ordinary situation within an appearance table which is not in daily life or by bringing many different classes together (Öngören, 1988). The caricatures may be used for developing the critical thinking skills of the students related with the subject, presenting their prior knowledge, providing commenting and communication skills, starting the discussion process, encouraging for using the imagination, arousing the interest of the students to the subject, providing the research of the subject and for evaluating the learned subjects (Kleeman, 2006).

The concept caricatures are developed for an innovative teaching and learning strategy which considers the structuring opinions related with the science learning. (Keogh and Naylor, 1999). Therefore, for an effective learning and success in online environment, appropriate strategies are required to be used. Concept cartoons are significantly important in natural science teaching. Students are motivated to think about various subjects in general (Hejnová, 2013). The concept caricatures must include the elements which provide the transfer of the scientific knowledge, encourage the students for researching and discussing and arouses the attention of the students.

There are many implication related with the usage of concept caricatures in science learning and teaching. These are:

- to increase motivation.
- to present objects for practical studies.
- to underline the implementation in science.
- to provide opportunity to the students for evaluating their own understanding levels.
- to support the conscious, interest and understanding of the public for the science.

The concept caricatures has a function as stimulant for presenting scientific thoughts, encouraging the discussing, attracting attention and asking questions (Long and Marson, 2003). The concept caricature materials provide a discussion environment where the students may change or develop their thoughts (Morris, Merrit, Fairclough, Birrell and Howit, 2007). It is possible to state that cartoons, cartoon films and animations whose visual dimensions are put in prominence to develop positive attitude towards course and to increase academic success have essential place in improving student motivation (Yıldırım, 2016). Effective usage of animations allows students to accomplish their targets directly and relieve them from loading of abundant unnecessary information and develop their perception and attention skill to enhance efficiency of learning (Bayram and Koçak, 2013).

Consequently, the educational approaches which increase the attractiveness in online learning environment, provide to students to think critically and develop their mental skills, are needed in online learning environments. The literature shows that the humor may positively affect the emotions of the individual for the content and may be a positive factor for learning. Besides, in the studies for the usage of caricatures in the education, it is observed that the caricatures increase the efficiency in education, make the course more attractive and entertaining, contribute to the mental and emotional aspects of the students and help the student to participate to the discussion environment and change their minds. It is thought that the implementation of the online learning environment supported with the humorous elements which are different from domestic and abroad example and lack of any similar studies in this field, shall make important contributions to the literature for meeting the need.

The question of whether the online learning environment which is prepared related with Science and Technology by benefitting from the "caricature animations", has an effect on the success of the students, forms the problem of this research.

The purpose of this research is to analyze the effect of the caricature animation-based online learning environment on the success of the student and their attitude for the humor. The sub-purposes for this purpose are as follows:

Between the control group working in online learning environment where the caricature animation is nıt used and the experiment group working in online learning environment where the caricature animation is used;

1. In terms of success points of the students,
2. Is there any significant difference in their attitude towards humor?

The present research;

1. Humor factor in online learning environment are limited with “cartoon animations” presented in two-dimensional,

2. Content and success tests provided in an online learning environment are limited with the "Human and Environment" and "Sun and Space" units of the Natural Science and Technology Course.

METHOD

1. RESEARCH DESIGN

The effect of the online learning environment with or without caricature animations on the success and attitude of the students towards the humor, is examined in the experimental operation stage of the study. Semi experimental pattern with Pretest- final test control group is used in this study. For providing the equation in the group, the control and experimental groups are assigned objectively (Hovardaoğlu, 1994). The figurative appearance of the research model is given in Table 1.

Table 1. Figurative Appearance of the research model

		Pretest		Final test
G_D	R	O_1	X	O_3
G_K	R	O_2		O_4

G_D: The experiment group with caricature animations
G_K: The control group without caricature animation
R: Objective assignment
O_1 and O_3: Experiment group pretest and final test
O_2 and O_4: Control group pretest and final test
X: Independent variable which is applied to the participants in experiment group

The independent variable of the research is the online learning environment. The online learning environment includes two sub-levels as the existence and nonexistence of the caricature animations. The dependent variables of the study are the successes of the students and their attitude towards to humor.

2. STUDY GROUP

For using the semi experimental pattern with pretest-final test control group in research, the study groups are determined instead of sampling and population. The study is made in Kırşehir State Secondary school for the communication convenience with the school personnel in providing the participation of the experiment and control group students and the availability of the computer laboratory usage. When forming the experiment and control groups, 7/C class studying the Science and Technology course with objective assignment method in Kırşehir State Secondary School is determined as experiment group and 7/E class is determined as control group. Total 15 students from 61 students are excluded from the scope of the research for the nonparticipation of 11 students to the final test and lack of continuity of 4 students to the application. The research is made on total 46 students who take science and technology course and participate to whole activities; 14 female and 9 male students in experiment group and 10 female and 13 male students in control group. The experiment group is the online environment with caricature animations and control groups is the online environment with no caricature animation.

3. LEARNING ENVIRONMENT

The content of online learning environment consists of "Human and Environment" and "Sun and Space" in 7th grade Science and Technology courses. The online environment is prepared as two different environments with caricature animations and without caricature animations. The purpose of the introductive animations (introduction animations) which are used in the beginning of both units in online learning environment, is to attract the attention of the student and to arouse the interests of the students. It is aimed to have the introductive animations as to be a visual presentation summarizing the content of the course.

The students are directed to main page after watching the introductive animation for a specific period of time. The main page includes the titles and sub-titles of the subjects, discussion, site map, about and help menus. Information, video, application and caricature (caricature animation) activities are found under the sub-title of each subject. The activities under the sub-title of the subject are respectively explained as follows.

Information: It is the section where the information is presented both as aural and visual. There are two separate channels which shall process things we hear and see. (Paivio, 1986). The elements which the students may follow the information as aural and visual, take place in this section.

Video: It is aimed to make the content more entertaining and attractive by appealing to different sense organs using the actual videos related with the sub-title of the subject. The videos are used widely in the web environments for materializing the abstract conceptions and for supporting with text or visuals (Somyürek and Atasoy, 2008, s.214).

Implementation: When the students give right or wrong answers to the questions asked for the content, explanations are made to the students about why their answers are right or wrong. Through these explanations, it is aimed to remove the problems in interpreting the question options while answering the questions.

Caricature (Caricature Animation- Cartoon Animation): It is tried to present how the caricature animations provided to the experimental group students in online learning environment as an education material, affect the education process. Help is asked from the expert for learning what kind of an editing shall be actualized for creating motion images from the caricatures.

Discussion: Through the discussion made in the online learning environment, the active participation of the students to the learning environment. By means of the online discussion, a learning environment is provided where all students participate simultaneously and communicate with each other. The discussion process of the experiment and control group students, is performed in environment which is independent from each other.

Site Map: It is aimed to have the students monitor the content in online learning environment easier.

About: It is the section where information is provided related with the copyrights like recorder, text, video, picture, caricature.

Help: It is the section with the contact sites which shall be beneficial for the students for learning what to pay attention in using online learning environment

4. APPLICATION PROCESS

The experimental process in research process, is made in a computer laboratory environment during a period of 11 weeks. Besides the Science and Technology course which is 4 hours weekly, the computer laboratory is presented to the usage of the students because the information technologies course is not compulsory.

The information technology teacher and researcher in school remedy the hardware and software deficiencies of the computers in laboratory environment for the application to be applied on both experiment and control group. Earphones are given to each student for not being affected from the external environment. NetOp School software is installed to the computer for monitoring the transactions in screen and for timely intervention during the actualization of experimental process. NetOp School is a software which is useful for controlling the computers in computer laboratory environment during the course. Due to the actualization of whole applications through the online learning environment, the internet infrastructures are made suitable.

The students are given training for the usage of the system (listening or reading the course content, following the videos, solving the test questions, providing the discussion, commenting the caricatures etc) during two course

hours User names and passwords are given to each student which shall provide the access of the student to online learning environment and the students are demanded to write on the suitable section in the identification badge.

The students are requested to answer Success Test of "Human and Environment" first when the online learning environment is accessed. After completing the success test, the students are requested to fill "Attitude against humor scale" when they click on "End the test". It is not permitted not to answer any articles while filling the System Success Tests and Scales. Besides, the students are permitted to access to the unit after filling Success tests and Scales.

One each computers are supplied in computer laboratory for providing the students to work independently. When the students access to the system, they face the activities which are required to be made under the title. The system does not allow students to skip the activities under the next title without completing the activities under the relevant title. The students in experiment and control group actualize activities for the acquisition of "Human and Environment" and "Sun and Space" units during 8 weeks. Besides, an additional period of 3 weeks is given to experiment group students for the humorous activities

The students who complete "Human and Environment" unit, reply the success test again which they have answered at the beginning of the unit as the final test. System gives the access permit to the students who complete the success test of "Human and "Environment" unit, to the "Sun and Space" unit. When the students access to the "Sun and Space" unit, they provide unit access by entering the success test related with this unit.

Experiment group students who complete the activities under each subject title, face "caricature animations" which are the last humorous activity. The students write their first opinions related with this activity before participating to discussion environment by questioning the caricature animation which they face in the last activity stage. The students who click on the completed button after writing their opinions related with this activity, are included to the environments where the opinions related with the caricature animations conflict (discussion) and combine (negotiation). The administrator send messages to the students for what they need to do in the next stage for ending the discussion process. As of this message is delivered to all students, the discussion environment becomes closed. The students are requested to transfer their final thoughts which they create in their minds related with the humorous activities through the discussion.

In the last week, the students who complete "Sun and Space" unit, are requested to reply the success test again which they have answered at the beginning of the unit as the final test. Besides, the students are requested to fill "Attitude against humor scale" which they have filled at the beginning of "Human and Environment" unit".

5. DATA COLLECTION TOOLS

It is developed for determining the successes of the experiment and control group students related with "Human and Environment" and "Sun and Space" units. Belirtke Table is prepared by considering Bloom's cognitive Field Taxonomy and the acquisition are determined in company with the experts and in accordance with Science and Technology Course program. Success tests which are issued according to Belirtke table, are implemented as pretest and final test to the experiment and control groups in online learning environment.

For determining the attitudes of the students towards the humor, Likert type scale with 44 articles which is issued by Aydın (2006), is applied on 550 students. The number of articles is decreased to 29 by calculating the data of the articles of students and the reliability of the scale increases to 0.86 in accordance with these calculations. The reliability coefficient of the scale which is applied to 238 persons in 6 elementary schools in the centre of Kırşehir by the researcher, increases to 0.92.

6. DATA ANALYSIS

SPSS packaged software is used in the analysis of quantitative data and the significance value is determined as $p<0,05$.

Covariance analysis (ANCOVA) with single factor is used for determining whether there is a significant difference between success tests point and Attitude towards humor scale of the students studying in online learning environment with caricature animation and online learning environment without caricature animation.

FINDINGS

1. FINDINGS WHICH ARE OBTAINED FROM THE SUCCESS TESTS

Covariance analysis is made for determining the change in "Human and Environment" and "Sun and Space" Success test points of the control group students using the online learning environment without caricature animation and the experiment group students using the online learning environment with caricature animations.

Covariance analysis is used for analyzing the data of a few different types of studies. These are;

- In the researches where the experiment and control groups are assigned according to the pretest applications,
- In the researches which the intergroup matching is made according to pretest points,
- In the researches where the unexpected results may occur which the researcher cannot take under control (Green and Salkind, 2008).

1.1. FINDINGS WHICH ARE OBTAINED FROM HUMAN AND ENVIRONMENT SUCCESS TEST

Covariance analysis (ANCOVA) with single factor is used for determining the change in "Human and Environment" and "Sun and Space" Success test points of the control group students using the online learning environment without caricature animation and the experiment group students using the online learning environment with caricature animations.

Table 2. Success test (Human and Environment) of the students in experiment and control group, Pretest-final test, corrected arithmetical averages, Standard Deviation Values and Final Test Corrected Averages and Standard Error Values

Groups	N		Total Points		Corrected Final Test Averages	
			$\overline{X}$	SS	$\overline{X}_d$	SH
Experiment Group	23	Pretest	10.83	2.85		
		Final test	12.39	3.45	11.49	.60
Control Group	23	Pretest	8.70	3.35		
		Final Test	8.65	4,13	9.55	.60

As seen in table 2, the corrected final test total point average of experiment group ($\overline{x}$ =11.49) is higher than the average of control group ($\overline{x}$ =9.55). For determining between which groups does the difference exists, Bonferroni paired comparison test is applied and the obtained results are given in table 3.

Table 3. Bonferroni test results related with the significancy (human and Environment) of the differences between the corrected averages of Success Test, Final Test Total Points of the students in experiment and control groups

Comparison	Actual Difference	Standard Error	P
Experiment Group Control Group	1.944	.871	.031*

*p<.05

When table 3 is analyzed, it is observed that there is a statistical significant difference in favor of experiment group according to the studied environment between the "Human and Environment" unit of the experiment and control group. Therefore, according to the findings which are obtained from success test of "Human and Environment" unit, the students studying in learning environment with caricature animations, are more successful in significant level than the students studying in environments without caricature animations.

1.2. FINDINGS WHICH ARE OBTAINED FROM SUN AND SPACE SUCCESS TEST

Covariance analysis (ANCOVA) with single factor is used for determining the change in "Sun and Space" Success test points of the control group students using the online learning environment without caricature animation and the experiment group students using the online learning environment with caricature animations.

Table 4. Success test (Sun and space) of the students in experiment and control group, Pretest-final test, corrected arithmetical averages, Standard Deviation Values and Final Test Corrected Averages and Standard Error Values

Groups	N		Total Points		Corrected Final Test Averages	
			$\overline{X}$	SS	$\overline{X}_d$	SH
Experiment Group	23	Pretest	8.70	2.24		
		Final test	14.82	4.49	14.83	.93
Control Group	23	Pretest	8.70	3.12		
		Final Test	11.04	5.42	11.04	.93

As seen in table 4, the corrected final test total point average of experiment group ($\overline{x}$ =14.83) is higher than the average of control group ($\overline{x}$ =11.04). For determining between which groups does the difference exists, Bonferroni paired comparison test is applied and the obtained results are given in table 5.

Tablo 5. Bonferroni test results related with the significance (Sun and Space) of the differences between the corrected averages of Success Test, Final Test Total Points of the students in experiment and control groups

Comparison	Actual Difference	Standard Error	P
Experiment Group Control Group	3.783	1.313	.006**

**p<.01

When table 5 is analyzed, it is observed that there is a statistical significant difference in favor of experiment group according to the studied environment between the "Sun and Space" unit of the experiment and control group. Therefore, according to the findings which are obtained from success test of "Sun and Space" unit, the students studying in learning environment with caricature animations, are more successful in significant level than the students studying in environments without caricature animations.

2. FINDINGS WHICH ARE OBTAINED FROM ATTITUDE SCALE

When the pretest points of the students in experiment and control group from the "attitude towards humor scale" are controlled, covariance analysis (ANCOVA) is used for determining whether there is a significant difference between the final test points

. Table 6. attitude pretest-final test of the students in experiment and control group, corrected arithmetical averages, Standard Deviation Values and Final Test Corrected Averages and Standard Error Values

Groups	N		Total Points		Corrected Final Test Averages	
			$\overline{X}$	SS	$\overline{X}_d$	SH
Experiment Group	23	Pretest	103.70	11.40		
		Final test	105.74	15.40	105.19	3.33
Control Group	23	Pretest	100.39	12.53		
		Final Test	103.74	16.81	104.25	3.33

As seen in table 6, the corrected final test total point average of experiment group ($\overline{x}$ =105.19) is higher than the average of control group ($\overline{x}$ =104.25). For determining whether this difference is significant or not, covariance analysis is applied and the obtained results are given in table 7.

Table 7. Covariance Analysis Results of Final test total points of Students' attitude in the experiment and control groups

Source of Variance	Sum of Squares	Sd	Sum of Squares	f	p
Controlled Variable (Pretest)	595.747	1	595,747	2.363	.132
Grouppping main effect	9.993	1	9.993	.040	.843
Error	10841.557	43	252.129		
Total	515905.000	46			

As seen in Table 7, the covariance analysis results show that the groupping main effect is not significant in terms of final test corrected average points of the groups when pretest total points are taken under control [F (1,43)= .040 p=.843].

The findings of the research related with the student attitudes show that there is no significant difference in the attitude of the students towards humor according to online learning environment. Therefore usage of caricature animations in learning environment does not create a significant difference in the attitude of the students towards humor.

DISCUSSION, RESULTS AND SUGGESTIONS

This research aims to analyze the effect of the education actualized by using humor inn online learning environment on the attitude of the students towards humor and success of the students. Caricature animations are used as humorous element in online learning environment. The education which is actualized by benefitting from caricature animations in online learning environment increases the successes of the students in significant level. As the result of the interviews made by experiment group students, it is observed that the students understand the subjects better with the caricature animations which are used as an education strategy. Various online learning approaches could result in different consequences for student success (Porter, 2015). In his study, Hung (2012) has examined the effect of various learning methods in program design course of the students who learn with special learning styles in online learning systems. In this study, the learning performances are analyzed by focusing on the relation between the learning methods and learning styles in program design course. As the result of the study, a more significant difference is observed in the students who learn with diagram method in program design course than the students who learn with the other method. As a result of the study which aims to reveal the effect of online activities based on learning strategy for natural science course teaching on academic success of students and on persistent learning, a statistically significant difference was determined with online learning environment in terms of academic success of students (Ünlü and Karataş, 2016). In the experimental study which Ziv (1988) made related with the humor in higher education, he used a control group where no humor exits and a control group where humor exists in statistics course. 161 students participate to the study and the results show a significant difference in favor of student group who learn with humor. In the study made by Karakuş, Palaz, Kılcan and Çepni (2012), the effect of the usage of caricatures in environmental problems in "Transnational Bridges" in Social Sciences course of 7th grade students on the success of the students. According to the findings of this study, the course which is made with the caricature based activities, makes a positive effect on the academic successes of the students in favor of experiment group. Akamca, Ellez and Hamurcu (2009) has examined the effects of concept caricature based computer educations. The qualitative data which is obtained from observation and interview, is analyzed with the content analysis and according to the results of the study, the concept caricature based learning environment positively affects the successes of the students. In his study, Kılınç (2008) develops a humorous comprehension mechanism which may be used in commenting normal caricatures and science caricatures. As the result of the study, the education which is made with science caricatures increases the successes of the students rather than plain teaching method. In another study, it was reported that usage of interactive concept cartoons and concept maps in social science teaching had positive significant effect on their academic success (Akbaş and Toros, 2016). In another study conducted by Evrekli and Balım (2015), it was reported that animation-supported concept cartoon and conceptual cartoon practices in the unit of "Material and Heat" resulted in that post-test scores of experiment group were higher than pre-test scores significantly. In another study conducted by Daşdemir and Doymuş (2016), it was determined that animation-supported teaching in the unit of “structure and characteristics of material” increased student success and persistence of knowledge. In their study, Tokcan and Alkan (2013) observed that courses held by support of concept cartoons increased student success in the experiment group. In the study conducted by Başal and Gürol (2014), it was determined that it has statistically significant effect on success scores of students from the experiment group attending to online foreign language education. In the study conducted by Swan, James, Daston and Raleigh-Durham (2016) on success levels of students attending to online undergraduate programs, it was not adversely effective on students’ success; on the contrary, students made moderately faster progress by having some online course. In the study which investigated effect of cartoon-supported learning activities on "Chemistry and Energy", significant difference was determined as a result of students’ academic success test in the favor of experiment group (Özyalçın-Oskay and Efil, 2016). Success is not only relted with student satisfaction and high grades, but learning perception and information transfer as well (Barbera, Gomez-Rey and Fernandez-Navarro, 2016).

There is no significant difference in the attitudes of the students towards humor in terms of whether the caricature animations exist in online learning environment. It is thought that a long study process is needed for having to student to present a positive attitude related with a different strategy and to get used to the caricature animations which are not frequently seen in daily curriculum. In his study Baba (2012), examines the effects of concept caricature usage in giving citizenship awareness to elementary school students. While the course in experiment group is made by using concept caricatures, the social sciences program is made normally in control group. At the result of the research, it is observed that the usage of the concept caricature does not affect the attitude of the students towards the course .

The humor aims to make a connection between the student and teacher trough entertainment and to help the students for being more careful and fit (Wandersee, 1982). Humor is considered as a sign of emotional intelligence; it is strong communication type (Taiwo, Odebunmi and Adetunji, 2016) and it is a strategy utilized to improve students' inclination to accept scientific information accurate (Wizner, 2014). In the study conducted by Akbaş and Toros (2016), students expressed their opinions as interactive concept cartoons have positive characteristics such as funny, allowing persistent learning, consolidating what was taught during course and drawing attention. As a result of interviews held with natural science teachers about usage of concept cartoons developed by them, it was determined that they were having positive opinions about preparation and usage of concept cartoons (Ekici, 2015). In another study, it was observed that students were satisfied with teaching and tools in which video, animation, cartoon and cartoon films etc. materials based on multimedia; and that they displayed high attention level during the course (Akın and Çeçen, 2015). By means of humor in online courses, students would find the course process more funny and they would think more creatively (Stoll, 2016). The development of visual media makes the caricatures and cartoon animations more attractive. Various learning materials are used for providing the permanence of the teaching and to make the learning more fun. The usage of the visuals that shall extend the imaginations of the children shall make the learning more effective. The caricature and cartoon animations are confronted as the education materials which provide the information to be visualized easily and help the student by learning through entertainment. According to the results of this study, it is though that the usage of caricature animations which are designed according to the individual differences and development level of the students, shall increase the success of the students.

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APPENDIX: NOTATION TABLES

Human and Environment Success Test Notation Table

Part Of Unit	To Ecosystem From Kind	Different Ecosystems	Food Network	Biological Diversity	Let Love Living	Environmental Problems and Effects	Solution Proposals and Activities
Knowledge				9	12	14	
Comprehension	1,4	3,5		7,10			
Application					11	13	
Analysis	2			8		16	
Synthesis			6			15	17
Evaluarion							18

Sun and Space Success Test Notation Table

Part Of Unit	Let Examine Celestial Bodies	Stars Groups	Comet	Getting to Know Planets	Satellite of our Planet	Getting to Know Sky Island	History of Space Exploration	Telescop	Space Technology
Knowledge	1		6,8						
Comprehension	2	3,4	5,7	10, 11, 12, 13, 14, 18		15	17, 19	20	21, 22, 23
Application									
Analysis				9	16				24
Synthesis									
Evaluarion									

The Effects of Geography Information System (GIS) Based Teaching on Underachieving Students' Mastery Goal and Achievement

Soon Singh Bikar Singh
Faculty of Psychology and Education, University Malaysia Sabah
soobs@ums.edu.my/ sohan4025@gmal.com

Balan Rathakrishnan
Faculty of Psychology and Education, University Malaysia Sabah
rbhalan@ums.edu.my

Sabariah Sharif
Faculty of Psychology and Education, University Malaysia Sabah
sabariah@ums.edu.my

Rosy Talin
Faculty of Psychology and Education, University Malaysia Sabah
rostalin@gmail.com

Oliver Valentine Eboy
Faculty of Humanities, Art and Heritage, University Malaysia Sabah
pprodong@yahoo.co.uk

Abstract
Recent studies indicate that the number of students electing to study Geography in Malaysian upper secondary schools, and their level of achievement in the subject, has declined. The main factor appears to be a lack of motivation. Yet there has been little research into the impact of instructional methods on Geography students' motivation and their learning outcomes. This study applies a concurrent triangulation mixed method model to determine the effect of GIS based teaching on underachieving students' achievement and their motivation to learn Geography. The quantitative data were collected through a quasi-experimental design while the qualitative data were collected through students' interviews. The treatment groups included 44 students and control group with 40 students. For the treatment group, a unit on the type and distribution of world vegetation was given with GIS-based lesson material. For the control group, the same subject matter was presented using the traditional teaching methods. The quantitative evaluation showed the mastery goal and achievement post-test mean score of experiment group student participants' are significantly higher than control group student participants. The evaluations of student participants' interviews are consistent with quantitative findings. The triangulation of the quantitative and qualitative data reveals that GIS-based teaching had a more positive effect as compared to traditional teaching methods in enhancing participants' mastery goal learning motivation and achievement in the topics being taught in the classroom. Thus, it is possible to draw overall conclusion that GIS based teaching has positively impact the student participants' achievement and motivation to learn Geography.

Keywords: GIS-based teaching, underachieving students', motivation, mastery goal, achievement

INTRODUCTION

In 1988, the Malaysian Ministry of Education introduced the integrated secondary school curriculum as a continuation of curriculum changes initially introduced in the primary school. These changes impacted the profile of Geography in secondary schools, with Geography becoming a compulsory subject at the lower secondary school level but offered as an elective subject at the upper secondary school level. As a result, fewer schools in Malaysia offer Geography at the upper level today. In 1999, the Ministry of Education also established the Smart School Program that emphasizes the use of technology as an important aid in the learning and teaching process. However, the integration of Information and Communications Technology (ICT) has been prioritized in subjects deemed critical only, namely; Science, Mathematics, and English. As a result, Malaysian students in upper secondary schools are now avoiding studying Geography. Furthermore, of the remaining students who do continue to study Geography, the percentage that passes the exam is declining each year. Singh (2013) reported that the major factor correlated to this issue was that Malaysian students are not motivated to study Geography and increasingly perceived it as a dry subject with little opportunity to use technology.

EFFECTS OF ICT, GIS ON STUDENT MASTERY GOAL

In the 1990s and 2000s**,** there was a growing acceptance of the value of ICT in primary and secondary schools and universities. It was acknowledged that Integrated ICT-based learning in educational practice could yield significant benefits in terms of knowledge, development of skills and attitudes. In recent decades too, a large and growing body of literature has indicated that ICT integrated learning increases students' motivation to learn (Agudo, Rico, & Sánchez, 2016; Aladag, 2010; Daungcharone, 2016; Y.-T. Lin & Jou, 2013; Luo & Yang, 2016; Meluso, Zheng, Spires, & Lester, 2012; Omwenga, 2016; Park, Park, & Kim, 2011; van der Meij, van der Meij, & Harmsen, 2015; Vos, Van der Meijden, & Denessen, 2011). The studies demonstrated that the use of ICT in teaching activities provides more fun in an authentic learning environment, while increasing learning autonomy, interaction, and collaboration; it is therefore a rich opportunity for motivating students to study.

Midgley (2002) stressed that mastery goal plays an important role in shaping student academic interest. Based on this claim, numerous studies have been conducted to examine the relationship between ICT integrated teaching and students' mastery goal (Beckers, Dolmans, & van Merriënboer, 2016; Z.-H. Chen, Liao, Cheng, Yeh, & Chan, 2012; Dori, Rodrigues, & Schanze, 2013; Erhel & Jamet, 2015; Lorenzo, 2016; Su & Cheng, 2015; Yıldız-Feyzioğlu, Akpınar, & Tatar, 2013). The findings of these studies indicated that ICT and technology integrated learning have favourable effects on students' mastery goal. These outcomes resulted from the fact that ICT and technology integrated learning enhanced the student participants' interest, curiosity, and excitement in learning the content of the topic, which in turn, encouraged them to set a goal to learn the content of the topic. This is further reinforced by Beckers et al. (2016); Su and Cheng (2015), who posit that new technology-based learning environments motivate students to engage in the learning process and create competing motivations for task completion, along with enhance their need for recognition and self-valuation.

Although a growing body of research has specifically examined the relationship between ICT integrated learning and goal orientation motivation for school children, there is scarce research on the relationship between ICT integrated learning in primary and secondary schools and student goal orientation motivation. In particular, there is no research mediating the role of ICT integrated learning on underachieving students' mastery goal. Mayers (2014); Obergriesser and Stoeger (2015) and Fong and Krause (2014) affirmed that underachievers have very low confidence in their abilities. Consequently, they try to avoid challenging tasks when there is a risk of failure. On the other hand Wang, Teng, and Chen (2015), Bouzid, Khenissi, Essalmi, and Jemni (2016) posits that the integration of ICT and multimedia technology in teaching and learning raises a student's learning interest, ability and confidence, and allows students to involve themselves in the subject matter and generation of ideas and think creatively. It is therefore important to investigate the effect of ICT integrated learning on underachieving students' goal orientation motivation.

EFFECTS OF ICT, GIS ON STUDENT ACHIEVEMENT

Much research in recent years has focused on identifying the key factors that promote academic achievement among students. The explosion of ICT has influenced the development of society, and current pedagogy has given researchers new directions to explore the effects of ICT integrated teaching on student academic achievement. A large and growing body of literature has investigated the effects of ICT integrated teaching on students' achievement and has proven that ICT is a useful tool for supporting and transforming teaching, and for enhancing student achievement (Alibrandi & Goldstein, 2015; Dalal, 2016; Gungadeen, 2015; Hwang, Chiu, & Chen, 2015; Q. Li & Ma, 2010; Prieto-Rodriguez, 2016; Rutten, van Joolingen, & van der Veen, 2012; Skryabin, Zhang, Liu, & Zhang, 2015; Yang & Wu, 2012; K.-H. Yang, 2014; Y.-T. C. Yang & Chang, 2013). Several studies also have been carried out to examine the effectiveness of ICT tools on students' achievement in Geography in primary and secondary schools (Asaolu, 2012; Cowan & Butler, 2015; Diab, Diab, & Awada, 2016; Z. Li, 2012; Ong, Ho, & Teow, 2011; Solari, Demirci, & van der Schee, 2015; Zivkovic, Jovanovic, & Ivanovic, 2010). The findings of these studies demonstrated that the utilisation of ICT in teaching and learning activities in the classroom enhances students' achievement in Geography. These results may be attributable to the students finding working with computers interesting and that three-dimensional images and interactive maps attract their interest in the classroom lesson. In addition, ICT integrated teaching engaged the student participants in the learning process by encouraging them to gather the necessary and important information, search for solutions to the problem and attain the right solution(Diab et al., 2016; Gungadeen, 2015; Hwang et al., 2015) . The activities conducted in a GIS integrated class encouraged students to use the internet resources actively to find information to complete their mapping projects compared to their counterparts in the control group who passively accepted information from teacher(Alibrandi & Goldstein, 2015; Delparte, Richardson, Eitel, Matsaw, & Cohn, 2016; Stonier & Hong, 2016). As a consequence, the student participants could understand the content of topics taught in the class easily and scored good grades in the post- test (Z. Li, 2012; Rutten et al., 2012; H.-C. Yang & Chang, 2016; K.-H. Yang, 2014)

Over the past three decades, GIS has become a central tool for natural resources management, disease mapping and monitoring, crime analysis, and city and regional planning. Therefore, GIS use has become so pervasive that it is emerging in secondary school education and is being integrated into Geography classes in a number of countries (Oppong & Ofori-Amoah, 2012). Aladag (2010) and Artvinli (2010) asserted that the introduction of GIS in Geography classes has a positive effect on students' attitudes towards Geography lessons. This view is strongly supported by Kaya's (2012) research on Grade 6 primary school students in Turkey. His research addressed how GIS integrated lessons promoted academic success among high risk failure and low motivation students in Social Studies. Supporting his findings are numerous studies that have attempted to explain the effects of GIS integrated lessons and Geospatial technology on students' achievement. For example, Shin (2007) reported that GIS integrated lessons have helped Grade 4 primary school students engage in more difficult tasks, enhancing their Geographic content knowledge mapping skills and achievement. Similar findings were also reported by Aladag (2010); Demirci (2011); Favier and Van der Schee (2014); Goldstein and Alibrandi (2013); Kaya (2011); and (Blank, Almquist, Estrada, & Crews, 2016; Delparte et al., 2016); Liu, Bui, Chang, and Lossman (2010). In summary, GIS has been recognised as an effective tool in classrooms because it promotes students' Geography skills and leads to more dynamic learning in Geography, thus enhancing students' achievement. Similarly, Milson and Earle (2008) and Liu et al. (2010) emphasised that GIS not only enhances students' skills but also provides students opportunities to work with actual data that deals with their local area. Therefore, they concluded that GIS is an effective tool to teach Geography in primary and secondary schools. However, the effectiveness of GIS in teaching and learning Geography remains arguable because to date not a single study has investigated the effects of GIS with underachieving students in primary and secondary schools.

METHODOLOGY

This study employs a mixed method research design, namely the Convergent Parallel Design (concurrent triangulation mixed method design) to address the research questions. The main reasons for using this design are that data collected from supplies works to offset the weaknesses of the other form, and that a more complete understanding of a research problem results from collecting both quantitative and qualitative data (Creswell, 2012, p. 540). This mixed method research design gives equal priority to both forms of data, the collection of which were undertaken concurrently or simultaneously during the research. The collected data was analysed separately and the findings compared and triangulated in the interpretation section.

Quantitative research design

This study employed an experimental research design, which is well known as a powerful method to determine cause and effect relationships (Fraenkel, Wallen, & Hyun, 2012, p. 265). More specifically, a non-equivalent quasi-experimental control group design was employed to determine the cause and effect relationship that was due to difficulties in randomly assigning two groups of underachieving Geography students. The experimental design used in this study manipulated different instructional methods in order to determine the effect on a subject's performance in achievement and motivation tests. This approach also consisted of giving both the experiment and control groups a pre-test and then a post-test after the experimental treatment condition had been administered upon the experiment group. The responses of the two groups were then analysed by comparing the pre-test to post-test differences in scores of the two groups (Johnson & Christensen, 2012).

Qualitative research design

This study employed an intrinsic case study research design, which is well known for developing an in-depth understanding of the research issue (B. Johnson & Christensen, 2012, p. 408).The intrinsic case study was conducted to understand the effect of GIS-based teaching and traditional teaching methods on student participants' achievement and motivation to learn Geography.

Sample

The specimen population of this study comprised Form 4 (Grade 10) underachieving Geography students from the two rural secondary Smart Schools in Sabah. A ppurposive sampling method was used to select the school with the highest number of low achievers in Geography. The above method also aided in the selection of student participants who had special characteristics (underachievers in Geography) and could better understand the research phenomena to answer the research questions. The identification of low achievers in the subject was carried out by the respective Form 4 Geography teachers, based on the E (fail) grade obtained in the *Penilaian Menengah Rendah* (Malaysian Lower Secondary Certificate of Education) by the student participants in the previous year. Overall, 84 student participants were chosen from a potential research population of 185. The experiment and control groups consisted of 44 and 40 student participants respectively. A random sampling method also was used to select five students from each group for the interviews.

Instruments

The personal achievement goal orientation item, drawn from The Pattern of Adaptive Learning Scale (PALS) instrument, was used to measure participants' perception of their achievement goals. This instrument was originally published in 1997 and refined over time by a group of researchers (Midgley et al., 2000). The revised version by Midgley et al. (2000), which focuses more on the Goal Orientation Theory, examines the relationship between the learning environment and students' motivation and behavior. The personal achievement goal orientation consists of 14 items and is divided into three sub-scales: Mastery Goal Orientation, Performance Approach Goal Orientation, and Performance Avoidance Goal Orientation. However for this study only mastery goal orientation which consists 5 items was used.

The pre-test and post-test instruments were designed to evaluate respondent understanding and achievement of the targeted Form 4 (Grade 10) Geography topic of ' The Distribution of the Forests and Wildlife in the World', using 20 multiple choice questions, which are known to have a high degree of reliability (Haladyna, 1999). The questions were designed based on the multiple choice *Sijil Pelajaran Malaysia* (Malaysian Certificate of Education) Geography exam paper. The pre-test aims to identify the range of student participants' existing knowledge of the topic, while the post-test, administered after the eight weeks of intervention treatment, hoped to determine the respondents' achievement in the topic in the intervening period. The students' results in the pre-test and post-tests were then converted into percentages, by multiplying the correct number of questions by five. Marks obtained were then converted to overall scores to determine the level of each student.

The quantitative data was collected through standardized, open-ended interviews, which required all respondents to answer the same question; to examine the effect of GIS and traditional teaching methods on interviewees' achievement and mastery in learning Geography. The interviews were conducted on a one-to-one basis in the school administrative meeting room. Each interview session began with a brief description of the structure of the interview to be conducted, and ended with the researcher thanking the student for their participation and ensuring them of the confidentiality of their responses. Every interview session lasted between 50 and 60 minutes and was audio-taped.

Quantitative data analysis

In this study, a parametric statistical test was used to analyze the quantitative data. Normal distribution, homogeneity of variances and independence of observation tests were conducted to ensure all of the variable scores in this study met the general assumption for a parametric test. The test revealed that the variable scores in this study met the general assumption for the parametric test as described above. This shows that the sample from which the score was obtained came from a population of equal variance and was normally distributed. A repeated measures ANOVA were used to test the study hypotheses because by collecting data from the same student participants under different conditions (GIS-based teaching and traditional teaching methods) and repeated conditions (pre-test and post-test), the individual differences could be eliminated or reduced as a source of between-group differences (Field, 2013, p. 549)

Qualitative data analysis

In the current study, a thematic analysis method was used to analyse the qualitative data. The qualitative data in the current study was analysed based on the six phases of thematic analysis suggested by Braun and Clarke (2006). Firstly, the audiotapes of the student participants in the experiment and control groups were transcribed verbatim. The transcribed versions were then checked against the tapes for accuracy. Further to this, the transcriptions were imported into NVIVO version 10 software for analysis. In the second phase, open coding was used to create categories or related codes from the initial points, this having been identified in the data familiarization process. The focus of the coding draws on The Goal Orientation theory, which proposes that mastery goal-oriented students are more concerned with learning and understanding the subject or topic taught in the classroom (Anderson & Lawton, 2014). Thus, all of the student participants' conversations that indicated their interest in learning and understanding the topic taught in the classroom were observed and coded. The researcher gave equal attention to each data item during the coding process. The open coding feature of NVIVO allowed the researcher to generate many initial codes for potential themes and patterns by tagging and naming selections of text within each data item. The initial codes created during the open coding were refined in Phase 3. The refined codes were then analysed with a view to re-arrange and collate the different codes in potential themes. In the fourth phase, the initial themes were reviewed again to refine, combine or separate them to generate overarching themes. In this phase, more attention was focused on gaining internal homogeneity (the data within each theme should cohere meaningfully together) and external heterogeneity (the data should be clear and apparent between the themes). The fifth phase started with examining the validity of the themes with respect to the data set as a whole by moving back and forth between the data extracts and themes. The researcher ensured that the themes accurately represented the data set by noting and working through similarities

and contradictions with and between themes. The researcher further reviewed the final set of themes to ensure that these themes satisfactorily addressed the research question. The findings were reported in Phase 6 and were based on the themes using direct quotations from the data set.

GIS-based instruction

For the experiment group, a GIS-based instruction unit composed of eight lessons was designed using ArcGIS 10.0 software. The unit focused on the topic of 'The Distribution of the Forests and Wildlife in the World'. Teaching activities were conducted in a computer laboratory for eight weeks, where one lesson weekly was conducted for 80 minutes. However, an extra two weeks (two lessons) were devoted to the experiment group to introduce the GIS software to student participants. The instructor started to teach the subject content in the third lesson, using a desktop and projector to present. Each lesson began with induction set activities of between five to ten minutes to probe the student participants' existing ideas, continuing for the next 40 minutes with class activities in accordance with the daily lesson plans. These lesson activities focused on creating the data, inserting the hyperlink, tracing the forest area, and comparing and labeling the forest areas on the world maps. The instructor also devoted 10 to 15 minutes to classroom exercises, ending the lesson with 10 minutes of question and answer activities followed by a conclusion.

Traditional teaching methods

For the control group, eight traditional teaching instructions were developed using paper maps and the Form Four (Grade 10) textbook. The unit focused on The Distribution of the Forests and Wildlife in the World. The teaching activities, based on the traditional teaching method, were conducted in a regular classroom for the control group. One lesson was allocated for each week, with each lesson lasting 80 minutes (double period). Teaching activities in the group were based on traditional methods. The instructor used paper maps, the Form 4 Geography textbook, charts and posters to deliver the subject content. Most of the lessons were presented in a conventional manner and were more teacher-centred than those conducted in the experiment group. Lessons typically began with an introduction of the topic during the first 10 minutes of the lesson time. This was followed by 45 to 50 minutes of class activities that had been pre-planned for the session. Then, 10 minutes of each lesson was devoted to evaluate the student participants' understanding of the subject content. After this there was 10 minutes of question and answer activities, followed by the conclusion of the lesson.

EFFECTS ON STUDENT MASTERY GOAL

Quantitative analysis

A 2 X 2 mixed model analysis of variance (ANOVA) was conducted to investigate the effects of the treatment on experiment and control group student participants' mastery goal.

Table 1: One-Way Repeated ANOVA Mastery Goal Variable Test of Within-Subject Effects

Variable	Source	Type III Sum of Squares	Mean Square	F	Sig	Partial Eta Squared
Mastery Goal	Time	243.203	243.203	30.18	.001	.269
	Time*Treatment	34.632	34.632	4.29	.041	.050

Analysis of the data tabulated in Table 1 indicates that there was a significant main effect for time, with both groups showing an increase in mastery goal scores across the two time points. According to Cohen's (1988, p. 284) effect

size classification, .01 is considered a small effect, .06 a medium effect, and .14 a large effect. Thus, the significant main effect for mastery goal is classified as a large effect. This suggests that there is a difference in mastery goal scores within the experiment and control groups.

To investigate the significant difference further, the researcher examined within-group differences with pairwise comparison at α of .05. The analysis reveals that the control group's post-test mean scores (M = 18.48, SD = 3.33) were higher than the pre-test (M = 16.93, SD = 3.79). This difference, -1.50, BCa 95% CI [-2.889, -.111], was significant: F (1, 39) = 4.77, p = .035, and represents a medium sized effect, η_p^2 = .109. The experiment group's post-test scores (M = 20.39, SD = 2.86) were higher than the pre-test scores (M = 17.07, SD = 2.13). This difference, - 3.318, BCa 95% CI [-4.440, -2.196], was significant F (1, 43) = 35.58, p = .004, and represents a large sized effect, η_p^2 = .453. This reflects that there is a significant difference in the effect of treatment within the experiment and control groups on student participants' mastery goals.

Table 2. One-Way Repeated ANOVA Mastery Goal Variable Test of Between- Subject Effects

Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
Mastery Goal	Intercept	55529.067	1	55529.067	5191.973	.000	.981
	Group	46.400	1	46.400	4.338	.040	.050
	Error	877.005	82	877.005			

The analysis in Table 2 shows that the main effect in comparing the two groups was significant and represents a small effect. This suggests that there is a significant difference in mastery goal scores between the control and experiment group student participants. In addition, the analysis of data in Table 1 shows that there was a significant

interaction effect between mastery goal and time and this represents a small sized effect. This suggests that the mastery goal scores of the student participants frequently changed between pre- and post-tests and differed between experiment and control groups.

To examine the significant interactions further, the researcher examined between-group differences with a simple effect test using a Bonferonni correction. The results in Table 3 show that there was no significant difference in mastery goal scores between the experiment and the control groups at pre-test. The analysis shows that there was a significant difference in mastery goal scores between the experiment and control groups at post-tests. The mean for the experiment group was significantly higher than for the control group's. Based on guidelines proposed by Cohen (1988), there was a medium-sized effect of GIS-based teaching on the experiment group student participants' mastery goals to learn Geography.

Table 3. Pre-test, Post –test, Mean Scores, Standard Deviation, p values, end Effects Sizes For Mastery Goal Variable

	Group	N	M	SD	*P*	Partial Eta Squared
Pre-test	Experiment	44	17.07	2.13	.829	.005
	Control	40	16.93	3.79		
Post-test	Experiment	44	20.39	2.86	.005	.093
	Control	40	18.48	3.33		

Quantitative analysis

Student participants'interviews.

The interviews were conducted in the experiment and the control schools after eight weeks of implementing the intervention program. Five student participants from the experiment school: Shah, Adri, Jacson, Siti, and Alfera (pseudonyms), and five student participants from the control school: Fazilah, Robin, Kim, Josh, and Aldi (pseudonyms), who obtained the highest scores in the achievement post-tests, were selected for interviews. In the following, the questions and students' responses are provided.

1. What is your main reason for and goal in participating in this class?

Interestingly Shah, Adri, Jacson Siti and Alfera form experiment group stated that:

> *We wanted to learn a new topic and this was the first time we heard about GIS. Therefore, we were looking forward to learning Geography using GIS. Thus, our main goal was to learn and understand the content of the topic through GIS. However, the first time we attended the class, we were worried that we would not able to learn anything in this class. However, in the second lesson, we were motivated and excited to learn more about GIS by exploring the tool ourself. At the end of the class, we realized that we had managed to learn and understand the topic taught in class.*

Fazilah, Robin, Kim, Josh, and Aldi from control group explained :

> *I wanted to learn and enhance my knowledge in the Geography subject. It is important for me to answer exam questions. So my main goal for attending this class and take part actively in every activity was to learn, enhance my Geography knowledge, and score good grades on the exam.*

2. Do you think that you have achieved your goal in this class and believe that activities conducted in this classroom integrated) has enhanced your learning goals in Geography study?

All of the interviewed participants from experiment group (100%) said that they have achieved their main goal in the class. For example Shah said:

> *Yap… I strongly agree that I have achieved my goal in this classroom. I managed to learn and understand the content of the topic well. As a result, in the first test I only got 45 marks and in second test I improved and got 87 marks. So I can say that I have achieved my goal. Emm… learning through GIS is really fun and challenging. This has enhanced my goal and motivated me to learn more and understand the content of the topic*

Fazilah, Robin and Kim from control group added:

> *In the first and second lessons we could not understand much on the topic taught in the class. However, we started to set our goal to learn and understand the topic in the third lesson. Thus, we always asked the teacher if we could not understand about the topic taught in the classroom. Finally, we could understand well the entire topic taught in this class. As a result, we could score good marks in the last test. In addition, the activities conducted in this class have enhanced our learning goal. Therefore, we can say that my main goal in this class to learn and understand the content of the topic has been achieved.*

By contrast, Josh and Aldi from the control group had this to say:

> *Our main goal in this class was to understand the content of the topic and score a good grade on the exam. Nevertheless, we were having difficulty in understanding most of the topics taught in this class. However, we still managed to score 80 marks on the test because we did review this topic many times to make sure that I understood the content well. Thus, we conclude that we did not achieve 100% of our learning goal and the activities conducted in this class were unable to motivate us or enhance our learning goal.*

The experiment group student interviews revealed they were excited to learn about GIS. This was because they participated actively in every activity conducted by the teacher in the classroom. Involvement in classroom activities helped students to understand the topic and achieve their goals. Similarly, the control group student participants agreed that the activities conducted in the classroom had enhanced their learning goal. However, two of the participants confessed that they were unable to achieve their learning goal because they were unable to understand the lessons delivered in the classroom. This indicated that traditional teaching methods had a moderate effect on the student participants' mastery goal in learning Geography.

Triangulation

The quantitative analysis showed that there was a significant effect of GIS-based teaching and traditional teaching methods on experiment and control group student participants' mastery goal mean scores, indicating that both teaching methods enhanced the student participants' mastery goal to learn Geography. However, the quantitative analysis showed the experiment group student participants' mastery goal mean score was significantly higher than that of the control group student participants. This suggests that GIS-based teaching had a more positive effect on student participants' mastery goal to learn Geography. Responses from the experiment and control group student participants' interviews suggest that these participants achieved their learning goal. In addition, the interviews with the teacher participants in the experiment group revealed that the GIS-based teaching activities enhanced the student participants' mastery goal to learn Geography and helped them achieve their learning goal.

EFFECTS ON STUDENT ACHIEVEMENT

Quantitative analysis

Table 4: One-Way Repeated ANOVA Achievement Variable Test of Within-Subject Effects

Variable	Source	Type III Sum of Squares	Mean Square	F	Sig	Partial Eta Squared
Mastery Goal	Time	8485.63	8485.63	187.85	.001	.696
	Time*Treatment	3704.05	3704.05	88.83	.001	.520

The analysis of data tabulated in Table 4 reveals that there was a significant main effect for time, with both groups showing change in achievement scores across two time periods. This reflects that there was a significant

difference in the effect of treatment within experiment and control groups on student participants' achievement scores. According to Cohen's (1988, p. 284) effect size classification, the effect size was large. To investigate the finding of the significant difference further, the researcher investigated within-group differences with pairwise comparison at α of .05. The analysis revealed that the control group post-test mean scores (M = 44.01, SD = 7.55) were higher than the pre-test (M = 39.57, SD = 10.09). This difference, -4.45, BCa 95% CI [-6.61, -2.28], was significant F (1, 39) = 17.27, p = .001, and represents a large sized effect, η_p^2 = .307. The experiment group post-test scores (M = 65.75, SD = 9.34) were higher than the pre-test scores (M = 41.74, SD = 9.15). This difference, - 24.02, BCa 95% CI [27.49, -20.54], was significant F (1, 43) = 194.03, p = .001, and represents a large sized effect, η_p^2 = .819.

The analyses tabulated in Table 5 prove that the main effect in comparing the two groups was significant, and represents a large effect. This suggests that there is a significant difference in achievement scores between control and experiment group student participants.

Table 5: One-Way Repeated ANOVA Achievement Variable Test of Between- Subject Effects

Variable	Source	Type III Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
Mastery Goal	Intercept	382477.46	1	382477.46	3184.661	.000	.975
	Group	5989.52	1	5989.52	49.871	.001	.378
	Error	9848.19	82	9848.19			

The analyses of data in Table 4 also show that there was a significant interaction between achievement score and time and this represents a large sized effect. This suggests that the achievement test scores of the student participants frequently changed between pre-test, post-test and differed between control and experiment groups. To examine the findings of the significant interactions further, the researcher examined group differences with a simple effect test using a Bonferonni correction.

Table 6: Pre-test, Post –test, Mean Scores, Standard Deviation, p values, end Effects Sizes For Mastery Goal Variable

	Group	N	M	SD	*P*	Partial Eta Squared
Pre-test	Experiment	44	41.74	9.15	.304	.012
	Control	40	39.57	10.09		
Post-test	Experiment	44	65.75	9.34	.001	.623
	Control	40	44.01	7.55		

The results in Table 6 showed that there was no significant difference in achievement test scores between the experiment and control groups at pre-test. However, post –test analysis revealed that there was a significant difference in achievement scores between the experiment and control groups. The mean score for the experiment group was significantly higher than for the control group at post-test, and this signifies a large sized effect.

Quantitative analysis

Student participants' interviews.

To enable further investigation into the post-test results that indicated the positive effect of both GIS-based teaching and traditional teaching methods on student participants' achievement in the classroom, five student participants were selected randomly from the experiment (pseudonyms; Shah, Adri, Jackson, Siti, Alfera) and control (pseudonyms; Fazilah, Robiah, Kim, Josh and Aldi) schools respectively. The purpose of the interviews was to examine the experiment and control group student participants' understanding of the topic content taught. In these interviews, they were asked three fixed questions based on the content of the topic that had been taught earlier. The student participants were provided no clues to guide them towards the correct answer, and were asked to asked to give clear answers.

Interview Question 1.

Pre-test question

What is the tropical rainforest?

Post-test question
What do you understand about the tropical rainforest?

Question 1 was designed to probe the experiment and control group student participants' understanding of tropical rainforests. In this question, the researcher expected responses for the definition of a tropical rainforest to be "a forest occurring within 28 degrees north or south of the equator and the ecosystem experience (ing?) high average temperature and heavy rainfall" (Ahmad & Osman, 2011, p. 145).

In the pre-test, most of the experiment group student participants had difficulty giving the correct definition of a tropical rainforest. When the researcher asked why they could not remember the topic that they had learned in the class, the students replied the lesson was very boring and difficult to remember. However, Adri was able to give the correct answer. When the researcher asked how he knew the answer, Adri's reply was as follows:

> I learned this topic two weeks ago in the classroom and yesterday I saw the documentary about the tropical rainforest. Thus, I have a little bit of knowledge about the tropical rainforest.

The above responses show that before the intervention, experiment group student participants could not understand nor remember the content of the topic that had been taught in the classroom.

For the control group, only Kim was able to give the correct answer for the definition of a tropical rainforest. When asked how he remembered the answer, Kim's reply was as follows:

> I learned about the tropical rainforest in the classroom last month. However, I could not understand much. I learned about this topic again in the tuition class last week. I remembered that the tropical rainforest received very heavy rain. If I'm not mistaken, it averages around 2600 millimetres a year. Aaa… the forest grows within 28 degrees north or south of the equator. The ecosystem experiences very high temperatures.

The above response shows that Kim remembered the definition of the tropical rainforest and that it was a part of his existing forest knowledge. However, his explanation about the temperature was wrong. He mistakenly stated that the tropical rainforest experiences very high temperatures, indicating that he could not fully understand everything about the tropical rainforest. The correct answer is that the tropical rainforest maintains average temperatures.
Fazilah, Robiah, Josh, and Aldi from the control group had some ideas about the tropical rainforest, but they confused it with the monsoon forest, even though he Form 4 Geography textbook it clearly differentiates between monsoon and tropical rainforests. For example, Aldi stated that tropical rainforests "drop their leaves in the dry season". The description given by Aldi is a characteristic of the monsoon forest. This suggests that Fazilah, Robiah, Josh, and Aldi had difficulty defining the tropical rainforest because of a lack of knowledge. In the post test interviews, the experiment and control student participants had no difficulty giving the correct definition of the tropical rainforest. This suggests that the student participants were able to learn and remember the content of the topic which had been taught using GIS-based teaching and traditional teaching methods.

Interview Question 2
Pre-test question
Can you tell me the areas covered by the monsoon forest?

Post-test question
Could you list the areas covered by the monsoon forest?

The above question was designed to investigate the student participants' ability to identify the location of forest growth on the world map. To answer this question, the student participants needed to know and remember the forest types and distributions on the world map. The correct answer for this question is: Thailand, India, Zambia (Africa), and Myanmar.

For the pre-test, four of the experiment group student participants were only able to list one area covered by monsoon forests. However, Alfera was able to list all three areas correctly. The student participants' responses suggest that they could not remember and had a lack of knowledge about the locations covered by monsoon forests on the world map. As further investigation, the researcher asked student participants the reason why they could not remember the locations covered by the forest. Their response was that they had difficulty in

remembering the content of the topic that they had been taught in the classroom because they weren't given adequate practical exercises such as drawing, plotting, and labelling the types and growth of the forest areas on the world map. This prevented the student participants from understanding and remembering the exact area covered by monsoon forests on the world map.
For the control group, Fazilah was able to recall one of the areas covered by the monsoon forest, whereas Kim was able to remember two areas. However, Robiah, Josh, and Aldi were unable to answer the question. The responses indicate that the control group student participants had a lack of knowledge of the location of the forest.

In the post-test, all the experiment student participants were able to give the correct answer. Surprisingly, Jackson and Siti could list two different areas covered by monsoon forests, which were not taught in the classroom. For further investigation, Jackson's response to why he could easily remember and list the growth areas of the monsoon forest was:

> Using GIS mapping in teaching Geography has enhanced our understanding of the type and area of forest growth on the world map. In addition, we were given a project to create our own forest map. I took this opportunity to trace, plot, and label my map, and to find extra information about the forest by creating the hyperlink icon on my map. This activity has enriched my knowledge of the type and area of forest growth on the world map.

Similary, in the post-test, Fazilah and Kim from the control group of student participants were able to list all of the locations covered by monsoon forest correctly. Josh, Robiah, and Aldi were able to list three of the locations correctly. The analysis demonstrates that Robiah showed positive improvement in memorising the forest areas. When the researcher asked how she could remember the location so well, Robiah replied:

> In this class, the teacher used the world map to teach us the type and distribution of the forest and followed up with shading and labelling the forest area on the blank world map. The activities were fun and helped me to remember the location easily.

These above responses suggest that the intervention activities conducted in the classroom enhanced the experiment and control control group student participants' understanding and knowledge of the locations of the forest.

Interview Question 3
Pre-test question
Could you tell me what kinds of animal live in the steppe?

Post-test question
Can you write the names of the animals that live in the steppe?

Question 3 was designed to probe student participants' understanding of the types of wildlife that live in the steppe. Based on the Form 4 (Grade 10) Geography curriculum in Malaysian schools, the student participants were expected to remember four of the wildlife types in the area, namely corsac fox, saiga, badger, and rabbit.

In the pre-test interviews, the student participants were asked to verbally name the above four steppe wildlife types. The experiment student responses revealed that only Adri was able to name the types of wildlife correctly. Shah and Jackson were able to answer three, Siti stated one type and Alfera was unable to answer the question. This shows that most of the student participants had difficulty remembering the wildlife that live in the steppe.

The control student participants' responses show that only Fazilah and Robiah were able to name one of the wildlife types that live in the steppe correctly; whereas, Kim, Josh, and Aldi were unable to answer the question. This seems to indicate that most of the student participants had difficulty identifying the wildlife that lives in the steppe forest.

In the post-test, the student participants were asked to write the names of wildlife that live in the steppe. The students were given 5 minutes to complete the task. Interestingly, Alfera, Siti, and Jackson from the experiment group who had difficulty answering in the pre-test interviews, were able to list all of the wildlife correctly.

More surprisingly, Shah could finish this task within 3 minutes. When the researcher asked how he could remember and complete the task so quickly, Jackson responded:

> One of the activities conducted in this classroom was to drag and drop. For this activity the student needs to find the wildlife symbol or picture and locate them on the map according to the forest in which they live. The activity was fun. Thus, I could remember the animal faces and their names easily.

In contrast, student participants from the control group only got one of these names correct.

In summary, the pre-test interviews revealed that before the intervention, the experiment and control group student participants demonstrated a poor level of knowledge of the topic. The student participants also remarked that the lesson conducted in the classroom was boring and difficult to understand. However the post-test interviews showed that the experiment student participants acquired an understanding of the topic taught in the classroom. In addition, the number of correct answers for simple as well as difficult questions after the intervention increased significantly. In contrast, the control group student participants' post-test suggests that the student participants were unable to answer questions which required them to analyses, elaborate and explain in more detail, or those questions that required a deep level of understanding of the topic taught. This suggests that GIS-based teaching had positive effects on the student participants' achievement in the topic taught in the classroom.

Triangulation

The quantitative analysis revealed a significant effect of GIS-based teaching and traditional teaching methods on the experiment and control group student participants' achievement. It indicates that both teaching methods enhanced the student participants' achievement in the topic taught in the classroom. However, the experiment group student participants' achievement mean score was significantly higher than that of the control group counterparts', which suggests that GIS-based teaching had a more positive effect on student achievement. The experiment and control group student participants' pre- and post-test interviews revealed that GIS-based teaching had favourable effects on student participants' achievement in the topic. However, the traditional teaching methods were only able to enhance student participants' surface understanding and knowledge of the classroom topic, indicating that the GIS-based teaching activities had a more affirmative impact on the student participants' achievement. On the basis of the consistent findings of the quantitative analysis and student participants' interviews, it is possible to infer that GIS-based teaching had a more positive effect compared to traditional teaching methods in enhancing participants' achievement in the topics taught in the classroom.

DISCUSSION

The primary aim of this study is to investigate the effect of GIS-based teaching and traditional teaching methods on student participants' mastery goal in learning and achievement in Geography. The analysis presented in this paper shows that the GIS-based teaching and traditional teaching methods enhanced both the experiment and control groups student participants' mastery goal to learn Geography. However, the results of the quantitative analysis reveal that GIS-based teaching had a greater effect on student participants' mastery goal to learn Geography as compared to traditional teaching methods. Moreover, its triangulation with the student participants' interviews suggests that GIS-based teaching had a more positive effect compared to traditional teaching methods in enhancing participants' mastery goal to learn Geography. Thus, it seems that GIS-based teaching can be a useful teaching tool to enhance underachieving students' mastery goal in learning Geography.

The findings of this study cannot be compared with the results of other studies because to date there are no studies measuring the effect of GIS-based teaching on high school or primary students' mastery goal in learning Geography. However, several studies have asserted that ICT integrated learning environments have a positive correlation with students' mastery goal orientation. For example, Lawlor, Marshall, and Tangney (2016) study of 425 secondary school students aged between 15 and 17 year old proved that learning through technology mediated learning develops higher motivation and learning goals in learning. Similarly, Ghanizadeh and Razavi (2015) study of eight graders students in Mashhad, Iran revealed that teaching integrating with multimedia elements as animation, cartoons and power points presentation enhanced their experiment group student participants' English learning goal.

One explanation for the findings of this study may be that learning through GIS-based teaching enhanced the student participants' interest, curiosity, relatedness, autonomy and excitement in learning the content of the topic, which encouraged them to set a goal to learn the content of the topic. In addition, GIS-based teaching encourage student to generate new ideas and build their own interest in learning the content of topic. These findings are supported by Anderman and Patrick (2012); Lawlor et al. (2016), who asserted that the individual

will only set a learning goal if the teaching activities are enjoyable, fun in learning and can help them to achieve their learning goal. As a result, the student participants tried to focus more on teaching, learning activities, developing new skills, improving their competence, and gaining understanding of the content of the topic and increase their task values. This view is supported by Gray, Chang, and Anderman (2015); Hatlevik, Ottestad, and Throndsen (2014), who posited that mastery goal-oriented students are more focused in the classroom and try to improve their competence. In the current study context, the results from classroom observations indicate that the experiment group students were trying very hard to grasp the content of the topic through GIS, and understand the class work which had been assigned by the teacher.

These findings are in line with Anderman and Patrick (2012) ; W.-W. Chen and Wong (2015) and yi Li and Shieh (2016) studies, which stressed that mastery goal-oriented student are cognitively engaged in the learning activities, where the learner is willing to exert the necessary effort to understand and master complex phenomena. yi Li and Shieh (2016) also argued that mastery goal-oriented students are behaviourally engaged in activities such as expending effort, discussing school work with other students, and seeking help when needed. In addition, the current study's findings show that the integration of GIS in teaching and learning created a self-regulated learning process in the classroom, which helped the student participants to set and achieve their mastery goal. For example, the comments from the student participants' interviews show that one of their main goals was to understand the content of the topic well, and the GIS integrated learning process encouraged them to actively participate in their own learning process. Here, the learning processes in the GIS environment involved students seeking help and discussing with their friends to ensure that they could understand the content of the topic well and achieved their goal. This finding is supported by Kramarski (2013); Lai, Shum, and Tian (2016); J. W. Lin, Huang, and Chuang (2015), who stressed that technology learning environments positively enhanced the self-regulated learning process among lower achieving students in the classroom.

The triangulation of the quantitative and qualitative analyses in the present study also suggests that the GIS-based teaching method enhanced student participants' achievement in the classroom topic more positively than traditional teaching methods. These results may be attributable to students finding working with computers to be interesting and that three-dimensional image and interactive maps attracted their interest in the lesson taught in the classroom. (Cowan & Butler, 2013; Delparte et al., 2016; Stonier & Hong, 2016). GIS-based teaching engaged the student participants in the learning process by encouraging them to explore and gather the necessary and important information, search for solutions to the problem, and attain the right solution. The activities conducted in a GIS-based class encouraged students to actively use internet resources to find information and data to complete their mapping projects compared to their counterparts in the control group who passively accepted information from teacher. As a consequence, the student participants could understand the content of topics taught in the class easily and scored good grades in the post- test (Alibrandi & Goldstein, 2015; Blank et al., 2016; Delparte et al., 2016; Z. Li, 2012; Rutten et al., 2012; K.-H. Yang, 2014). The findings of this study support the preliminary work undertaken by Kerski (2001), which indicated that the students who were using GIS scored higher in the performance test compared to their counterparts who were using traditional methods. Similar results have also been reported by Aladag (2010), Berglund (2008), Chun (2008), Alibrandi and Goldstein (2015); (Blank et al., 2016); Cowan and Butler (2013); Delparte et al. (2016) and Favier and Van der Schee (2014).

LIMITATIONS

A major strength of this study is the mixed method research examination of the effect of GIS integrated teaching on student motivation and achievement in Geography. However, a number of limitations prevail in the current study. First, this study was conducted using a mixed method design with a small sample size. Due to time and resource constraints, this study only involved two Smart Schools located in Sabah. The small sample reduced the statistical power to detect small effect sizes. It also potentially limited the extent to which findings can be generalised to other underachieving Geography students located in different Smart Schools. Thus, a larger study is needed to generalise the effect of GIS integrating teaching on student achievement and motivation in learning Geography.

Secondly, the evaluation of student achievement in Geography was created by the researcher, based on a set of multiple choice questions drawn from a previous year's exam paper. The researcher believes that students' achievement on the content of topics taught in the classroom would be measured more accurately by using more varied sources of questions (Talib, 2006). For instance, the teacher could combine multiple choice and short essay questions to test the students' knowledge and understanding of the content of the topic.

CONCLUSION

Overall, the results of this study study showed that GIS-based teaching has much to offer as an innovative teaching method that can be utilised by Geography teachers to stimulate students to adopt mastery goal in learning Geography. Moreover, the GIS integrated method used in this study did not require a high level of technical skills, for the teachers were able to learn and use the GIS software within two weeks of training. The results of this study also demonstrated that the GIS integrated method can be utilised to enhance the performance of the underachieving student achievement. Therefore, it is hoped that the findings of this study will be promoted and will inspire teachers to integrate GIS into their teaching of Geography.

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The Evaluation of the Cognitive Learning Process of the Renewed Bloom Taxonomy Using a Web Based Expert System

Dr. Idris Goksu, Ph.D.
Prof. Aslan Gulcu
idrisgoksu47@hotmail.com

ABSTRACT
The aim of this study is to develop the Web Based Expert System (WBES) which provides analyses and reports based on the cognitive processes of Renewed Bloom Taxonomy (RBT), and to put forward the impact of the supportive education provided in line with these reports, on the academic achievement and mastery learning state of the students. The study was carried out in a quantitative method, and pre-test, post-test matching control group model of semi-experimental designs have been used. A total of 50 students which are in 8th grade and also participate in supportive education have been selected (25 as the experimental group, 25 as control group) using the purposive sampling method. The experimental group has been given supportive education based on WBES system and the control group has been given the traditional supportive education. According to the conducted independent groups t-test and descriptive analysis, it's been found out that the method based on WBES is more effective than the traditional methods both in academic achievement rate and also mastery learning.

Keywords: Architectures for educational technology system; elementary education; evaluation methodologies; improving classroom teaching; teaching/learning strategies

1. INTRODUCTION

Education is a never ending process of life. This process is shaped as per the requirements of the society and goes on in a systematic way. The effectiveness of the educational institutions depends on the planned and purposeful execution of educational activities. The requirement of a system and plan in education brings with it the need for educational programs. Any educational program consists of three parts which are "aim, teaching process and evaluation". The aim which is the essential element of any educational activity acts as a guide for planning of the environment, efficiency and experiences (Anderson and Krathwohl, 2001; Bilen, 2002; Demirel, 2012; Ertürk, 1998; Varış, 1996). Aims define the features which are desired to be added to the student like knowledge, skills and attitudes (Anderson and Krathwohl, 2001; Bilen, 2002). Any aim that is added or desired to be added to any student is also defined as a gain. The gaining or changing of knowledge, skill, attitude and behaviors however is defined as learning (Schunk, 1991/2011). Teaching models are used for the learning and teaching of gains. One of the forefront of these models is the mastery learning model which offers an orderly teaching plan (Schunk, 1991/2011). This model is highly influenced from the "model of school learning" (MSL) of Caroll. It is based on the view that claims all the students can learn all the new behavior models that the schools aim to teach (Bloom, 1976; as cited in Schunk, 1991/2011). An important principle of this model proposes that the personal differences in between the students will be reduced along the process (Schunk, 1991/2011). In this model in which the teachers evaluate the development of the students and provide repeated or supportive courses, students develop their skills and continually need lesser time to learn (Schunk, 1991/2011).

The most common one among all the taxonomies which are based on the mastery learning model which determine the knowledge and skills desired to be given to the students and facilitate the mental process is the Original Bloom Taxonomy (OBT) (Bümen, 2006; Grounlund, 1998; Johnson and Fuller, 2006; Mcbain, 2011; Oermann and Kathleen, 2014; Özden, 2011; Poole, 2006; Valcke, Wever, Zhu, and Deed, 2009). This taxonomy, which was proposed by Benjamin Samuel Bloom in 1956, while developing the teaching strategies that support learning, also helps the students and ensures that the students progress from sub-level cognitive skills to high-level cognitive skills (Lovell-Troy, 1989). Machanick (1998) proposes that OBT should be taken as the basis for a more comprehensive review of the subjects which are taught in the teaching program. OBT was renewed by Anderson and Krathwohl (2001) as a result of changing educational requirements and innovations in learning (Bekdemir and Selim, 2008; Bümen, 2006; Huitt, 2009; Krathwohl, 2002; Turgut and Baykul, 2012; Zimmerman and Schunk, 2003). The Renewed Bloom Taxonomy (RBT) helps the teachers regarding the optimization and development of the educational programs (Raths, 2002). Raths also proposes that RBT is

extremely effective for the compliance of activities and evaluations with the aims and the development of learning goals. Raths (2002) emphasizes on the consistency between RBT and Carroll's school learning model, and mentions the importance of focusing higher goals for a more effective education. RBT is important regarding its focus on high-level cognitive processes and emphasize on high-level cognitive dimensions. Executing a teaching program which will operate high-level cognitive processes is important for developing the necessary problem solving skills. Also, RBT is quite efficient to classify the problems (Lord and Baviskar, 2007; Manton, Turner, and English, 2004), which makes a suitable for developing problem solving skills (Krathwohl, 2002; Pintrich, 2002).

While the information and education technologies rapidly developing, the requirements and skills and behaviors that the students need to gain are also changing. In our day, the effective access to the information for individuals is more important than the amount of knowledge one has. Aybek (2006) states that high-level cognitive skills are important for individuals to be effective in accessing information and solving problems. Rather than having the knowledge, the concept of effectively learning and using knowledge using high-level cognitive skills has become more important. This task has been greatly undertaken by educational institutions and in line with the process, constant changes in educational systems do happen. However, current educational systems do now allow a mastery learning of targeted behavior with all its parameters. Thus, an effective control over the current educational processes is required. This control can be made in the way of an evaluation at the end of each level targeted, and provision of supportive education in order to mastery learning deficiencies and to reach the targeted behavior patterns (mastery learning) to reach the desired goals. One of the most effective learning models in this scope is RBT which consists of two different dimensions as knowledge (factual, conceptual, procedural, metacognitive) and cognitive processes (remembering, understanding, application, analysis, evaluation, creation) (Anderson and Krathwohl, 2001). Thompson (2008) suggests that RBT has been used all along for years while classifying the cognitive processes of students. Huitt (2009) suggests that students shall complete a lower level completely before passing to a higher level. Also Köğce and Baki (2009) as a result of their study, have suggested that teachers should also use questions that require higher cognitive skills like analysis, evaluation and creation, together with questions that require lower cognitive skills like remembering, understanding and application. When considered from this perspective, the Web Based Expert System (WBES) which was developed as a part of this study seems to cover all the levels of cognitive processes of RBT and prepare the environment for the use of all levels.

With the rapid development of technology, almost all sectors started to benefit from Information Technology (IT). With the development in educational technologies, the learning requirements have also been increased. This change has necessitated a change in the learning and teaching methods. In this process, rather than learning the information directly, learning it by configuring the information has become more important and it has become necessary for some theories to update themselves. Bloom Taxonomy, which was first proposed in 1956, despite receiving some criticism (Dam and Volman, 2004; Romiszows, 1986), still protects its efficacy and usability, and after being renewed in 2001 by Anderson and Kratwohl, its importance has also increased. Heavily used in the teaching-learning processes, this taxonomy is continuously researched and more effective teaching (mastery learning) is targeted to be provided through these researches. Studies conducted on this issue show that the questions, gains, goals and skills which are developed and used to evaluate the students do not cover all the levels of RBT and they are mostly directed at low level cognitive skills (Ayvacı and Şahin, 2009; Çalışkan, 2011; Gezer, Şahin, Öner-Sünkür, and Meral, 2014; Gündüz, 2009; Kocakaya and Gönen, 2010; Lord and Baviskar, 2007; Özcan and Akcan, 2010; Tüzel, Yılmaz, and Bal, 2013; Usta, Okur, and Aydin, 2014; Vick and Garvey, 2011). The research conducted suggests that students are mostly evaluated based on the lower level cognitive processes of RBT. This reveals that it is necessary to get to work in order to utilize the high level cognitive processes of RBT. And in this very study, our goal was to understand how to make the teaching process which is based on mastery learning, a more efficient and more effective one, with the inclusion of the developing internet and information technologies into the process.

Nowadays, technology undertakes the task to help people both physically and mentally. Expert systems which are one of these technologies, are tools that undertake to carry out the work rapidly and correctly, which would normally be made by experts on the field. Expert systems are computer programs which can model the decision making processes that could normally only be made by the experts (Nabiyev, 2003) and can solve problems as the experts of that field can solve (Daskalaki, Birbas, and Housos, 2004). Kılağız (1996) suggests that a good expert system can mimic the skills of an expert like designing, planning, diagnosis, evaluation, summarizing, making generalizations, controlling and making suggestions. Yavaş and Civalek (2005) suggest that expert systems have the benefits of cost reduction, productivity, quality, reduction of operational errors, flexibility, reliability, and less response time. The WBES system which was developed in scope of this study shall be integrated in primary and secondary schools, and even private educational institutions, and help for the

evaluation covering all the cognitive processes at the end of each subject, book or course. In this context, by the inclusion of all the levels of RBT regarding cognitive processes, through a web based expert system which makes evaluations regarding targets, a more applicable and mastery learning environment for both the students and the teachers have been tried to be provided.

The overall objective of this research; is to develop the WBES system which makes analysis and provides reports of RBT based on cognitive process dimensions, and to reveal the effect of the supportive education which is provided in line with these reports over the academic success of the students and mastery learning status. In this context, answers to the following questions were sought:

1. Is there any significant difference regarding the impact on academic success, between supportive education based on WBES and traditional supportive education?
2. How can the mastery learning status of the students according to RBT be described in the end of the supportive education based on WBES and the traditional supportive education?

2. METHOD

2.1. Research Design

The study was carried out in a quantitative method, and pre-test, post-test matching control group model of semi-experimental designs have been used. Quasi-experimental design is the design that is preferred when random assignment is not done (Fraenkel, Wallen, and Hyun, 2012, p.275). The independent variable of the study is the supportive education based on WBES, and the dependent variable is the academic success rate. After the experimental and control groups are given the standard education of the school, the experimental group was evaluated using the expert system and the control group was evaluated in the classroom (pre-test) and an Academic Success Test(AST) has been applied in order to measure their academic success. The experimental group was given supportive education based on the reports which are compliant with the RBT cognitive process dimension levels provided by the WBES system. The supportive education consisted of six stages and took 2 weeks to finish. Later on, students were re-evaluated using the expert-system (post-test). The visuals of the experimental group while solving the AST over the WBES system can be seen in figure 1.

Figure 1. Students using the WBES system.

The control group was applied the pre-test and was given the traditional supportive education. The supportive education of the control group also took 2 weeks. Both groups were educated by the same teacher. After the supportive education, a post-test was conducted.

2.2. Population and Sampling (Study Group)

The target population of this research consists of the eight grade students in İMKB Middle School in Midyat district of Mardin province of Turkey. The sampling was made using the purposive sampling method which is a non-selective sampling method. With this method, a total of 50 students which are in 8th grade and also participate in weekend supportive education classes have been selected. The courses of supportive education can hold a maximum of 25 students (Ministry of Education, 2014). Thus 25 students were selected as the experimental group, and another 25 as the control group. Also a mathematics teacher who provides supportive education to both groups was included in the sample.

2.3. Selection and synchronization of the groups

In the middle school which was selected as the target population, a mathematics test of 28 questions which is about one subject of mathematics that all the students that participate in the supportive education had learned. The students were ranked regarding the correct answer count that they had. Later on, based on the correct answers, each group was included an equal amount of subjects based on the correct answer count. In the end, by considering the success factor, using the mechanical matching method, two equal separate groups have been formed. Mechanical matching method is the process of forming couples with similar two individuals with

specific variable points (Büyüköztürk et al., 2012, p.207; Fraenkel et al., 2012, p.274). The groups which were formed using the above given methods, have been randomly selected as the experimental and control groups. Demographic information regarding the sampling group of the study is given in Table 1.

Table 1. Demographic Information about Research Sample

Groups	**Female**	**Male**	**Total**
Experimental Group	15	10	25
Control Group	13	12	25
Total:	**26**	**24**	**50**

If one observes Table 1, it is possible to see that experimental group consisted of 15 female and 10 male students, and the control group consisted of 13 female and 12 male students. It is possible to say that groups are quite similar regarding the gender distribution.

Before the AST was conducted, the equality of the experimental and control groups which were equalized using the matching method were rechecked and verified by conducting an independent group t-test. Also, with a Levene test, it's been seen that variances regarding the points were also equal. ($p_{(.367)}>.05$). The findings of the independent groups t-test is given in Table 2.

Table 2. Pre-test Independent Samples t-test Results of Experimental and Control Groups

Groups	***N***	**Mean**	***Standard deviation***	***Degrees of freedom***	***t***	***p***
Experimental Group	25	18.72	9.96	48	.833	**.409***
Control Group	25	16.24	11.06			

*p<.05

As seen on Table 2, the pre-test point average of the experimental group was calculated as 18.72, and their standard deviation has been found to be 9.96; on the other hand, the pre-test point average of the control group was calculated as 16.24, and their standard deviation has been found to be 11.06. As seen on the table, because $p_{(.409)}>.05$, it is possible to say that the differences between the groups is insignificant. This result confirms the academic equality of the groups.

2.4. Data Collection Tool and Data Collection Process

2.4.1. Academic Success Test (AST)

AST was developed according to the cognitive process dimension steps of RBT. AST was developed considering the distribution chart for the eighth grade mathematics lesson gains provided by the Ministry of Education, and a total of four basic gains among the algebraic expressions were selected. Face to face interviews were held with the expert mathematics teachers who were to provide the questions and they were presented with detailed information regarding the RBT. The subject of algebraic expressions were associated with lower cognitive processes which consist the six basic processes of the cognitive process of RBT, by the teachers who were considered to be adequately informed of the RBT subject and a total of 16 sub-gains were formed. Two separate tests that consist of 48 questions (6x8) that cover all the gains were formed. In order to ensure the conformity of the test questions to the RBT cognitive process dimension, four expert educators, one research associate and three mathematics teachers checked and revised the tests without harming their structure. The demographic information of the educators and the teachers are provided in Table 3.

Table 3. Demographic Information of Domain Experts

Line	Professional Status	N	Gender	The Faculty, department or school where s/he works
1	Professor	1	Male	Faculty of education – Computer Education and Instructional Technology-Maths
2	Associate doctor	1	Male	Faculty of education – Computer Education and Instructional Technology
3	Associate doctor	1	Male	Faculty of education – Primary education
4	Assistant Professor	1	Male	Faculty of education – Secondary education Science and Maths
5	Research Assistant	1	Female	Faculty of education – Primary education Maths
6	Math teacher	2	Male	Secondary School
7	Math teacher	1	Male	High school

The test that consists of 96 questions which were controlled and revised by the field experts were then applied to a pilot sampling group which consisted of 171 high school 1st grade students of Midyat Anatolian High School in order to make a validity and reliability analysis. p_j and r_{jx} values of the articles were calculated. As a result of the analysis, the questions with r_{jx} values lower than 0.20 have been excluded from the tests (N=28). As a result of the reliability analysis, the most suitable 42 articles have been selected and AST has been formed by using these articles as both pre-test and post-test (see Appendix A). At the end of the analysis, it's been seen that a reliability coefficient is .86. While the articles were selected, previous gains and compliance to RBT cognitive process dimension were considered. The questions were selected to include at least two questions for each gain. AST testing gains and p_j and r_{jx} values were provided in Appendix B.

2.5. Analysis of the data

Independent group t-test was conducted in order to determine whether there is any significant difference between the experimental group and the control group. By using reports based on WBES and academic success averages, mastery learning status according to the levels of RBT of both the experimental and control groups have been analyzed descriptively and presented in graphs.

2.6. Supportive education based on WBES

The students in the experimental group, after completing their formal education according to the curriculum of their schools, they solved the AST over the WBES system, over the web. Later on, the teacher who will provide the supportive education, pursuant to the reports he/she obtained from the WBES system, tried to teach the relevant subject in the weekend courses which is in the nature of a supportive education. A photo from one of these courses can be seen in Figure 2.

Figure 2. A photo from the supportive education provided based on WBES

Supportive education consists of six levels. Each student was taken to the one that he/she was lacking, which was determined in accordance with the reports provided by the WBES system. The realization of the supportive education was given in figure 3.

Figure 3. The realization process of the supportive education based on WBES

2.7. Web Based Expert System (WBES)

WBES system which provides an evaluation report which is in line with the cognitive process dimension levels of RBT was developed in scope of this study. With this developed system, the aim was to primarily execute the learning statutes which belong to the qualifications like the courses, lessons, seminars, in-service training which require mastery learning. This system provides a report to the teacher pinpointing the specific lessons and subjects to focus on for the supportive education, by checking if the mastery learning has been realized or not using a module (See Appendix C).

2.7.1. The development of WBES system

At first, WBES was negotiated with the different field experts (computer engineer, education expert, mathematics teacher, computer and education technologies expert), as the basic purpose and structure of the system has been presented and after the algorithms and flow diagrams of the system is published, system analysts were hired to check whether the system is operating or not. Later on, the programming languages, software and technologies that will be used were determined and researchers have been provided training in those fields. After the design of the interface, WBES system was programmed. An expert's point of view was taken regarding the system and it was updated as per recommendations. Also, by performing a usability test over the experimental group (N=25), possible errors of the system were tried to be detected and also, the experimental group was allowed to get acquainted with the system. The development process of WBES system was provided in figure 4.

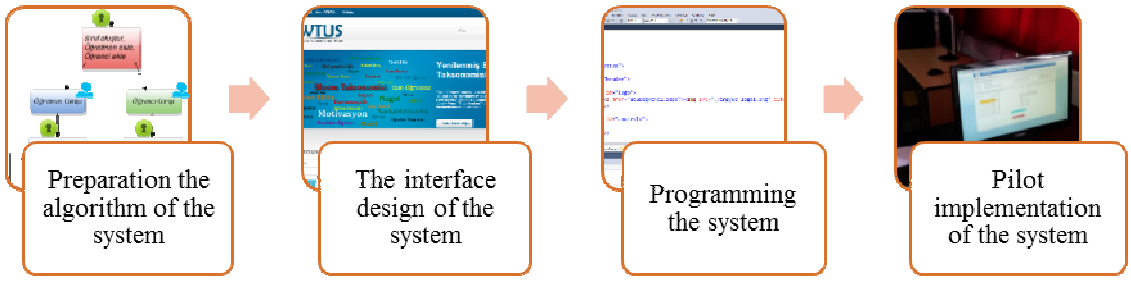

Figure 4. The development process of WBES system

Both the interface design and the programming of the WBES system have been made by researchers. For the interface design, image processing and modification programs like Fireworks, Photoshop were used. As editor and compiler, Visual Studio program was selected. The coding of the WBES system and suitable modules for RBT were made in VB language and technologies like Ajax, CSS, JQuery, Asp.net were used. SQL Server database was used as the data base solution. The developed WBES system was published in the web environment under the domain name www.wtusogretim.com.

In WBES system, interfaces for the student, teacher, and administrator are separate. The administrator identifies the teachers and the students to the system, with user id and password. The teacher can load to the system, questions which are suitable for the RBT cognitive process dimension and gains for these questions, teacher can also designate and modify tests. Teachers can also access the reports which provide the test results of the students pursuant to the RBT cognitive process dimension (see Appendix C). Students can log into the system and can solve the tests online that were designated for them from the interface that can be seen in figure 5.

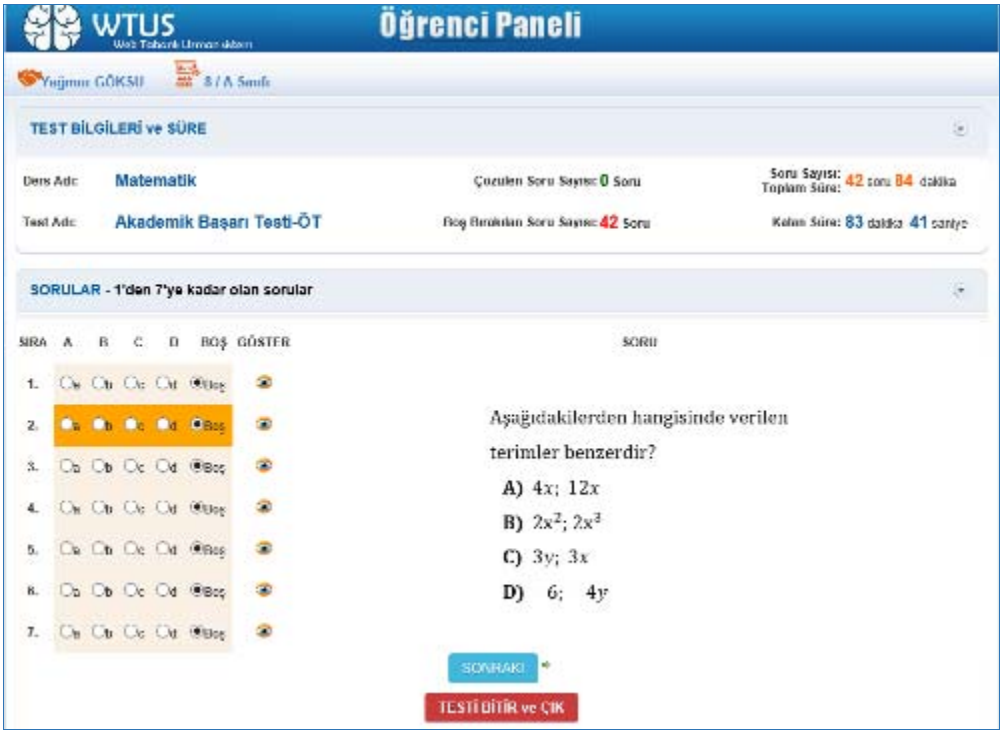

Figure 5. WBES online test interface

The teacher that is providing the course can upload the questions for this/her own class to the system, together with the question gains, in accordance with the RBT cognitive process dimension. It is mandatory for the teacher to have adequate information of RBT in order for him/her to make a reliable evaluation. The question uploading form can be seen in figure 6.

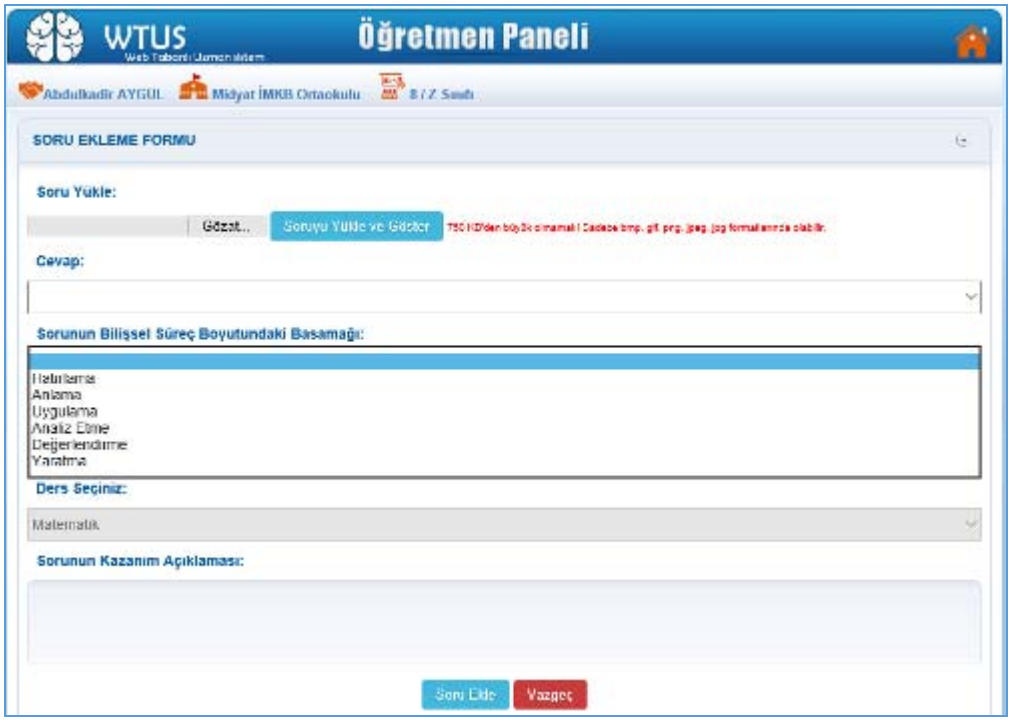

Figure 6. WBES question uploading form

In the question upload form which can only accept questions in bmp, gif, png, jpg or jpeg format, the right answer for the question and also its level regarding the cognitive process dimension of the RBT that it represents and the gain from the question can be uploaded to the system. The teacher can select questions from the question pool and create a test this way. After the selection of the test, the previously added number of questions to the

test can be listed in accordance with the levels of the cognitive process dimension of RBT. After the selection of the level, current questions in the pool can be listed. It is also possible to figure out which questions were added to the test, from this list. Test creation form can be seen in figure 7.

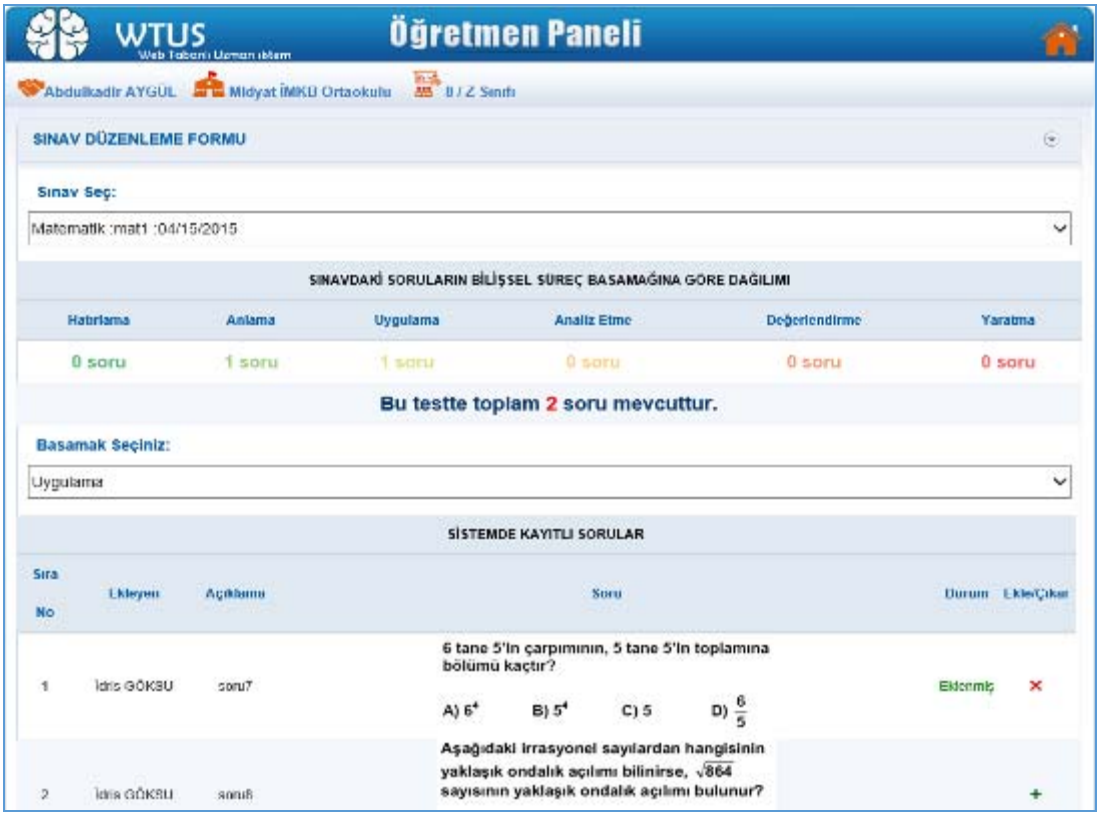

Figure 7. WBES test creation form

2.7.2. Reports which are suitable for the cognitive process dimension of RBT

The most important factor of the experimental process of the study is the student reports that the WBES system provides (See Appendix C). The main quality of this report is that it determines on which levels the students lacks gains and thus the exact levels that the student requires supportive education. When looked from this angle, it is possible to say that the work that normally belongs to the teacher has been taken over by the expert module of WBES system. While the system executes this task, and deciding on what levels the student is required to take additional courses, creating the review and procedure showings, it uses the rules written in Visual Basic.Net programming language which is shown in Table 4.

Table 4. Procedure Representation of Rules

	Condition	Operation
Incomplete competence rules	If $SP_{Remembrance}<85_{ICaz}$	$All_{AT} = All_{AT} + All_{Remembrance}$
	If $SP_{Comprehension}<85_{ICaz}$;	$All_{AT} = All_{AT} + All_{Comprehension}$
	If $SP_{Practice}<85_{ICaz}$;	$All_{AT} = All_{AT} + All_{Practice}$
	If $SP_{Analysis}<85_{ICaz}$;	$All_{AT} = All_{AT} + All_{Analysis}$
	If $SP_{Evaluation}<85_{ICaz}$;	$All_{AT} = All_{AT} + All_{Evaluation}$
	If $SP_{Creation}<85_{ICaz}$;	$All_{AT} = All_{AT} + All_{Creation}$
Comment rules	If $D_1 = 0, D_2 = 0, D_3 = 0,$	"In all steps additional training must be taken"
	If $D_1 = 0, D_2 = 0, D_3 = 1,$	"Successful in all steps and no need to take additional training"
	If $D_1 = 0, D_2 = 1, D_3 = 0,$	"Even though the success is good in all steps additional training is recommendable. But no need to take additional training in the steps."
	If $D_1 = 0, D_2 = 1, D_3 = 1,$	"Even though the success is good at D_2 step additional training is recommendable. But no need to take additional training at D_3 step.

If $D_1 = 1, D_2 = 0, D_3 = 0$,	"In all steps additional training must be taken"
If $D_1 = 1, D_2 = 0, D_3 = 1$,	"Must be taken additional training at D_1 step, no need to take additional training at D_3 step."
If $D_1 = 1, D_2 = 1, D_3 = 0$,	"Must be taken additional training at D_1 step. Even though the success is good at D_2 step additional training is recommendable."
If $D_1 = 1, D_2 = 1, D_3 = 1$,	"Must be taken additional training at D_1 step. Even though the success is good at D_2 step additional training is recommendable, but no need to take additional training at D_3 step."

D_1=Step$_{SP<70}$(The steps success percentage is below 70%, IC ≥1)
D_2=Step$_{70 \leq SP<85}$(The steps success percentage between 70 and 85, IC =1)
D_3=Step$_{SP \geq 85}$(The steps success percentage is 85 and higher than 85, IC ≤1)
SP: Success Percentage, IC: Incomplete Competence, AT: Additional Training

3. FINDINGS

3.1. The comparison of the effects of supportive education based on WBES and Traditional Supportive Education over academic success

In order to see if there is any significant difference in the impact of the students' academic succes rates, between the supportive education provided based on the reports obtained from the WBES system and traditional supportive education, independent groups t-test has been applied. The post-test values that belong to both groups which were calculated with the AST which is the dependent variable and equal interval scale showed normal distribution. Deviancy ($Z_{(experimental, post-test)}$=-.541; $Z_{(control group, post-test)}$=.944) and oblateness values ($Z_{(experimental group, post-test)}$=1.129; $Z_{(control group, post-test)}$=1.264), histogram and Q-Q plot graphs show that the data has normal distribution. Levene test results regarding the post-test data of the AST experimental group and the control group showed the variances to be equal ($p_{(.236)}$>.05).

The data obtained regarding the independent groups t-test have been provided in table 5.

Table 5. Post-test Independent Samples t-test Results of Experimental and Control Groups

Groups	*N*	Mean	*Standard deviation*	*Degrees of freedom*	*t*	*p*
Experimental Group	25	26.52	11.630	48	2.153	**.036***
Control Group	25	18.96	13.148			

*p<.05

As seen in Table 5, the post-test point average of the students within the experimental group is $\bar{X}$=26.52 and their standard deviation is 11.630; and for the students in the control group the point average is $\bar{X}$=18.96 and the standard deviation is 13.148. It's been seen as a result of the conducted t-test of dependent groups, there is a significant difference between the post-test average of the experimental group and the post-test average of the control group ($t_{(48)}$=2.153; $p_{(.036)}$<.05). Thus, it is possible to say that the supportive education provided based on the WBES adds a significant difference to the academic success rate of the students compared to the traditional supportive education.

3.2. The mastery learning status of the groups according to the RBT levels of pre and post supportive education

When evaluated regarding mastery learning (85% and up) the change in the experimental group can be seen in figure 8.

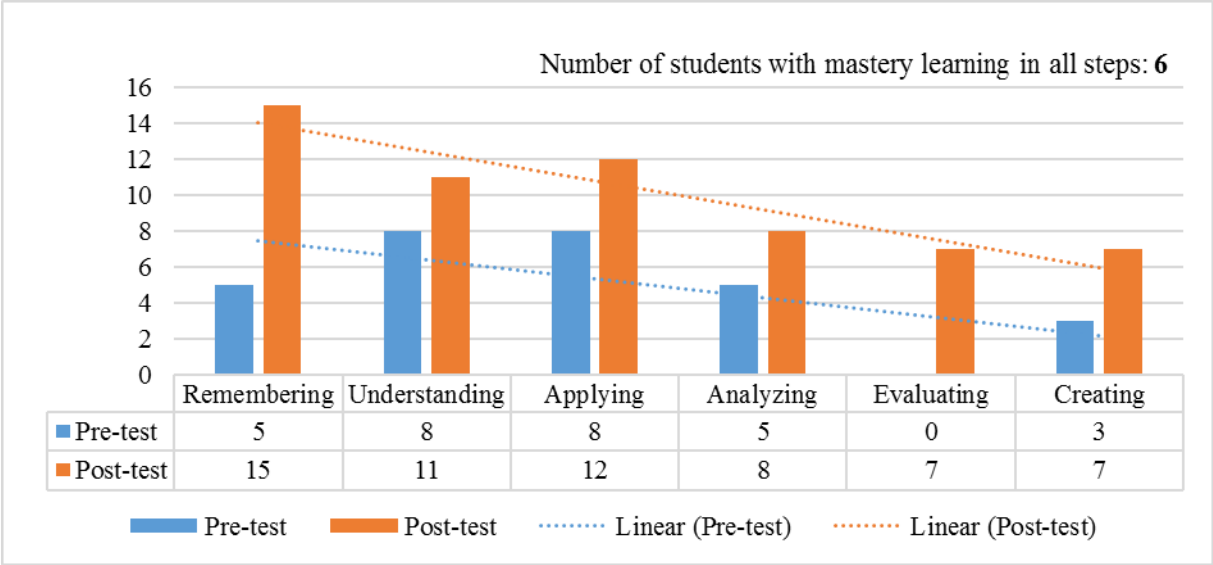

Figure 8. Mastery learning status before and after the supportive education based on WBES

As seen on figure 8, with WBES based supportive education, the number of students with mastery learning has increased with each new level. In the remembering level, pre-test results show 5 and post-test results show 15 students who completely learned. In the levels of understanding and application, it's been seen that as a result of the pre-test, 8 students had mastery learning, however after the supportive education, this number went up to 11 in the understanding level, and 12 in the application level. The pre-test results for mastery learning revealed that only 5 students learned completely in the level of analysis, and in the creation level it was 3 students only. In the evaluation level, no students could achieve mastery learning. After the supportive education however, the number of mastery learning students in the analysis and evaluation levels was 8, and it was 7 in the creation level. After the supportive educations given through the WBES based supportive education, 6 students could achieve mastery learning in all the levels.

The mastery learning status of the students after the traditional supportive education has been provided in figure 9. If observed, it is possible to see an increase in the number of complete learned students in the levels of understanding, application, evaluation and creation, after the traditional supportive education. In the remembering and analysis levels however, the number of completely learned students have diminished.

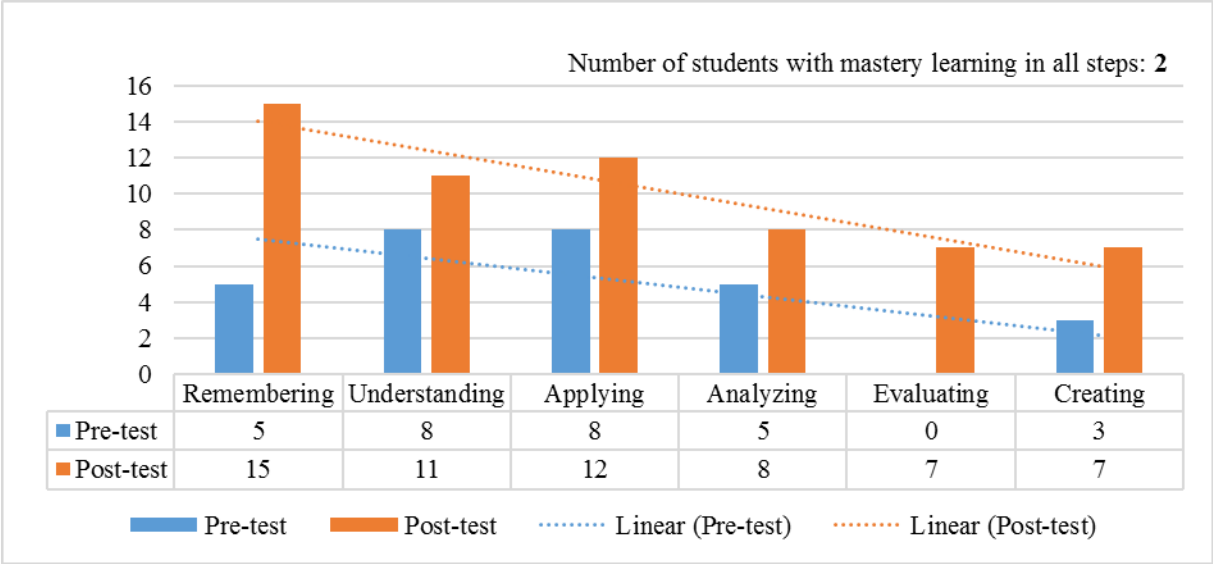

Figure 9. Mastery learning status before and after the traditional supportive education

According to figure 9, the number of completely learned students in the remembering level in the pre-test stage was 9, but after the post-test this number went down to 8. Similarly, while it was 4 in the analysis level, after the traditional supportive education this number also went down to 2. Besides, it's been seen that the number of completely learned students in the understanding level after the pre-test was 9, but this number went up to 10

after the supportive education, in the application level, the number went from 7 up to 10, in the evaluation level it went from 0 to 4 and in creation level it went from 2 to 4. After the supportive education provided by traditional ways, it's been seen that only 2 students achieved mastery learning in all the levels. The change in mastery learning status of both the experimental and control groups in accordance with the levels of cognitive processes of RBT was provided in figure 10.

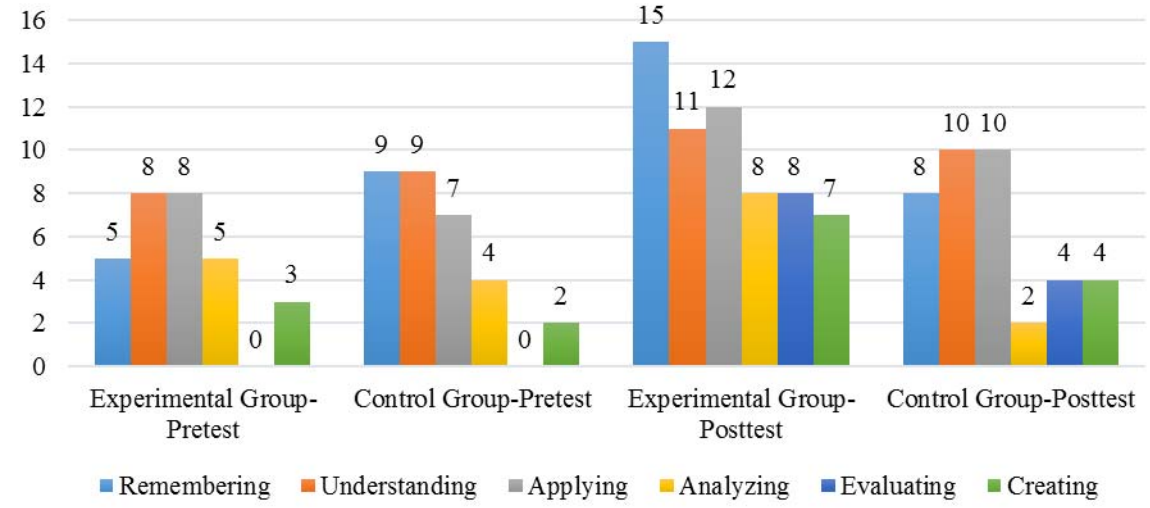

Figure 10. The change in the mastery learning status of the groups

According to figure 10, the number of completely learned students after the pre-test, in terms of the levels were pretty close to each other in both the experimental and control groups. It is clear to see that the difference gap has increased in favor of the experimental group after the post-test results. This actually shows that the WBES based supportive education is more effective regarding mastery learning. This result supports the result which states that the supportive education provided based on the WBES adds a significant difference to the academic success rate of the students compared to the traditional supportive education.

4. DISCUSSION

Independent group t-test was conducted in order to determine whether there is any significant difference between the impact on the success of the students in between the supportive education provided based on the reports obtained from WBES system and the traditional supportive education. As a result of this test, the post-test score average of the experimental group is found to be higher than the score average of the control group (X=26.52 / X=18.96) and the difference was found to be significant ($p_{(.036)}$<.05). In the end, it's been seen that the WBES based supportive education created a significant difference in the academic success of the students, compared to the traditional supportive education. Lamidi, Oyelekan, and Olorundare (2015) also reached a similar result and revealed that the education based on mastery learning is more effective than the traditional education. In various other studies, similar results have been erached and it's been suggested to use the mastery learning method in educational processes (Kularbphettong, 2014; Wambugu and Changeiywo, 2008; Yildiran and Aydin, 2005). The fact that the WBES based supportive education is based on the mastery learning model and RBT, also requires an evaluation from that aspect.

With WBES based supportive education, the aim has been to realize mastery learning. In this study, it's been seen that with WBES based supportive education, 6 students reached the mastery learning state in all the level of the RBT's cognitive process dimension (85% and up) and learned all the gains in all the levels of the RBT's cognitive process dimension. With traditional supportive education however, it's been seen that only 3 students reached the mastery learning state in all the level of the RBT's cognitive process dimension. It's been expected that with repeating supportive education, completely learned students would increase in numbers. The results obtained in this study actually strengthens the claim that mastery learning and RBT based education increases the academic success in a significant rate. Because many studies in various branches (Anderson et al., 1992; Bowen, 2006; Fier, 2007; Guskey, 2007; Miles, 2010; Thomas-Topp, 1995; Wambugu and Changeiywo, 2008; Whiting, Van-Burgh and Render, 1995; Yildiran and Aydin, 2005; Zengin, 2005) have shown that mastery learning affected the academic success in a positive manner. Some studies have also revealed that mastery learning is much more effective than traditional education techniques (Anderson et al., 1992; Block and Burns 1977; Kulik, Kulik, and Bangert-Drowns, 1990; Kurtuldu and Bakıoğlu, 2012; Nakajima, 2006). Also, Machanick (2005) emphasizes that education based on Bloom Taxonomy is much more effective than education based on traditional methods. Schunk (1991/2011) suggests that in supportive education provided in middle

schools, the use of mastery learning methods would allow the students to learn in their own pace and unlike traditional methods, would not stop students who want to progress fast.

5. RESULTS AND RECOMMENDATIONS

In this study a WBES system was developed which provides analyses and reports based on the cognitive processes of RBT, and through these reports, the impact of the supportive education on the academic achievement and mastery learning state of the students have been revealed. The impact on academic success rate was compared in between the WBES based supportive education and traditional supportive education. As a result, it is fair to say that WBES based supportive education brings a significant difference to the academic success of the students when compared to traditional supportive education methods. This result shows that WBES based supportive education is more effective than traditional supportive education. The number of students who achieved mastery learning according to RBT was more in the WBES based supportive education group, when compared to the traditional supportive education group.

Based on the results of the study, the following recommendations can be given to practitioners and researchers:

- ✓ The WBES system which was developed by Ministry of Education institutions in scope of this research or an expert system that will be developed based on this system can be coupled with the supportive education courses that are given in official or private middle or high schools. Thus, the students could learn their gains whenever and wherever they want, and school administrators can find out about the gains of all the students and prepare a supportive education based on the levels revealed and teachers can provide this education in accordance with the gains of the students. The parents will also be able to see the status of learning of their children. As a result, a more effective and efficient supportive education is expected.
- ✓ It is suggested to subject all the students which will participate in the supportive education programs, to a comprehensive test in the beginning of the semester, in order to determine their levels to form different classes. Also, this placement can be achieved based on the RBT over the WBES system.
- ✓ In this study, for each level of the RBT, it was assumed that students with a success rate of 85% and above achieved mastery learning in the level in question and was not taken to the supportive education class of that particular level. As stated by Block and Burns (1977), these students can also participate in supportive education classes and could help to other students who are having a hard time to achieve mastery learning, and thus, another study can be conducted which is based on WBES which also aims mastery learning.
- ✓ The developed WBES system is only compatible with RBT. Other taxonomies which will be used as grading systems can also be added to the WBES system and students can be evaluated based on a multitude of taxonomies.
- ✓ The expert system which was developed in scope of this study performs evaluations in accordance with some heuristic rules. A more useful, flexible and extensible system with different sizes can also be created by adding data mining algorithms to the system.
- ✓ By extending the duration of the supportive education courses based on WBES and mastery learning and by repeating the courses in any particular level, it would be possible to see how the mastery learning is affected by these procedures.

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Appendix A. Sample questions from AST (One in each level)

5. $x + 3y - 2x + 5 - y$ ifadesinin en sade hali aşağıdakilerden hangisidir?

A) $2y - x + 5$

B) $3y + x - 5$

C) $2y + x + 5$

D) $x - 2y + 5$

10. $2x + 12 = x + 7$

$3x - 2y = -21$

olduğuna göre y kaçtır?

A) 3

B) 2

C) 1

D) 0

15. $(x+4)^2$ ifadesinin eşiti aşağıdakilerden hangisidir?

A) x^2+16

B) $x^2+4x+16$

C) $x^2+8x+16$

D) $x^2-8x+16$

22. $(103).(97)$ çarpımı aşağıdakilerden hangisiyle ifade edilebilir?

A) 10^5-9

B) 10^4-9

C) 10^3-9

D) 10^2-9

29. $\frac{a^2-2ab}{2b^2-ab}$ ifadesinin sadeleştirilmiş şekli aşağıdakilerden hangisidir?

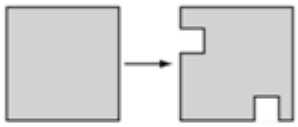
A) $\frac{a-b}{b}$

B) $\frac{-a}{b}$

C) $\frac{a+b}{a-b}$

D) $\frac{a}{a+b}$

41. Efe, proje ödevi için alanı **484** cm^2 olan kare şeklindeki kartondan, alanları otuz altışar santimetrekare olan iki kareyi şekildeki gibi kesip çıkarmıştır.



Kalan kartonun çevre uzunluğu kaç santimetredir?

A) 88

B) 112

C) 124

D) 136

Appendix B. The gains of AST based on RBT and p_j and r_{jx} *values*

		ACADEMIC SUCCESS TEST		
		Gain	r_{jx}	p_j
1	**Remembering**	Remembering the concept of similar terms and addition in algebraic expressions	0.50	0.44
2		Remembering similar terms	0.37	0.70
3		Remembering addition and subtraction in algebraic expressions	0.52	0.63
4		Remembering the addition and subtraction and the concept of coefficient in algebraic expressions	0.30	0.71
5		Remembering the concepts of addition and subtraction in algebraic expressions	0.61	0.61
6		Remembering the concept of constant term	0.41	0.69
7		The making of addition and subtraction in algebraic expressions	0.61	0.64
8	**Understanding**	Knowing the concept of identity	0.52	0.75
9		Knowing the concept of identity, understanding the unknown	0.46	0.51
10		Finding the value of the unknown	0.63	0.67
11		Knowing the concept of identity	0.48	0.67
12		Knowing the concept of identity and mathematical procedure knowledge	0.74	0.60
13		Multiplying a single term expression with parenthesis which include more than one term	0.43	0.81
14		Multiplication of a single term expression with parenthesis that include more than one term	0.48	0.71
15	**Applying**	Writing the open version of the identity	0.67	0.39
16		Writing the open version of the identity	0.80	0.46
17		Writing the open version of the identity	0.80	0.44
18		Multiplying the parenthesis that include more than one term	0.63	0.58
19		Writing the open version of the identity	0.70	0.47
20		Writing the open version of the identity and making additions and subtractions	0.52	0.29
21		Multiplication of parenthesis that include more than one term	0.74	0.53
22	**Analyzing**	Factorizing the expressions	0.46	0.37
23		Factorizing and abbreviation	0.39	0.24
24		Factorizing and abbreviation	0.33	0.27
25		Factorizing and abbreviation	0.26	0.25
26		Factorizing and abbreviation	0.41	0.34
27		Factorizing and making additions, subtractions	0.74	0.30
28		Factorizing of the open expressions	0.43	0.29
29	**Evaluating**	Factorizing and abbreviating the fractional expressions	0.24	0.28
30		Factorizing and abbreviating the unknown coefficient expressions	0.30	0.29
31		Factorizing the fractional and crowded expressions	0.24	0.16
32		Factorizing and simplifying the expression	0.20	0.22
33		Factorizing and simplifying the expression	0.35	0.30
34		Factorizing the crowded expressions	0.39	0.18
35		Factorizing and abbreviating the crowded fractional expressions	0.20	0.30
36	**Creating**	Factorizing an expression by associating it with another	0.28	0.23
37		Finding the value of the unknown by factorizing the expression	0.24	0.18
38		Forming the equation with expressions with shapes and factorizing them	0.39	0.33
39		Forming the equation in the expressions given as problems and factorizing them	0.59	0.27
40		Finding the unknown by turning the shape expressions into algebraic form	0.50	0.55
41		Finding the unknown by associating the shape expressions with identities	0.26	0.26
42		The solving of questions which are associated with old subjects using identities	0.28	0.17

Appendix C. A report sample based on WBES (pre-test)

Test Seçiniz:

Matematik Akademik Başarı Testi-ÖT (03/21/2015)

Öğrenci Seçiniz:

Ayşe [redacted]

Test Sonuç Bilgileri

Öğrencinin Adı Soyadı: Ayşe [redacted] | Ders Adı: Matematik | Katılan Öğrenci Sayısı: 25

Sınıfın Başarı Yüzdesi: %44,57 | Test Adı: Akademik Başarı Testi-ÖT | Testteki Soru Adedi: 42

Öğrencinin Başarı Yüzdesi: % 78,57

Ayşe [redacted]'ın Yenilenmiş Bloom Taksonomisine Göre Başarı Durumu

HATIRLAMA	ANLAMA	UYGULAMA	ANALİZ	DEĞERLENDİRME	YARATMA
100 %	85,71 %	85,71 %	85,71 %	42,86 %	71,43 %
Doğru: 7	Doğru: 6	Doğru: 6	Doğru: 6	Doğru: 3	Doğru: 5
Yanlış: 0	Yanlış: 1	Yanlış: 1	Yanlış: 1	Yanlış: 3	Yanlış: 0
Boş: 0	Boş: 0	Boş: 0	Boş: 0	Boş: 1	Boş: 2

Hatırlama eksik kazanım	Anlama eksik kazanım	Uygulama eksik kazanım	Analiz eksik kazanım	Değerlendirme eksik kazanım	Yaratma eksik kazanım
	1. Özdeşlik kavramını bilme bilinmeyeni anlama	1. Özdeşliğin açık halini yazıp toplayıp çıkarma	1. Açık verilen ifadelerin çarpanlarına ayrılması	1. Çarpanlarına ayrırarak ifadeyi sade hale getirme 2. Kalabalık ifadeleri çarpanlarına ayırma 3. Kesirli ifadeleri çarpanlarına ayırıp sadeleştirme 4. Bilinmeyen katsayılı ifadeleri çarpanlarına ayırıp sadeleştirme	1. İfadeyi çarpanlarına ayırıp, istenen ifadenin değerini bulma 2. Eski konularla ilişkilendirilen soruların özdeşlikler kullanılarak çözülebilmesi

Hatırlama öğrenilen kazanım	Anlama öğrenilen kazanım	Uygulama öğrenilen kazanım	Analiz öğrenilen kazanım	Değerlendirme öğrenilen kazanım	Yaratma öğrenilen kazanım
1.Benzer terim kavramını ve cebirsel ifadelerde toplamayı hatırlama 2.Benzer terimi hatırlama 3.Cebirsel ifadelerde toplama çıkarma işlemini ve katsayı kavramını hatırlama 4.Cebirsel ifadelerde toplama çıkarma kavramını hatırlama 5.Sabit terim kavramını hatırlama 6.Cebirsel ifadelerde toplama ve çıkarma işlemlerinin yapılması 7.Cebirsel ifadelerde toplama ve çıkarmayı hatırlama	1.Özdeşlik kavramını bilme 2.Bilinmeyenin değerini bulma 3.Özdeşlik kavramını bilme 4.Özdeşlik kavramını bilme ve işlem bilgisi 5.Bir terimli bir ifadeyi birden fazla terim içeren parantezlerle çarpma 6.Bir terimli bir ifadenin birden fazla terim içeren parantezlerle çarpılması	1.Özdeşliğin açık halini yazma 2.Özdeşliğin açık halini yazma 3.Özdeşliğin açık halini yazma 4.Birden fazla terim içeren parantezleri çarpma 5.Özdeşliğin açık halini yazma 6.Birden fazla terim içeren parantezlerin çarpılması	1.İfadeyi çarpanlarına ayırma 2.Çarpanlarına ayırma ve sadeleştirme 3.Çarpanlarına ayırma ve sadeleştirme 4.Çarpanlarına ayırma ve sadeleştirme 5.Çarpanlarına ayırma ve sadeleştirme 6.Çarpanlarına ayırıp toplayıp çıkarma	1.Kalabalık ve kesirli cebirsel ifadelerin çarpanlarına ayrılması ve sadeleştirilmesi 2.Kesirli ve kalabalık ifadeleri çarpanlarına ayırma 3.Çarpanlarına ayırarak ifadeyi sade hale getirme	1. Şekilli ifadeleri özdeşliklerle ilişkilendirerek isteneni bulma 2.Şekilli ifadeleri cebirsel şekle çevirip isteneni bulma 3.Problem olarak verilen ifadelerde denklemi oluşturup çarpanlarına ayırma 4.Şekilli ifadelerde denklemi oluşturup çarpanlarına ayırma 5.Verilen bir ifadeyi başka ifadeyle ilişkilendirerek çarpanlarına ayırma

Öğrencinin Katılacağı Ek Eğitim Düzeyleri

1. DEĞERLENDİRME
2. YARATMA

*Bir düzeyde %80'nin altında başarı varsa, o düzeyde ek eğitim alınması önerilir.

Basamaklara Göre Başarı Grafiği (%)

Ayşe [redacted], HATIRLAMA (%100), ANLAMA (%85,71), UYGULAMA (%85,71), ANALİZ (%85,71), basamağında oldukça başarılıdır ve bu basamakta ek eğitim almasına gerek yoktur. YARATMA (%71,43), basamağında ise iyi düzeyde olmasına rağmen bazı kazanımları edinmediği tespit edilmiştir ve bu basamakta ek eğitim almalıdır. DEĞERLENDİRME (%42,86), basamağında ise oldukça eksiği olduğu tespit edilmiştir. Dolayısıyla yukarıda tespit edilen tüm eksik kazanımları edinmesi konuyu tam öğrenmesini sağlayacaktır.

SONUCU YAZDI

Use of Intelligent Tutor in Post-Secondary Mathematics Educationi the United Arab Emirates

Anita Dani
Higher Colleges of Technology, United Arab Emirates
Anita.Dani@hct.ac.ae

Ramzi Nasser
Dhofar University, Sultanate of Oman
rnasser@du.edu.om

ABSTRACT
The purpose of this paper is to determine potential identifiers of students' academic success in foundation mathematics course from the data logs of the intelligent tutor Assessment for Learning using Knowledge Spaces (ALEKS). A cross-sectional study design was used. A sample of 152 records, which accounts to approximately 60% of the population, was extracted from the data-logs of the intelligent tutor, ALEKS. Two-step clustering, correlation and regression analysis, Chi-square analysis and ANOVA tests were applied to address the research questions. The data-logs of ALEKS include information about number of topics practiced and number of topics mastered by each student. A derived attribute, which is the ratio of *number of topics mastered* to *number of topics practiced* is found to be a predictor of final marks in the foundation mathematics course. This variable is represented by the name *mtop*. Cluster classification based on this derived attribute resulted into three groups of students for which the mean values of the variable *mtop* are 0.80, 0.66 and 0.53 respectively. A moderately strong, positive and significant correlation was found between *mtop* and the final exam marks.

Keywords-cluster analysis, intelligent tutor, learning analytics, ALEKS

INTRODUCTION
It has been reported that many students spend a greater period of time in early years of the higher education especially in remedial or foundation programs; they spend more than expected without achieving the program requirements (Nasser, 2012). As Hansen et al (2006) explain, that secondary schools prepare students for university requirements but do less in preparing them to achieve at the level that universities require. Significantly, English language appears to be a difficult subject as most universities use that medium of instruction to teach science and non science subjects. Many students in the Gulf countries have not achieved a level of competency to enable them to successfully operate in English as a language of instruction and learning.

Many programs, techniques, and methods are in place to support foundation year students in their learning in higher education among them is continuous assessments and review which are probably one of the key ingredients to improve student learning strategies to be used for enriching their learning experience as it has the cognitive as well as the motivational purpose (Ritter, Anderson, Koedinger & Corbett, 2007). Timely feedback in assessments fills the gaps between the actual learning and expected learning outcomes (Chappuis, 2014). Formative assessment with feedback is particularly significant when students are uncertain about what is expected of them and when they need instructional guidance about how to move ahead (Nguyen, Hsieh & Allen, 2006; Wood & Wood, 1996). One claim is that the process by which students are monitored during instruction can help teachers provide timely feedback on students' actual learning.

While formative assessments or continuous assessments followed by feedback can be used periodically to assess students' learning, it may not be feasible or practical to incorporate in large class sizes, (Chappuis, 2014). The first years in higher education, a great deal of stress is placed on the instructor to carry out continuous assessments, or formative assessments and provide timely feedback. More lately the use computer-based assessment systems known as intelligent tutoring are widely used in secondary schools and higher education. These systems are web-based and designed to run on multiple devices such as laptops, iPads and mobile gadgets. They can be used to conduct frequent formative assessments with appropriate and timely feedback to minimize the gap between actual learning and expected learning (Narciss & Huth, 2004). It also engages students in authentic learning opportunities and can increase student participation and motivation in the learning process (Miller, 2009).

A key feature of these software systems is their ability to record and store every learning activity occurring when a student interacts with the system. The data gathered for every user can be analyzed providing the "learning profiles" for each student or at the aggregate level. A learning profile is useful to understand students' study habits and their progress (Kotsiantis, Tselios, Filippidi & Komis, 2013). Learning profiles can be detected by applying methods of *Learning Analytics* in which system-generated large data logs are analyzed in order to understand students' learning activities (Siemens & Long, 2011). The data generated support instructors to assess where the students are and where to go forward.

LITERATURE REVIEW

Computer based assessments

In class, the instructor can engage students in student-centered activities in the classroom through intelligent tutors. Students can access such systems online at any time or anywhere, for which they are expected to develop self-regulatory approaches to succeed and use the technologies available to them in and outside the classroom (Aleven, Roll, McLaren, Koedinger, 2010; Nicol, 2006; Nguyen, Hsieh & Allen, 2006). Web-based intelligent tutoring systems allow students to practice, to have control over their learning and manage their time and interaction with peers and instructors (McArthur & Stasz, 1990). Also the use of online computer based assessments, have several advantages over paper based assessments (Aleven, Roll, McLaren & Koedinger, 2010; Balacheff & Kaput, 1996; Hagerty & Smith, 2005), they provide access to any number of students anytime and anywhere through any type of computer, such as a laptop, tablet or a smart phone. They provide a wider range of assessment techniques than the paper based assessments, for example, inclusion of graphics and multimedia. Students can provide their responses in various formats, such as drawing graphs on a digital screen, locating number positions on a number line by clicking on the webpage. The most significant aspect of computer based assessments is that individualized feedback is given instantly. More importantly, the software applications can generate questions randomly from a large bank of questions and different versions of assessments produced to tailor different levels of learning outcomes and practice questions required for mastering a topic (Shute & Underwood, 2006). Moreover, such web-based software can foster student-centered learning by engaging students in meaningful learning activities and can increase students' engagement in learning (Chen et al, 2008; Chen, Yunus, Ali & Bakar, 2008; Nguyen, Hsieh & Allen, 2006; Schneider, Egan & Julian, 2013).

Intelligent tutors

Generally, a computer tutor or intelligent tutor establishes task-related goals and guides the learner toward the goal. An expert tutor is capable of designing learning tasks to ensure that the student persists on the task and gains some new knowledge, the student when interacting with the computer tutor may heavily rely on the system to work out a problem as an act of educational transference (Thelwall, 2000). While early computer-based learning was based on behaviorist learning theories that each application is taught as a separate learning objectives, into modules with separate objectives that are linked in such a way that the outcomes in one module can be used as an input into another. However more recent advances in cognitive sciences recommend adapting the constructivist learning theory and emphasize that "true" understanding as connected and generalizable knowledge wholes (Ritter, Anderson, Koedinger & Corbett, 2007). According to constructivist learning paradigm, a student could cultivate independent and self-directed learning and higher ordered thinking. Researchers as Chen, Yunus, Ali & Bakar (2008) and McArthur & Stasz (1990) have shown that computer-based or web-based assessments had positive effects on students' mathematical learning processes especially where problems required analytical and critical approaches for solving them. In mathematics immediate correction and feedback can generally have substantial real-time benefits to students as it gives them an opportunity to analyze the problem and readjust, reorganize, restate, and recalculate the problem work and move to higher levels of the taxonomy of educational objectives.

The current and emerging technologies, such as *intelligent tutors*, which are supported by artificial intelligence techniques have an advantage compared to other information technologies (Chen, Yunus, Ali & Bakar 2008; Chen et al, 2008; McArthur & Stasz, 1990; McGatha, & Bush, 2013). The *intelligent tutors* have the ability to integrate more than one medium, provide authentic and concurrent learning activities and provide academic-content based support to a large student body. As reported in (Stiggins, 2001; VanLehn, 2011) human tutoring has an effect size of $d = 2.0$ relative to classroom teaching without tutoring. This effect is known as the 'two sigma gain'. Developers of intelligent tutors work towards achieving the same effect as human tutors by incorporating multidimensional tutoring with appropriate feedback and scaffolding techniques based on the knowledge of the subject and the knowledge of student's state of learning (Kao & Lehman, 1997; Stiggins, 2001). Intelligent tutors' development is based on combining theories of cognitive science and techniques of artificial intelligence (Anderson, Boyle, Corbett & Lewis, 1990; Ritter, Anderson, Koedinger & Corbett, 2007;

McGatha & Bush, 2013; Miller, 2009). The intelligent tutors can provide interactive and personalized learning environment for students allowing them to study and learn individually (Hagerty & Smith, 2005).

Some intelligent tutoring system, such as *Cognitive tutor*, allows students to write solutions procedurally as if they were solving it on paper. The system gives feedback on each step as well as for the overall solution (Ritter, Anderson, Koedinger & Corbett, 2007) whereas, intelligent tutors like ALKES (Assessment for Learning using Knowledge Spaces), provides feedback only on the final answer. Cognitive tutors are appropriate for novice learners where every step is supported through feedback, use of systems like ALEKS is appropriate in higher education where students are expected to develop the ability to follow through problem-solving procedures with minimal support.

One of the prominent theoretical frameworks underlie the development of intelligent tutoring systems, is the framework of *knowledge space theory*. The knowledge space theory is applied to make the learner agile to learning. Tutoring systems, such as ALEKS, is built on the foundations of knowledge space theory that can gauge the level of student's understanding and can detect the correctness of student's next response on the basis of current response. ALEKS provides learning goals, scaffolding support for learning and allows for formative and continuous assessments and feedback.

At the core of the analytic engine is the concept of two fringes. One fringe which consists of all topics that *What a Student Can do* and the second fringe consists of all topics that the student is *Ready to do or Learn*. Refer to Table 1 for illustration.

Table 1: Two states of student's learning (excerpt only)

What H00298326 Can Do as of 09/15/2014	What H00298326 Is Ready to Learn as of 09/15/2014
Place Value, Expanded Form, and Numeral Translation	Exponents and Order of Operations
Numeral translation: Problem type 1	Writing expressions using exponents

ALEKS is user friendly and interactive. A student can choose any topic available from the list of 'Ready to Learn Topics.' A question is presented on that topic by the system, a student can request an explanation and if a student can respond to the problem correctly, positive reinforcement is prompted on the system. If the student can answer three more similar questions correctly, then the system allows the user to terminate the task by prompting the option of 'Done.' If a student is confident about the mastery of this topic then, they can click on the button 'Done,' and the topic is added to the list of 'what a student can do.' If a student cannot answer three to four consecutive questions correctly, then the system does not present questions from the same topic but suggests that the student can try another topic. ALEKS has the ability to create individualized sequence of topics based on the student's background knowledge and level of cognitive development but the instructions provided by ALEKS are static and same for all students irrespective of their individual learning styles. It does not provide instructions in different multi-media format, such as audio or video, but allows instructor to upload presentations and video files customized for students.

ALEKS sets two types of in-built and individualized assessments known by the *progress test* and *comprehensive test*. These assessments include questions from the two sets, the first, a set of topics mastered by the student and the set of topics which the student is ready to learn. Progress tests are administered by the system based on the topics mastered and time spent by the student, whereas comprehensive tests must be assigned by the instructor. The purpose of the progress test is to ensure that students can retain and recall his or her learning. Thus by diagnosing student's current state of knowledge, the software can provide scaffolding exercises and/or problems that help the student progress gradually. Each student can learn at her own pace and monitor her own progress. Inclusion of ALEKS in the foundation mathematics curriculum is aligned with the strategic decision of ministry of higher education in the United Arab Emirates (UAE) to basically integrate computer-based technologies in the educational processes.

Learning Analytics

Learning analytics focus on deriving information which can reveal how students use the intelligent tutoring systems and identify potential "identifiers" of academic achievement. (Desmarais & Baker, 2012; Holden, Sottilare, Goldberg & Brawner, 2012; Kotsiantis, Tselios, Filippidi & Komis, 2013; Libbrecht, Rebholz, Herding, Müller & Tscheulin, 2012). Application of methods of learning analytics can be a powerful means to inform and support learners, teachers and their institutions to better understand and predict individualized learning needs and performance (Greller & Drachsler, 2012; Siemens & Long, 2011, Tempelaar, 2014). There

are specific student attributes when analyzing learning patterns, such attributes include time – spent on a topic, engagement with it and other system dispositional elements as skills and computer agility (Siemens & Long, 2011). Such system specific attributes are taken into account for analyzing students' learning patterns or their engagement in learning, but in some cases new attributes are derived to gain deeper understanding of determinants of students' learning (Antonenko, Toy & Niederhauser, 2012). Learning analytics attributes can be derived by combining the information about the number of topics practiced, time spent on learning and number of topics mastered. This analysis could provide information about whether a student can learn from the instructional queues and feedback provided by the software and utility for mastering the course content.

The system-specific attributes generated by ALEKS may not provide accurate information about student's learning efforts as the system cannot indicate the idle time, when students login to the system and do not attempt to respond. In addition, the time taken to master a topic is not signified as students are encouraged to learn at their own pace. It is worth investigating how to detect from such large data logs, information about students who are able to master a topic by studying independently.

We calculated the ratio of the two variables *number of topics mastered* and *number of topics practiced*, represented by the variable *mtop* (which is an abbreviation of *mastered-to-practiced)* which can be used as a construct of the extent of which the student has the ability to learn independently. The aim of this research is to examine whether *mtop* is a predictor of student's assessment in a course.

Course Structure

In the context of the UAE not too long ago, the ministry of higher education of the UAE took a decision to supply tablets to foundation year students in all federal higher education institutions. This decision was taken to address the strategy to develop technologically advanced environments to support learning in higher education (Gitsaky, Robby, Hamdan & Ben-Chabane, 2013). The supply of tablets to the foundation year students as the first year experience was perceived as an impetus for students to "ride" the information age and stay abreast of the technological advancement in higher education in preparation for the workplace (Nguyen, Hsieh & Allen, 2006; Yorke & Longden, 2004).

Two foundation courses covering basic arithmetic, algebra, geometry and statistics are delivered using the ALEKS software used tablets. Students use their tablets (iPads) to access this program. The software provides explanation and practice problems on each topic. Students are expected to master all topics as per their learning pace. Upon registering into the course on ALEKS, the software gives each student an initial assessment and detects their prior knowledge about the subject. This score is denoted by the variable Initial Assessment (IA). As the student interacts with the software and progresses towards the completion of all topics, the software maintains a record of progress and the status of mastery of the course is displayed in the form of a Pie chart as shown in Figure 1.

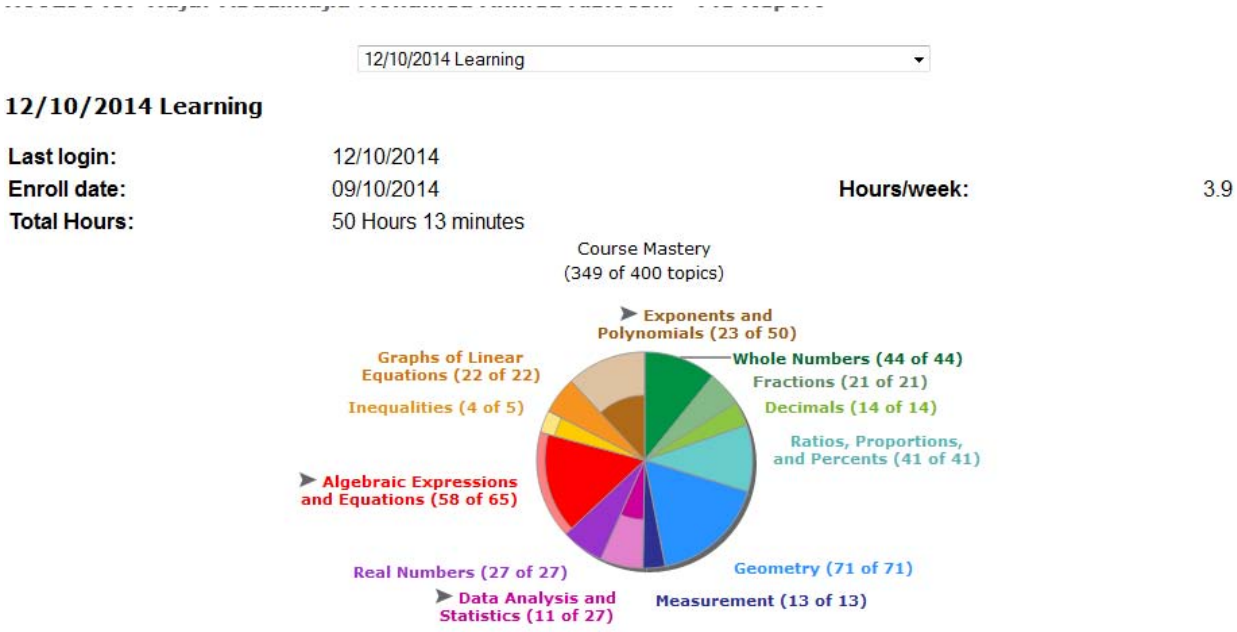


Figure 1: Pie-chart showing learning status of a student on ALEKS

In terms of course grade distribution through ALEKS, 40% weighting is assigned to completion of all topics, which works as the formative assessment. Students are expected to master these topics outside the regular class time. 60% weighting is given to in-class quizzes and the final exam which form the summative assessment component is denoted by FE in the rest of the paper. The assessments are created by teachers but graded by the software. Students can review their own answers after the examinations are graded, but the software does not provide a detailed feedback on their answers. The software only indicates whether the answer is correct or incorrect. In case of incorrect answers, the system does not provide an explanation. It only provides the expected correct answer.

There is also a summative assessment, which is a comprehensive test generated by ALEKS, and is based on what the student has mastered. This assessment component is denoted by CT in the rest of this paper. These tests are conducted in classroom under controlled conditions. After each test, the software indicates which topics are retained by the student and which are not. In these tests unlike the formative assessments, the software does not provide feedback on student's performance in the comprehensive test, neither teacher can see student's solutions nor the student can see their own answers and know the mistake; hence a student has to re-learn the topic that is dropped after each comprehensive test.

Regular course runs over 16 weeks but students who complete at least 85% of the topics after each comprehensive test are given an opportunity of exiting the course earlier than those who do not. The software allows teachers to set individual or group classwork, homework, quizzes and worksheets.

METHODS

Data was gathered from a cumulative report generated from a 20-weeks data which included the following information: time spent in ALEKS in each week, number of topics practiced each week and number of topics mastered each week. The excerpt of the data file used for analysis is given below and each variable is described subsequently.

Table 2: Excerpt of the data file

EPL (English Language proficiency)	Number of progress tests Ptests	IA	CT	FE	EE (early exit)	WT-1 (Time spent in week -1 in min)	WM-1 (Topics mastered in week -1)	WP-1 (Topics practiced in week-1)	*mtop*-1 (Ratio of WM-1 /WP-1)	WT-1 (Time spent in week -1 in min)	WM- 2 (Topics mastered in week -2)	WP-2 (Topics practiced in week-2)	*mtop*-1 (Ratio of WM-1 /WP-1)
3	6	36	83	71	Yes	237	22	25	0.88	432	24	37	0.65
3	5	27	61	61	No	38	4	4	1.00	189	19	21	0.90
3	4	28	50	32	No	48	0	0	0.00	251	25	34	0.74
3	7	17	65	60	No	288	26	27	0.96	1334	126	152	0.83
3	3	23	62	60	No	72	5	5	1.00	365	30	31	0.97

IA=Initial assessment , CT= Comprehensive test, FE=Final Exam; WM-1: Topics mastered in week-1; WP1-Topics practiced in week-1,*mtop*-1: Ratio of WM-1/WP-1 WM-2: Topics mastered in week-2; WP2-Topics practiced in week-2, *mtop*-2: Ratio of WM-1/WP-1. …..

The data file also included the following variables: student's score in the initial assessment (IA), total number of topics mastered by the student after the comprehensive test (CT), student's marks in the final exam (FE), and number of progress tests taken by the student (Ptest) and whether the student passed the course or not in less than 12 weeks. If a student passes the course in less than 12 weeks, then the values assigned attribute to variable EE is "Yes." For other students who do not pass in less than 12 weeks, the assigned attribute to this variable is "No." The system administers progress tests based on the number of topics completed by a student. The number of progress tests attempted is different for each student as the pace of their learning is different. In the data file, the variable *Ptest* denotes the number of progress tests taken by a student. The ratio of the two variables of topics mastered to topics practiced is represented by the variable *mtop* for each week and is used as a measure of ability to learn independently. The mean value of this variable *mtop* over 20 weeks was calculated. Refer to the Table 2 given above.

This research aims to assess the relation between student's ability to work independently through ALEKS and student's final marks in the course. The research aims are:
(1) To explore learning profiles of students based on similar learning patterns.
(2) To investigate the following research questions:
Does the ability to work individually effect students' marks in the coursework and in the final exam?
Does the proficiency in English affect the ability to study individually?

Data Analysis
The data file consisted of 152 records from five sections of Basic Mathematics and Pre-Algebra taken at a 4-year technical college in the UAE. The students were in the foundation year, and candidates enter regular degree programs upon completion of English and Mathematics courses.

In the first stage of the analysis the Shapiro-Wilk test of normality was applied to test the normality of the variable *mtop.* The result shows that value of the statistic is 0.99 and p-value is 0.142. Since the p-value is higher than 0.05, it implies that the variable *mtop* is normally distributed and hence parametric tests are applicable.

Cluster analysis
In order to determine which groups of students have similar learning profiles, a cluster analysis can be applied (Antonenko, Toy & Niederhauser, 2012; Cohen, Manion, and Morrison, 2011). Two-step clustering method is applied where variables are continuous and the number of clusters is not known apriori (Field, 2009). Students are classified into clusters based on the mean value of the ratio of topics mastered to topics practiced (*mtop)*. The clustering created three different profiles based on the value of the variable *mtop*. The software detected three clusters by applying the Log-likelihood method. Based on these cluster profiles, it is observed that the students in the cluster number one had the highest value for the variable *mtop*, which means on an average they mastered 80% of the topics out of the topics that they practiced, whereas students in the cluster two and cluster three mastered only 66% and 53% of topics, respectively. One-way ANOVA test was applied to test if these clusters were independent of each other. The results of the ANOVA test showed that the mean value of *mtop* was statistically different for each cluster (F=10.26, p-value=0.000), which confirms that the three clusters are independent of each other.
Table 3 presents the cluster distribution and the mean and standard deviation of the clusters.

Table 3: Cluster profiles

Cluster number	Mean (*mtop*)	S.D. (*mtop*)	Number of students
1 (high)	0.80	0.05	32
2 (Medium)	0.66	0.05	61
3 (Low)	0.53	0.03	59

Effect of mtop on early completion of the course. As described in the section above, students were given an opportunity to pass the course in less than 12 weeks if they mastered 85% of topics by studying independently. A total of 34 students out of 152 passed the course within 12 weeks. Out of those 34 students, the 44% belonged to the cluster two which means a high percent of students who passed the course early, were able to master 67% of the topics they practiced. Whereas 35% students belonged to the cluster one, which means they were able to master 80% of the topics they practiced. A total of seven students in this cluster three passed the course in less than 12 weeks, which means they were able to master only 53% of the topics they practiced.

Table 4: Cross-table showing number of students who passed the course early in each cluster

			Two-Step Cluster Number			
			1(high)	2 (medium)	3 (low)	Total
Early exit	No	Count	20	46	52	118
		% within early exit	16.9%	39.0%	44.1%	100.0%
	Yes	Count	12	15	7	34

	% within early exit	35.3%	44.1%	20.6%	100.0%
Total	Count	32	61	59	152
	% within early exit	21.1%	40.1%	38.8%	100.0%

Whereas though students in the cluster one, had a high score for *mtop*, 20 students from this cluster did not pass the course early. Refer to Table 4 for further detail.
A Chi-square test analysis was performed to test if the number of students who passed the course in less than 12 weeks is the same for each cluster. The distribution of students was statistically different. (Chi-square statistic= 8.42, p=0.017). It can be concluded that there is evidence to support our claim that the variable *mtop* predicts academic achievement, as the early exit from the course is based on a high score in the coursework as well as in the final exam.

Effect of number of progress tests attempted on the final grades.
The variable *Ptest* was analyzed to determine if the progress tests administered by the software are supporting students' academic achievement. The descriptive statistics of this variable revealed that the minimum number of progress tests taken by students was zero, the maximum number was 13. The average number of progress tests taken by students in clusters one, two and three are 3.47, 4.21 and 3.83 respectively. The average number of progress tests was not statistically different when compared among the three clusters (F=0.378, p=0.48). It can be concluded that the number of progress tests taken by students is not associated with value of the indicator *mtop*. There was no statistical evidence to claim that students in different clusters attempted different number of progress tests and whether the number of progress tests had any impact on their learning efforts.

Correlation and ANOVA test.
Further ANOVA test and correlation analysis were carried out to test whether *mtop* can be considered as a predictor of the final exam (FE) and the coursework (CT). The ANOVA test results showed that the mean value of coursework marks and final exam marks are different for all three cluster groups. The difference was found to be statistically significant at 0.05 level for CT, F(2, 151)= 4.89, p=0.01 and FE, F(2, 151)=4.28, p=0.019, consequently a statistical difference among the three groups.

Also, a moderately strong positive and statistically significant correlation was found between the value of mean *mtop* and the marks in the final exam (r=0.41, n=152, p=0.000). From the results of ANOVA test and correlation analysis, higher value of *mtop* indicates higher marks in FE and CT. It can be concluded that the ability to study individually is one of the predictors of student's marks in the coursework and in the final exam.

Regression analysis
Since the correlation between *mtop* and FE is significant, further linear regression analysis was done. The unstandardized coefficient for the variable was 69.2, p=0.00 and the constant term is determined as 17.9, p=0.03.

The value of R^2 is 0.166, which indicates the 16% of the changes in FE are explained by the changes in *mtop*. This implies that there are other predictors which should be explored further.

Effect of English language proficiency. Out of 152 students, 41 students had a moderate level of English language proficiency whereas 111 students had low level of English language proficiency with M=0.63 and SD=0.1 compared to those in level 4 who had a mean of M=0.67 and SD=0.12.

Parametric independent samples t-test was applied to test the hypothesis for research question 3. The output of the independent samples t-test (t-value= -2.165 and p-value=0.034) indicates that the mean value of *mtop* was statistically different between the two groups based on their language proficiency level. These results indicate that students' English Language proficiency affects their ability to learn independently. For the current research, students' marks in English were not available for further analysis.

DISCUSSION

On average, students mastered 64% of the topics they practiced. Students in cluster 1 have a higher rate of mastering topics whereas students in cluster 3 had a lower rate of mastering topics. Refer to the Figure 2 for further detail.

The high score for *mtop* can be attributed to the regularity in studying whereas the low score of mastering can be due to a lack of time and effort spent at the task. Although some students may be spending sufficient time still they may not achieve the expected mastery and such students will have a low score for *mtop*. Instructors can monitor students' progress periodically and identify students whose score for *mtop* is less than 0.6. These students may need encouragement, motivation as well as additional support to understand a topic.

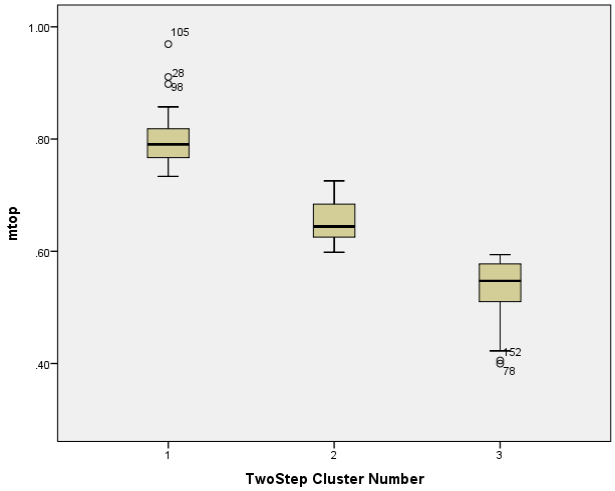


Figure 2: Box-plots for each cluster.

Further investigation was done to examine if the distribution of students with different language proficiency is uniform across the three clusters.

Table 5: English language proficiency and cluster membership

			Two-Step Cluster Number			
English level proficiency			1(high)	2(medium)	3(Low)	Total
Level	Low	Count	18	46	47	111
		% within Level	16.2%	41.4%	42.3%	100.0%
	Moderate	Count	14	15	12	41
		% within Level	34.1%	36.6%	29.3%	100.0%
Total		Count	32	61	59	152
		% within Level	21.1%	40.1%	38.8%	100.0%

One of the factors affecting students' ability to learn independently is poor language skills. As shown on Table 5, only 16% of students with low level English proficiency had a high score for *mtop* and they belonged to the cluster one and 42% had a low score for *mtop* belonged to cluster 3.

Another factor affecting the ability to study individually is poor technology skills. Poor technology skills result into the under-utilization of the features of ALEKS which is likely to result out of inability to understand gaps in what a student knows and what is expected of them. One pertinent theoretical framework is Vygotsky's concept of zone of proximal development. It refers to the gap between 'what a student can do alone' and 'what he can achieve with the support from an expert'. The interactions between the expert and the student are termed as 'tutorial interactions' and the expert is termed as the 'tutor'. The gap between the expert and novice can close through scaffolding techniques embedded in the ALEKS software that provide strategies to implement goals of constructivist learning paradigm, building on student experience and prior knowledge (Azevedo & Hadwin, 2005; Hohenwarter, Hohenwarter, Kreis & Lavicza, 2008).

The most important feature of ALEKS is that it designs a sequence of activities appropriate for each student and allows the student to learn at his or her own pace. As a result, it builds confidence in the student to solve problems independently. From the findings we can see that the complete potential of ALEKS is utilized, if students follow the learning paths suggested by ALEKS. Currently ALEKS interface is not providing clear

instructions about how to achieve this and further development may be needed to enhance this aspect of the software.

According to the knowledge space theory, a student is not able to solve problems unless he or she has mastered the pre-requisite topics. The limitation in the application is there are no clear instructions presented on the home screen of the system. Students often misinterpret this representation as not to complete those topics. This can be avoided with an improved representation and menu friendly system, in which the student can see the list of all topics without a hyperlink to their detailed explanation.

Occasional progress tests are administered by ALEKS to detect where students are and generally to formatively assess where they can move forward. After each of these formative assessments benchmarks or progress tests, the previous learning score is adjusted. This mechanism provides accurate and up to date model of student's learning progress. Students tend to avoid the automatic progress tests and they request teachers to cancel it. It may be due to these reasons: the system does not provide details and feedback about the solution submitted during automatic progress tests and they have to relearn all topics which are not retained in the progress test. These tests may affect the confidence of students because some questions are taken from the list of topics which a student have not yet mastered, however, but the system finds that the student is ready to learn. Weaker students fail to answer these questions which result in decreasing their previous achievement score. In order to remove these barriers in learning independently, students should be given more training about how to use the system. Also quizzes and homework assignments on ALEKS can be set as formative assessments as the system provides feedback on these assessments unlike the progress tests.

CONCLUSION

In this paper, we established the ratio of topics mastered to topics practiced *(mtop)* as an indicator of student's ability to study individually. This indicator was further applied for classifying students. This classification formed three groups of students for which the mean *mtop* were 0.80, 0.66 and 0.53 respectively. A strong positive and significant correlation was found between the *mtop* and final exam marks and between *mtop* and the coursework marks, which indicates that *mtop* can be a predictor of student's final marks in the ALEKS based course.

Based on the evaluation of the system, we found that ALEKS can measure student's attainment of factual and procedural knowledge, but it fails to measure meta-cognitive aspects, because neither ALEKS shows the different strategies to solve these problems nor students could show the strategies used for problem solving in order to develop metacognitive abilities. Thus, the ALEKS based coursework can be supplemented by project assignments but may require instructional feedback from the instructor. The expectation is that the performance effect size of such type of sophisticated intelligent tutors is almost equal to that of expert human tutor (VanLehn , 2011),

LIMITATION AND FUTURE DIRECTION

Though this is a quantitative study and the results are significant, some limitations of this study must be considered before generalizing the results. It should be noted that the participants in this study are all female students studying English as their second language and this is their first year of using English as the medium of instructions. Male students or students with higher proficiency in English may have different ways of learning using the tutor. Considering also that learning may be different for a different type of intelligent tutor, results can be generalized only on similar population and similar type of intelligent tutor.

The application of intelligent tutors may not provide the same result to all students. There are other factors, such as learning style, efforts, cognitive agility, the affective state of learner and ability to learn using the technology, which may have different achievements. Though effectiveness of intelligent tutors has been confirmed by many researchers, some researchers claim that if students believe a computer can't help them learn (even though they do actually learn), then they have a high probability of disliking the system. They may believe that they cannot learn from the tool and may become less motivated to use the tool for learning (Jackson, Graesser & McNamara, 2009). In continuation of this study, other non-cognitive factors such as students' learning styles; their attitude towards technology and towards mathematics will be analyzed along cognitive and educational elements related achievement to understand the impact of these factors on students' learning experience.

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