Pre-Service Teachers' Learning Styles and Preferences towards Instructional Technology Activities and Collaborative Works

Farrah Dina Yusop
Department of Curriculum and Instructional Technology, Faculty of Education, University of Malaya
50603 Kuala Lumpur, MALAYSIA
For correspondence: farah@um.edu.my

Melati Sumari
Department of Educational Psychology and Counseling, Faculty of Education, University of Malaya
50603 Kuala Lumpur, MALAYSIA
melati@um.edu.my

ABSTRACT

The main purpose of this exploratory study was to investigate pre-service teachers' learning styles and their preferences with respect to 15 technology-based instructional activities and collaborative work tasks. Felder and Silverman's online Index of Learning Style (ILS) and a questionnaire were used to measure students' learning styles and preferences. Respondents were 53 third year pre-service teachers in the Early Childhood Education program and the Islamic Studies program at a Malaysian public university. Data analyses involved both descriptive and inferential statistics to further understand the learning style patterns of pre-service teachers. Findings revealed that pre-service teachers in this program tended to be reflective in the way they process information, sensitive in the way they perceive information, visual in the way they receive information, and sequential in the way they understand information. Although no significant correlation was found between students' learning styles and preferences towards collaborative and group work activities, interesting trends were observed in this study; active, intuitive, and global learners tended to dislike collaborative and group work activities when compared to reflective, sensing, and sequential learners. The findings of this study are important in assisting instructional technology instructors and higher education faculty in general in designing effective training programs for pre-service teachers particularly in relation to improve their technological skills.

INTRODUCTION

To date the Malaysian Ministry of Education has implemented a variety of technology-based programs in schools and higher-education institutions. Unfortunately current approaches to teaching and learning remain the same: heavy emphasis on rote learning and memorization techniques closely related to the exam-oriented educational system employed in the country (Author, 2014). This gap between what is intended to happen and what is currently happening in our educational system signifies the existence of a big gap deemed to require further scrutiny.

One of the reasons for this gap is the quality of teacher training at higher educational institutions. Despite various instructional technology courses having been incorporated into training programs, pre-service teachers (PST) are still unconfident and uncomfortable in integrating current technologies such as Web 2.0 and social media into their teaching practices (Chuang, Thompson, & Schmidt, 2003). Many factors have been considered as causing such problems, including lack of training facilities and limited time for exploring various technologies (Bingimlas, 2009; Jones, 2004), but mismatches between PST's learning and their teaching styles has received very little attention to date except several emerging research focusing on computer-based adaptive learning systems. Additionally, most research has been exploring the learning style profiles of PST but very few studies have been dedicated to investigating the relationship between students' learning styles and preferred teaching and learning strategies. Perhaps the closest research available is a study by Naimie, Siraj, Abuzaid, and Shagholi (2010) who suggested a *hypothesized* framework in which activities suit a specific learning style dimension. An empirical research in this area is still very limited.

This study thus intends to replicate previous studies on learning styles among PST, especially in Malaysia, by profiling their learning style dimensions based on Felder and Silverman's (1988) index of learning style (ILS). Most importantly, this study extends previous research by investigating the relationship between PST's learning style dimension with their demographic background such as gender and program of study, as well as their actual preferences towards certain technology-based instructional activities and collaborative works.

SIGNIFICANCE OF THE STUDY

Findings of this study are important in shedding some light into understanding suitable teaching approaches for pre-service teacher training programs in Malaysia and elsewhere. Additionally, findings on preferred

technology-based activities are helpful for assisting teacher education coordinators in including specific technology-based learning activities into their existing programs.

Research questions
This study is designed to answer the following questions:
- What are the general learning styles of Malaysian PST undertaking an instructional technology program? Are there multiple relationships between each of the learning styles?
- What is the relationship between learning styles and the students' gender, programs of study, and number of courses taken in the semester?
- What are the students' most and least preferred instructional technology activities?
- What is the relationship between learning styles and preferences towards collaborative work?

Learning styles
Knowledge of learning style is important in addressing the issues of individualized instruction and matching students' learning styles to teachers' teaching styles to maximize learning and enhance student performance (Felder & Brent, 2005; Ozgen, 2013). Review of learning-style literature has revealed that there are tendencies among researchers to discuss the issue of matching (or mismatching) teacher's and students' personalities and teaching methods (Smith & Renzulli, 1984) to enhance both teaching and learning. However teachers' lack of understanding of their learners' learning styles and even their own teaching styles often results in both parties inability to perform with excellence.

Taking an example from a compilation of research in engineering education, Felder & Brent (2005) reported that 63% of engineering students were found to be sensory learners, 82% were visual learners and 64% were active learners, while the typical instructional approach was "overwhelmingly verbal, emphasizing written explanations and mathematical formulations of physical phenomena over demonstrations and visual illustrations; and… rely almost exclusively on lectures and readings as the principal vehicles for transmitting information" (p.61-62).

This mismatch between learning and teaching style results in students becoming bored and inattentive with the lessons, "do poorly on tests, get discouraged about the courses, the curriculum, and themselves, and in some cases change to other curricula or drop out of school. (Felder & Spurlin, 2005, p. 2)".

Learning styles and demographic factors
Previous studies have examined several demographic factors contributing to preferred learning styles. These factors are closely related to how a person preferred to be taught such as needs for individualized instruction or collaborative group works and the types of learning activities they would like to exercise.

Matthews (1991) studied the differences between male and female students. He found that males preferred working with numbers and inanimate objects while females preferred language-based activities and were more likely to be people-oriented than males. Similarly female respondents in Jedin and Saad (2006) were found to be more collectivistic rather than individualistic, especially when working within a close circle of friends.

Academic program nature is another element influencing learning styles. It is common to assume that pure science students are more likely to be visual, kinesthetic, and … In contrast, social science students are assumed to more likely be auditory, verbal, and reflective students (Jedin & Saad, 2006). This observation could be related to the nature of the program of study itself. Pure science programs put emphasis on experimentation and discovery learning, while social sciences programs focus more on reflecting on current situations to make sense of what is happening in society in general.

However current research suggests that this may no longer be the case (Hamidah, Sarina, & Jusoff, 2009; Kumar, Voralu, Pani, & Sethuraman, 2009; Mohammed, Narayanasamy, Mutalib, Kaur, & Ariffin, 2011). This is because there is a possibility that the design of the academic programs themselves may influence the teaching strategies adopted by lecturers. Pure science, including programs like medicine and engineering, thus place emphasis on clinical and lab work compared to social science programs. Thus the course workload measured by the number of credit hours a student needs to register per semester for pure science programs may be fewer than for social science students. This is because social science students are required to register and enroll in as many courses as possible, sometimes across various social science disciplines, to better assist their understanding on the nature of the society; pure sciences students tend to be taught to focus only on very specific areas of study. Knowing the differences in the characteristics of the academic programs is thus crucial in assisting researchers to understand why students in certain programs prefer certain ways of learning.

The index of learning style (ILS)
ILS is a learning-style instrument based on Richard Felder's and Linda Silverman's (1988) model of learning style (Felder and Spurlin, 2005). The instrument consists of 44 questions with two options for answers. It identifies four categories or dimensions of learning: *Active* or *Reflective*, *Sensing* or *Intuitive*, *Visual* or *Verbal,* and *Sequential* or *Global*. The initial version, created by Richard Felder and Barbara Soloman in 1991, was tested with several hundred sets of responses. That version was revised through factor analysis methods with ineffective questions replaced with more suitable ones. The pencil-and-paper version of the instrument was later converted into a freely-available web-based instrument in 1997 (Felder and Spurlin, 2005) and was well-received by various learning institutions, both in the United States and internationally. The online version of the ILS instrument was reported to have been taken over 100,000 times annually and to have been used in a number of published studies (Litzinger, Lee & Wise, 2005).

The ILS instrument has the ability to include the various dimensions of learning style studied and developed by other researchers. For instance, the Active/Reflective dimension was coded from Kolb's Active/Reflective dimension, the MBTI's Extravert/Introvert dimension, and studies in the field of modality theory and neurolinguistic programming (Reid, 1987). However, it was more widely used to assess engineering students' and faculty's learning style preferences more than those of any other field, probably due to the fact that the developers of the instrument themselves came from the engineering field.

Active vs Reflective
The Active/Reflective dimension describes how students process information received. *Active* learners tend to *do* something with the information, such as discuss it, explain it, or test it in some way, while *reflective* learners are more likely to think and reflect on the information by examining and manipulating it introspectively (Felder and Silverman,1988). Thus, *reflective* learners may benefit a great deal from instructional activities that allow them to think and reflect on the information received, while *active* learners prefer instructional activities that provide an opportunity for actively experimenting with the information received. Also, *reflective* learners are more likely to work and learn better by themselves or with at most one other person compared to *active* learners who tend to work well in groups.

Sensing vs Intuitive
Developed based on Carl Jung's model of sensing and intuition learning, the Sensing vs Intuitive dimension explains the ways in which students perceive information, either externally or internally. *Sensor* learners tend to gather information externally, i.e., through their senses, including observations, while *intuitive* learners tend to perceive information internally, including speculation, imagination, and hunches (Felder and Silverman, 1988). Thus, *sensors* are more likely to prefer facts and data better over theories and principles, and to solve problems using standard methods, disliking uncertainty but exhibiting patience with details. Consequently, they may be slow but careful and good at memorizing facts. In contrast, *intuitors* prefer innovation and welcome complicated problems. They are quick but may perhaps be careless. They are also better at grasping new concepts when compared to *sensors*.

Visual vs Verbal
This dimension describes the way in which learners best receive information. *Visual* learners remember best what they *see*: pictures, diagrams, symbols, charts, demonstrations etc., while *verbal* learners remember best what they *hear*, e.g., when someone explains something to them such as when listening to lectures and engaging in discussion.

Sequential vs Global
This dimension deals with the way learners understand information. *Sequential* learners are more comfortable with materials presented logically ordered and in linear steps, while *global* learners tend to learn in large jumps. Felder and Silverman (1988) stated that *global* learners may find it easy to get lost in a wealth of information, but after some time may find that suddenly everything clicks and makes sense to them, even though they may have a hard time in explaining exactly how they arrived at their conclusions. *Sequential* learners are able to work with partially-presented materials, but *global* learners are more likely to search for the bigger picture to better understand the material. Thus, *sequential* learners benefit greatly from instructional activities presented sequentially, ranging from easy to more complex problems, while *global* learners may do better by jumping right into more complex and difficult problems. In addition, *sequential* learners are more likely to be convergent in their thinking and analysis. In contrast, *global* learners tend to be more divergent thinkers and synthesizers.

Given the four learning dimensions described in Felder-Silverman's Index of Learning Style (ILS), this study seeks to understand the learning styles of Malaysian PST in the "Instructional Media" course and to determine

relationships among elements of their demographic backgrounds, namely, students' gender, program of study and number of courses taken in a semester. Their preferences with respect to 15 types of active-based instructional technology activities and collaborative works were also investigated. It is hoped that findings from this study will provide a capability for helping teacher educators understand how Malaysian PST' in Instructional Technology programs perceive, receive, process, and understand information, and to use this knowledge to explore and experiment with various types of instructional technology and group work activities designed to support learning.

METHODOLOGY

Participants

Participants were 53 PST co-majoring in the Instructional Technology (IT) program in a Malaysian public university. The students were in their third year of study and enrolled in two academic programs: the Early Childhood Education program and the Islamic Studies program. All third year students from both programs (N=53) were invited to participate. All of them accepted and returned the completed questionnaire; the return rate was thus100%. Of that number, 75.5% (n=40) were females, reflecting the nature of the teaching profession in Malaysia with respect to gender. Although the participants had some exposure to computers and the Internet for personal use, the majority (n=30) stated a lack of confidence in utilizing technology for either teaching or learning purposes. Even though all participants were non-English speakers, they were considered to have at least an intermediate level of English proficiency. This is due to the fact that minimum requirement to enroll in both programs was a score within a range of 101 to 139, also known as Band 2 learners, in the Malaysian University English Test (MUET), an English language proficiency test used for the purpose of university admissions in Malaysia. Band 2 MUET scores mean that the learner was not a fluent communicator but did understand the language and its context when limited to certain situations (Malaysian Examinations Council, 2006).

Data collection

Data was collected through a combination of a combined structured (i.e. pre-defined options) and open-ended (i.e. subjective responses) questionnaire. The details of the questionnaire were as follows:

Section 1 – Demographic and Learning Style

This section describes information about the students' gender, age group, academic programs, and learning style. The learning style was measured using the Index of Learning Style (ILS) instrument. Students were required to take the online Index of Learning Style (ILS) instrument developed by Dr. Richard M Felder and Barbara A. Soloman of North Carolina State University (available at no cost at http://www.engr.ncsu.edu/learningstyles/ilsweb.html) to determine their individually-preferred learning styles. There were 44 questions to be answered with one of two options. Once the test was completed, student responses were analyzed by the system and analysis of their learning style was returned in the form of numbers, each indicating the degree of learning style. For example, a student who received the results "7/4" for Active/Reflective means that the student is a moderately Active learner in contrast to being a Reflective learner. The total for each number pair must be 11, since there are 11 questions in the test for each of the four learning-style dimensions, i.e., Active/Reflective, Sensing/Intuitive, Visual/Verbal, and Sequential/Global.

The decision to use ILS over other instruments was based on the fact that it was both free and accessible online, making it convenient for both the instructor and the students to access at any time. Also, the ILS instrument was developed using a combination of various developers' research and included justifications (and modifications) made from other learning-style instruments, e.g., the Myers-Bringgs Type Indicator (MBTI) and Kolb's model of learning. This made this choice, from the perspective of the instructor, a comprehensive yet simplified version of various learning-style instruments. Moreover, the ILS instrument contained only 44 questions that could be completed within as little as 15-20 minutes, compared to other instruments that might take longer times for completion and thereby distract students from giving honest answers.

Section 2 – Instructional technology activities

This section contains questions related to students' preference towards 15 instructional technology activities on a scale of 1 to 15, where 1 indicates the most enjoyable learning experience and 15 the least enjoyable learning experience. A space was provided next to each of the activities to enable students to more completely express their thoughts about these activities.

Section 3 – Learning resources

This section contains questions related to students' preferences towards the learning resources used in the course. Answers were to be given in the form "Yes/No".

Section 4 – Feedback on group work
Answers to questions in this section were in the form of "Yes/No" and were related to evaluating the effectiveness of the course from a student perspective. The section included preferences toward working in groups and collaborative type of work in general.

Data analysis
Data gathered from the questionnaire were coded and analyzed using the SPSS (**S**tatistical **P**ackage for the **S**ocial **S**ciences) software. Analyses used include descriptive statistics to describe the data and Pearson correlation coefficients to discern the relationships between learning styles and each of the variables investigated.

RESULTS AND DISCUSSION
This section will present the results of the analyses conducted in answering each of the research questions. Analyses were also conducted to support these results.

The pre-service teachers' (PST) learning styles
Initially, scores for each learning style were entered exactly as indicated by the students themselves. For instance, if a student scored "7/4" for Active/Reflective learning dimension, the score will be entered as "7" for the "Active" variable, and "4" for the "Reflective" variable. The scores a student received in each dimension must not exceed 11 (the maximum score) nor be less than 0 (the minimum score), and the total of the scores in each dimension must be 11, since each of the styles are paired together to constitute a dimension.

The scores were then re-coded using the 're-code' feature in SPSS, following the Felder and Spurlin (2005) suggestions for categorization of learning-style dimensions. As a result, 3 categories of strength of learning style (strong, moderate, and mild) were created corresponding to the range of the learning-style scores, as indicated in Table 1.

---Insert Table1 at about here ---
Caption: Categorization of the learning style into strong, moderate and mild

The first component of each pair of the learning-style dimensions is referred to as the 'a' item and the second component is referred to as the 'b' item. For example, scores of 10 and 11 were categorized as 'strong 'a' learners, and so on.

A frequency distribution of students' learning styles based on strengths of the learning style preferences: *strong, moderate* and *mild* is presented in Table 2.

---Insert Table 2 at about here ---
Caption: Frequency distribution of the learning styles based on the strengths: Strong, Moderate and Mild

The results showed that the dominant learning styles in each dimension were mild reflective (45.5%), mild sensing (32.6%), moderate verbal (30.2%), and mild sequential (37.2%). These learning styles were found to be similar to those found for other technically-oriented programs. A study on engineering students' learning styles (Litzinger *et al.*, 2005; Zywno, 2003) revealed sequential, sensing, and visual styles. The only difference was that engineering students in those studies were identified as active learners while the PSTs in this study were found to be more in the nature of reflective learners. This difference is perhaps due to the differing natures of the two fields; students in science-based programs such as engineering are more often exposed to active and hands-on learning activities than those in social science programs like education.

Interestingly, comparison among the four learning dimensions revealed that the most dominant learning-style dimension is the Visual-Verbal dimension. 41.9% students are identified as strong Visual-Verbal learners in contrast to strong Active/Reflective (2.3%), strong Sensing/Intuitive (7%), and strong Sequential/Global (2.3%) learners. This result is consistent with past studies demonstrating that typical education and liberal arts students are Visual-Verbal learners (Litzinger *et al.*, 2005).

Relationship between each of the learning style
Analysis of Pearson correlation coefficients between each of the learning styles was also conducted to analyze the relationships among them, as presented in Table 3.

---Insert Table 3 at about here ---

Caption: Correlation coefficient between each of the learning style

The Pearson correlation coefficient results in Table 3 above revealed some interesting findings:
1. It was confirmed that all of the original 'a' and 'b' pairs suggested by Felder-Soloman (1991) are true, except for Visual-Verbal dimensions, for the PSTs in this study.
2. It also suggests the following interconnections between learning style preferences:
   a) active learners tend to be visual
   b) sensor learners tend to be sequential and not likely to be global or intuitive
   c) visual learners tend to be active and sequential and not likely to be reflective and global
   d) sequential learners tend to be sensing and visual and not likely to be intuitive
   e) global learners tend to be intuitive and not likely to be sensing or visual

a) Comparison between the findings and the original learning style pairings
In detail, all of the original pairs of learning styles, except for the Visual and Verbal learning style, revealed statistically-significant moderate to very high negative relationships,. It was found that there is a significantly high negative relationship between Active and Reflective (-0.877) at the 0.001 level, a significantly moderate negative relationship between Sensing and Intuitive (-0.559) at the 0.001 level, and a significantly very high negative relationship between Sequential and Global learning styles (-0.877) at the 0.001 level. These results imply that the pairings suggested by Felder and Soloman (1991) were true for the respondents in this study. In other words, the three learning dimensions of Active/Reflective, Sensing/Intuitive, and Sequential/Global were confirmed by this study. However, there was no significant correlation, either negative or positive, between the Visual and Verbal learning styles.

b)   *Interconnections between the learning style preferences*
Findings also suggested that there is a low tendency for active learners to be visual (r= 0.372 at 0.05 level). This suggests that students who receive information best through visual representations (visual) are more comfortable in experimenting with data (active).

Another finding revealed that sensor learners tend to be sequential (r= 0.491 at the 0.01 level), not likely to be global (r= -0.484 at the 0.01 level) or intuitive (r= -0.559 at the 0.01 level). This means that students who learn best through their senses (sensing) tend to understand better if the information is presented sequentially (sequential).

It was also found that visual learners tend to be active (r= 0.372 at the 0.05 level) and sequential (r= 0.406 at the 0.01 level), but not likely to be reflective (r= -0.319 at the 0.05 level) or global (r= -0.356 at the 0.05 level). In other words, it is is suggested that students who receive information best through visual representations (visual) are not likely to thoughtfully reflect on it (reflect); instead they are more comfortable in experimenting with it (active). Similarly, visual learners may not be comfortable to learn in large jumps (global); they learn best when they are able to see interconnections between the new information and previously-obtained information (sequential).

In addition, sequential learners tend to be sensing (r= 0.491 at the 0.01 level) and visual (r= 0.406 at the 0.01 level), but not likely to be intuitive (r= -0.319 at the 0.05 level). This implies that students who understand better when information is presented logically in sequential order (sequential) are more comfortable working and learning with facts, data, principles, standards (sensing), and visual representations (visual) rather than concepts, theories, and uncertainties (intuitive).

Finally, global learners tend to be intuitive (r= -0.316 at the 0.05 level), but not likely to be sensing (r= -0.484 at the 0.01 level) or visual (r= -0.356 at the 0.05 level), implying that global learners able to learn in large jumps are more likely to explore uncertainties and possibilities when solving problems and may be bored with facts (sensing) and visuals (visual).

To summarize, these findings are different, except for the Sensing and Visual relationship, from those of another study conducted by Zywno (2003) with engineering students as the sample. In his study, Zywno found that there was a very low positive relationship between Sensing and Active (0.176) and Sensing and Sequential (0.323). Interestingly, he found a significantly very low negative relationship between the Sequential and Visual styles among engineering learners (-0.086 at the 0.05 level), while in this study involving PST, it was found that the relationship between Sequential and Visual learning styles is significantly low positive (0.406) at the 0.01 level. This means that PST students co-majoring in Instructional Technology programs who are Sequential learners

tend to also be Visual learners compared to Sequential Engineering learners who are unlikely to be Visual learners.

Relationship between learning style and the demographic background
Analysis of Pearson correlation coefficients between learning styles with respect to gender, program of study (i.e., Early Childhood and Islamic Education), ethnicity, and course workload measured by the number of courses taken in a semester revealed that there is no significant differences among the variables. In other words, the students' gender, program of study, ethnicity and course workload measured by number of courses taken in the semester are not significantly related to their learning-style preferences.

Preferences towards 15 instructional technology activities
The students were asked to rank their preferred instructional technology activities on a 15-point scale, with 1 being the most enjoyable activity and 15 the least enjoyable activity. The means and standard deviations for the 15 items of these instructional activities are presented in Table 4. The smallest mean value indicates the most preferable activity while the mean value, closest to 15 indicates the least preferable activity.

---Insert Table 4 at about here ---
Caption: Means and standard deviations for preferred instructional activities. (Note: 1 = Most enjoyable and 15 = Least enjoyable)

Table 4 indicates that the most preferred activity is the first, production of short video clips using a variety of multimedia equipment and software (mean = 4.07), followed by the third, the live, in-class debate on an instructional technology-related topic (mean = 4.58), and the second, the presentation of short video clips (mean = 6.49). It was also found that activity 7, student-led presentation on the topic history of media in instruction, is the least preferable activity (mean = 10.87), followed by activity 6, analysis of a short video via e-Group (mean = 9.84), and activity 14, student-led training in the use of presentational software (PowerPoint) for tutorial purposes (mean = 9.51).

These findings reflect the students' preferences towards instructional activities that deal with *doing* something related to visual representations as well as toward verbal-related activities such as presentation, discussion, and reflection. These preferences may exist because a majority (41.9%) of the students exhibited a strong Visual-Verbal learning style. The results also showed that the students least preferred activities that deal with history, i.e., details and facts, even though they were assessed to be Sensor learners.

The relationship between learning styles and preference for being involved in group-oriented work activities
Table 5 presents the means and standard deviations of the learning styles with respect to two questions related to group-oriented work preferences among the respondents. The answers are dichotomous, either "Yes" or "No", so a mean below 1.5 reflects "Yes" answers and vice versa.

---Insert Table 5 at about here ---
Caption: Means and standard deviations of learning styles and preferences towards group work activities

The results in Table 5 revealed that students prefer collaborative and group-oriented work activities. Their preferences towards such activities are shown by the relatively small values of the means, i.e., 1.0377 and 1.0755.

A Pearson correlation coefficient analysis between learning styles and group-oriented work preferences was also conducted to test relationships among the variables. The results are presented in Table 6.

---Insert Table 6 at about here ---
Caption: Pearson correlation coefficient analysis between learning style and preferences towards group work activities

The results shown in Table 6 reveal that, while there is no statistically significant correlation between students' learning styles and their preference towards group-oriented work activities, there are still some interesting connections between learning styles and preferences towards such activities.

The statistically insignificant results indicate that Reflective, Sensing, Verbal, and Sequential learners, representing the identified learning styles of the students in the study, prefer collaborative and group-oriented work activities more than do Active, Intuitive, and Global learners. These results are supported by the large percentage (94.34%) of responses that indicated preferences towards collaborative and group work activities.

These findings, even though statistically insignificant, differ from the Felder-Silverman suggestion that Reflective learners learn best by themselves and therefore show tendencies towards working alone or at most with one other person (Felder & Silverman, 1988) unlike Active learners who are said to work well in groups. Data in this study shows that Reflective learners along with Sensing, Verbal, and Sequential learners seemed to prefer collaborative and group work activities.

CONCLUSIONS

The results indicate that Malaysian PST co-majoring in the Instructional Technology program tend to be reflective, sensing, verbal, and sequential. In other words, the PST are more likely to think and reflect (reflective) on rather than to do something about the information they acquired externally (sensor) and in sequential (sequential) order. This finding supports the common perception of the characteristics of typical social sciences students as being reflective and sequential in nature.

The most obvious and dominant learning style dimension is the Visual-Verbal learning dimension suggesting that students learn best when they are given the opportunity to interact with a variety of visual representations (visual) as well as the opportunity to explain and share their thinking to others (verbal). This finding is not uncommon among PST whose profession involves verbal communication when interacting with their students. The visual aspect of their learning styles also aligned with their tendencies to create instructional materials to help with their teaching practices.

What is particularly interesting is their preference toward being sensor learners. It suggests that the PST in this study actually value the opportunity to use and manipulate multimedia equipment to produce creative media products such as video clips, the most preferred type of instructional technology activity, for instructional purposes,. However, this need for sensory learning is not necessarily exhibited in current instructional methods used by teacher educators in many teacher education training programs. Except for a few courses, such as micro-teaching and those relating to instructional methods for teaching specific subject areas, the most common instructional strategies used are combination of lectures and small group discussions.

Findings in this study suggest that teacher educators should revamp their instructional strategies to include more sensory-based activities for PST. In the context of technology-based courses, this will mean more activities involving students' manipulating and experiencing a variety of multimedia technologies such as video editing, courseware development, and modification through social media such as Facebook, Twitter, and wiki, for teaching and learning purposes. These teaching and learning activities will allow PST achieve a better understanding of how technologies can be manipulated to support their future teaching. Additionally these are the skills that are required from PST as indicated in the ISTE (International Society for Technology in Education) National Educational Technology Standards (NETS) of teaching with technology (ISTE, 2014).

Findings in this study are significant in explaining PST's preferences with respect to a variety of learning styles and instructional activities. It is important for PST to be aware of their own learning style preferences, both in terms of their strengths and weaknesses, so that they will be aware of the diversity of learning-style preferences among their future students in the classroom. For teacher-educators, the findings imply that there is a need to expose PST to various instructional activities that support a variety of learning styles and group-oriented work. As Smith & Renzulli (1984) stated, information about students' learning styles should not be limited to only matching teaching styles with learning styles, but should also create a balance or mismatch between them so that students are given opportunities to try out other learning styles about which they may be unaware.

ACKNOWLEDGEMENTS

REFERENCES
Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: a review of the literature. *Eurasia Journal of Mathematics, Science & Technology Education, 5*(3), 235-245.

Chuang, H.-H., Thompson, A., & Schmidt, D. (2003). Faculty technology mentoring programs: major trends in the literature. *Journal of Computing in Teacher education, 19*(4), 101-106.

Dunn, R. S. (1983). Learning style and its relation to exceptionality at both ends of the spectrum. *Exceptional Children, 49*, 496-506.

Dunn, R. S., Dunn, K. J., & Price, G. E. (1979). *The productivity environmental preference survey*. Lawrence, KS: Price Systems.

Felder, R. M., & Brent, R. (2005). Understanding student differences. *Journal of Engineering Education, 94*(1), 57-72.

Felder, R. M., & Spurlin, J. (2005). Applications, reliability and validity of the Index of Learning Styles. *International Journal of Engineering Education, 21*(1), 103-112.

Felder, R. M., & Silverman, L. K. (1988). Learning and teaching styles in engineering education. *Engineering Education, 78*(7), 674-681.

Hamidah, J. S., Sarina, M. N., & Jusoff, K. (2009). The social interaction learning styles of science and social science students. *Asian Social Science, 5*(7).

ISTE. (2014). National educational technology standards (NETS). Retrieved January, 2014, from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-S_PDF.pdf

Jedin, M., & Saad, N. (2006). *A preliminary study on gender and learning style in Malaysian higher learning institutions: evidence from a cultural perspective.* Paper presented at the Critical Visions, Proceedings of the 29th HERDSA Annual Conference, Western Australia.

Jones, A. (2004). *A review of the research literature on barriers to the uptake of ICT by teachers*. UK: British Educational Technology Agency (Becta).

Kumar, L. R., Voralu, K., Pani, S., & Sethuraman, K. (2009). Predominant learning styles adopted by AIMST University students in Malaysia. *South-East Asian Journal of Medical Education, 3*(1), 37-46.

Jonassen, D.H. (1996). *Computers in the classroom: Mindtools for critical thinking.* Columbus, OH: Merrill/Prentice-Hall.

Litzinger, T. A., Lee, S. H., & Wise, J. C. (2005). A study of the reliability and validity of the Felder-Soloman Index of Learning Styles. *Education, 113*, 77.

Malaysian Examinations Council (2006). Malaysian University English Test (MUET): regulations, test specifications, test format and sample questions. Retrieved January, 2013, from http://www.google.com.my/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0C B4QFjAA&url=http%3A%2F%2Fwww.mpm.edu.my%2Fdocuments%2F10156%2Fc5c332ab-3d97- 4959-83c0-09866eea0774&ei=mLr5U9LEFNC- uASEzoCQBw&usg=AFQjCNFw5H0WLEccr_zByVElihjCTjMD1A&sig2=O3yveKqmIQWqdNoH4rv7 Ew&bvm=bv.73612305,d.c2E

Matthews, D. B. (1991). Learning styles research: Implications for increasing students in teacher education programs. *Journal Of Instructional Psychology, 18* (4).

Mohammed, Z., Narayanasamy, S., Mutalib, H. A., Kaur, S., & Ariffin, S. R. (2011). Learning styles preferences among third year optometry students of Universiti Kebangsaan Malaysia. *Procedia-Social and Behavioral Sciences, 18*, 384-387.

Naimie, Z., Siraj, S., Abuzaid, R. A., & Shagholi, R. (2010). Hypothesized learners' technology preferences based on learning style dimensions. *Turkish Online Journal of Educational Technology, 9*(4), 83-93.

Ozgen, K. (2013). An analysis of high school students' mathematical literacy self-efficacy beliefs in relation to their learning styles. *The Asia-Pacific Education Researcher, 22*(1), 91-100. doi: 10.1007/s40299-012-0030-4

Reid, J. M. (1987). The learning style preferences of ESL students. *TESOL Quarterly, 21*(1), 87-111. Field independent cognitive styles and their educational implications. *Review of Educational Research, 47*, 1-64.

Smith, L. H., & Renzulli, J. S. (1984). Learning style preferences: a practical approach for classroom teachers. *Theory into Practice, 23*(1), 44-50.

Witkin, H. A., Moore, C. A., Oltman, P., Goodenough, D. R., Friedman, F., & Owen, D. R. (1977b). Role of field dependent and field independent cognitive styles in academic evolution. *Journal of Educational Psychology, 69*, 197-211.

Author. (2014). Social media for social advances: Use of social media in educating future generations. In Ainin Sulaiman and M. Muzamil Naqshbandi, *Social dynamism, issues and challenges*. USA: Patridge Publishing.

Zywno, M. S. (2003). *A contribution to validation of score meaning for Felder-Soloman's Index of Learning Styles.* Paper presented at the American Society for Engineering Education Annual Conference & Exposition.

List of tables and captions

TABLE 1
Categorization of the learning style into strong, moderate and mild

The 'a' items	The 'b' items	Categorization
Active	Reflective	• strong 'a' - 'a' score between 10 or 11
Sensing	Intuitive	• moderate 'a' - 'a' score between 8 or 9
Visual	Verbal	
Sequential	Global	• mild 'a' - 'a' score between 6 or 7
		• mild 'b'- 'a' score between 4 or 5
		• moderate 'b' - 'a' score between 3 or 2
		• strong 'b' - 'a' score between 0 or 1

TABLE 2
Frequency distribution of the learning styles based on the strengths: Strong, Moderate and Mild

	Active/Reflective (%)		Sensing/Intuitive (%)		Visual/Verbal (%)		Sequential/Global (%)	
	Act	Ref	Sen	Int	Vis	Veb	Seq	Glo
Strong (10 or 11)	0	2.3	4.7	2.3	16.3	25.6	0	2.3
Moderate (8 or9)	4.5	25	18.6	18.6	2.3	**30.2**	18.6	7
Mild (6 or 7)	22.7	**45.5**	**32.6**	23.3	9.3	16.3	**37.2**	34.9

TABLE 3
Correlation coefficient between each of the learning style

	Active (a)	Reflective (b)	Sensing (a)	Intuitive (b)	Visual (a)	Verbal (b)	Sequential (a)	Global (b)
Active (a)	1	-.877**	0.049	0.061	**.372(*)**	-0.269	0.045	-0.005
Reflective (b)	-.877**	1	-0.040	-0.067	-.319(*)	0.250	-0.028	0.017
Sensing (a)	0.049	-0.040	1	-.559**	0.249	0.254	**.491****	-.484**
Intuitive (b)	0.061	-0.067	-.559**)	1	-0.114	-0.112	-.319*	**.316***
Visual (a)	**.372(*)**	-.319*	0.249	-0.114	1	-0.105	**.406****	-.356(*)
Verbal (b)	-0.269	0.250	0.254	-0.112	-0.105	1	0.252	-0.275
Sequential (a)	0.045	-0.028	**.491(**)**	-.319(*)	**.406(**)**	0.252	1	-.988**
Global (b)	-0.005	0.017	-.484**	.316*	-.356(*)	-0.275	-.988**	1

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

TABLE 4
Means and standard deviations for preferred instructional activities. (Note: 1 = Most enjoyable and 15 = Least enjoyable)

Instructional activities	n	Mean	SD
1. Produce short video clips using multimedia equipment i.e. digital camera, digital video recorder, interactive whiteboard etc.	45	**4.07**	3.63
2. Present short video clips to whole class and receive feedback from peers and instructor	45	**6.49**	4.42
3. Live, in-class debate among groups on a instructional technology related topic	45	**4.58**	4.47
4. Discuss the use of traditional children's songs to deliver instructional content and motivate students to learn via e-Group	45	8.38	4.17
5. Discuss the multimedia technique used in a picture via e-Group	45	7.69	4.24
6. Analyze a short video posted in the web via e-Group	44	**9.84**	4.32
7. Student-led presentation on the history of media in education – creative use of blackboard and interactive whiteboard to bring in the history	45	**10.87**	4.07
8. Student-led presentation on application of behaviorism in media design – application of design principals and techniques	45	7.60	3.45
9. Student-led presentation on application of cognitivism in media design – the use online games to solve problems and motivate learning	45	6.87	3.82
10. Student-led presentation on application of constructivism in media design – direct presentation of the content	45	7.71	3.98
11. Student-led presentation on the social-psychological perspective in media design -	45	9.31	3.83
12. Student-led training on the integration of word processor in instruction – application of software to enhance data management	45	7.87	3.34

TABLE 5
Means and standard deviations of learning styles and preferences towards group work activities

Learning Style	Mean	Std. Deviation
Active Learning Style	5.41	1.62
Reflective learning style	7.75	1.63
Sensing learning style	6.19	2.40
Intuitive learning style	6.32	2.37
Visual learning style	3.44	2.13
Verbal learning style	8.05	3.38
Sequential learning style	6.81	1.97
Global learning style	6.23	1.96
Do student appreciate collaborative learning	1.04	0.19
Do students learn better in groups	1.07	2.67

TABLE 6
Pearson correlation coefficient analysis between learning style and preferences towards group work activities

	Preference towards collaborative	Preference of learning in groups
Active	-0.192	-0.238
Reflective	0.169	0.210
Sensing	0.169	0.286
Intuitive	-0.125	-0.233
Visual	-0.046	0.029
Verbal	0.129	0.105
Sequential	0.248	0.120
Global	-0.254	-0.127

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

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