The Effects of Webopac Self Training Tool with Guided Exploration on Information Literacy Skills among First Year Degree Students

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ABSTRACT

The purpose of this study is to investigate effects of WebOPAC Self Training Tool with Guided Exploration (WSTTG), WebOPAC Self Training Tool with non-guided exploration (WSTT) and Traditional (T) groups as the learning strategies on information literacy (IL) skills standards among first year degree students in Malaysian public university. The proposed learning strategy (WSTTG) was developed according to Ausebel's Instructional Design Theory and Gagne's Nine Events of Instruction which consist of constructivist learning environment model and cognitive of multimedia learning model. This unique and novel learning strategy is used to develop individual's logical thinking skill and access the information literacy skills which comply with Association of College and Research Libraries Information Literacy Competency Standards for Higher Education and Bloom Taxonomy standard. This study investigates the effects of the learning strategies amongst the students with high and low logical thinking level on their IL skills. Student's logical thinking level was measured using Group Assessment of Logical Thinking Test (GALTS). Meanwhile, students' information literacy skills were measured through a WebOPAC Training Assessment Information Literacy Skills (WTAILS). A quasi-experimental study with posttest-only nonequivalent group design that employed a 3x2 factorial design was applied in the study. The sample considered of 150 students from three academic libraries in Malaysia which were all randomly selected and assigned to the treatment and control groups. The findings of this study suggest that WSTTG is preferred compare to WSTT and T methods in developing student's information literacy skills at both logical thinking levels. From the practical perspective, the findings should alert librarians on the need to adopt this effective learning strategy for library orientation program and to be used by both the librarians and library users for WebOPAC teaching and learning purposes.

Keywords: Information literacy, logical thinking skill, WebOPAC self-training tool, learning strategy, library orientation program, academic library.

INTRODUCTION

Today, academic libraries are shifting their role from collection-centered to learning-centered due to continuous changing on the academic agenda and user needs. This academic library plays a significant role in the context of new learning paradigm. Based on the new perspective of learning, an academic library as a subsystem of academic organization has not been a division that is added providing services for studies and research any longer. Instead, it has become an important unit of academic's information infrastructure and an active participant in the learning process of particular study training. It is an integral part of the academic's educational system. The academic library serves two complementary purposes: to support the universities' curriculum, and to support the research of the academic faculty and students.

Past review, academic libraries are the important organization and core component with the roles to teach and support the integration of information literacy especially to the undergraduates students courses (Head, 2013; Ghaphery & White, 2012; Maitaouthong, Tuamsuk, & Tachamanee, 2012; Edzan, 2008). According to Rice & Gregor (2013)and Madhusudhan and Singh (2010), library orientation programs plays a vital role in the communication process between the library and its user, although the library orientation program formats changed with the advent of various technologies. The library orientation programs offers an introduction to the

library's resources and services, to the fresh undergraduates in the academic as well as information on study skills and academic integrity to help in the survival of the first year students throughout their studies at tertiary scores.

To date, Malaysia has twenty public universities which are funded by government and governed as self-manage institutions. Generally, Malaysian academic libraries of each universities were actively conducting their various library orientation programs, library skill trainings, library research trainings, information skills trainings and other similar trainings whose main aim is to educate the user on information use (Klaib, 2011; Edzan, 2008). In Malaysia, most of these academic libraries are doing their academic orientation for their users especially for undergraduate and post graduate students. Library orientation trainings are compulsory for every new student and are conducted usually at the beginning of every academic year or semester. Throughout the year, the libraries will organize program with the aim of familiarizing the students with the various tools within the libraries. This program is a way to help new students familiarize themselves with the layout, regulations, types of services and facilities offered by the particular academic library.

This library orientation has two main purposes: first is to train users to tap library resources and services and second, to instil awareness among its users about the significance of principles and practices of information skills. Madhusudhan and Singh (2010) also supported that this library orientation has to make 1) provision of guidance for understanding the features of specific information system or information in relation to user's needs, (2) provision of guidance on the specific information sources accessible through a specific system, (3) provision of guidance in the use of specific tools (e.g. online public access catalogue (OPAC) used in specific information system; and (4) developing familiarity with the outputs obtainable through a specific system.

Information Literacy (IL) is one of the critical digital-age illiteracies for higher education. Thanuskodi (2013) defined that IL is a way to move efficient access, evaluation and use of information should be taken into account and used for improving information end users. Therefore, the library orientation programs need continuously improvement to be taken seriously by academic library to develop information literacy skill among undergraduates which will allow them to function in an information society as envisioned in Malaysian Vision 2020 (Edzan, 2008). Thus, students need to be information literate to cope with the challenges in further studies and future profession.

The Association of College and Research Libraries (ACRL) provided a standard which is Information Literacy Competency Standards for Higher Education as a guideline that will assist student in learning how to use the information, describe, locate, satisfies, evaluate and use the information need effectively (ACRL, 2011, 2000). Recent studies found that few problems facing during practicing information literacy training which relate to the ineffective way and strategy of conducting library tours, introductory information skills classes, and in teaching advanced information skills. The studies conclude that the academic agencies do not aware the importance and development of information literacy among students. Supporting facilities such as class spaces, funding and training coordination provided on information literacy development was not seriously manage. Previous studies also reported that logical thinking skill moderates the relationship between teaching strategy and information literacy skills (Ralph Catts, 2010; Špiranec & Pejova, 2010; King, 2007). They concluded that students are lacking of logical thinking skills to evaluate IL, to identify the most efficient search strategy, to use scholarly information resources, and to use information ethically. This problem was supported by Fabunmi and Asubiojo (2013); Sankari et al., (2013), who believed that the lack of basic skills such as logical thinking skills of IL might become serious problem among undergraduate students in using WebOPAC in any academic library. As the result, the information literacy training during the orientation sessions does not comply with ACRL's standards (Shao & Purpur, 2016; Derakhshan, Hassanzadeh, & Nazari, 2015; Nurfaezah Mamat, Mohd Nasir Ismail & Adnan Jamaludin, 2014; Magnuson, 2013; Baro & Keboh, 2012; Husaini, Aziz, Karim, Jamin & Saad, 2011; Syamalamba, 2011; Gullikson, 2006). They major finding and supported by Nurfaezah Mamat et al. (2014); Rice and Gregor (2013); Gregory & Broussard (2011) concluded that the ineffective way and strategy of conducting these orientations programs contribute to the deficiencies of information literacy skill among university students.

PROBLEM STATEMENT
In most of academic libraries in Malaysia, library orientation activities are consist of library tours, hands on library system (WebOPAC), library briefings, information skills classes using online databases, lectures and multimedia presentations (Jyoon & Ibrahim, 2015; Salleh, Halim, Yaacob, & Yusoff, 2011; Ali, Abu-hassan, Md Daud, & Jusoff, 2010; Edzan, 2008). Ironically, even though library orientation program in Malaysian academic libraries were carried out every semester to new students; Nurfaezah Mamat et al. (2014) discovered that information literacy education in Malaysia is still at infancy since year 2002. The most common problem

faced by academic libraries in Malaysia that was reported in previous studies is basically due to conventional ways of conducting library orientation programs. The problems identified were regards to information overload, student's time constraint, varying levels of information skill among trainers, limitation of classroom and with burden to the library staffs (Briggs, 2016; Koltay, Sonja, & Karvalics, 2015; Ismail, Dorner, & Oliver, 2011; Salleh, Halim, Yaacob, & Yusoff, 2011; Ranaweera, 2010; Edzan & Mohd Saad, 2005; Bahri, 2003)

A needs assessment was done by Nurfaezah Mamat et al. (2014) by collecting data from interviews with five expert librarians to see in depth problems occur, which relate to the orientation programs conducted at the academic library in five different public universities in Malaysia. This needs assessment was conducted in order to elicit information concerning to the expert librarians' experiences in conducting library orientation programs, perceptions on student's IL skill and problems which corresponds to training strategies and content coverage during orientation programs. According to the needs assessment which also supported by previous studies, they found and concluded that the major problem among students is regarding to deficiencies of information literacy skill (Syamalamba, 2011; Madhusudhan & Singh, 2010) which were relate to these four factors: 1) lack of problem solving skills among students (Fabunmi & Asubiojo, 2013; Sankari et al., 2013; Mohd Nasir Ismail et al., 2010; Ralph Catts, 2010; Špiranec & Pejova, 2010; King, 2007); 2) lack of effective strategy of using WebOPAC (Rice & Gregor, 2013; Baro & Keboh, 2012; Yusuf, 2012; Nilsen, 2012; Gregory & Broussard, 2011; Xiao, 2010); 3) lack of proper content to conduct training of WebOPAC (Baro & Keboh, 2012; Diep & Nahl, 2011; Ranaweera, 2010); and 4) there is no standard measurement on WebOPAC to measure the scores of Information literacy (Martin (2013); Karshmer & Bryan (2011); Abdullah, Kassim, Sharif, Saad, Tarmuchi, & Aripin, 2006). To conclude, these four factors give a very accurate affect to the lack of information literacy skills among students. So, there is need improvement and idea to overcome the problems which are to increase information literacy skill among students and academic staff in university. In other words, the ability of academic libraries to develop the library orientation programs be more effectively and achieve their goals in the development of information literacy skill especially in using WebOPAC system.

In this study, a unique and novel learning strategy known as WebOPAC Self Training Tool with Guided Exploration (WSTTG) was developed which is expected to train and access individual's IL skills. This learning strategy consists of WebOPAC web based self-training tool and self-guided manual which are complies with Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education and Bloom Taxonomy standard. The WSTTG instructional design was developed according to Ausebel's Instructional Design Theory (Ausubel, Novak, & Hanesian, 1978) and Gagne's Nine Events of Instruction (Gagne & Merrill, 1985) which consist of constructivist learning environment model and cognitive of multimedia learning model.

RESEARCH OBJECTIVES
The main purpose of this study is to investigate effects of WebOPAC Self Training Tool with Guided Exploration (WSTTG), WebOPAC Self Training Tool with non-guided exploration (WSTT) and Traditional (T) groups as the learning strategies on information literacy (IL) skills standards among first year degree students in Malaysian public university.

The study also intended to find out whether a WebOPAC Self Training Tool with Guided Exploration (WSTTG) can be used to develop students' information literacy skill for WebOPAC training provided and they had develop their logical thinking skill through guided exploration manual. The main focus of the study is the comparison between two different modes: WebOPAC Self Training Tool with Guided Exploration (WSTTG) method and WebOPAC Self Training Tool without Guided Exploration (WSTT) method, as well as comparison with WebOPAC Traditional (T) method in order to determine if other mode of self-training tool is equally effective in producing desired student information literacy outcomes.

Consequently, this study conducted to further investigate if there are any significant differences in student's information literacy skills between learners who were taught in three different instructional methods. These instructional methods are the WebOPAC Self Training Tool with Guided Exploration (WSTTG), WebOPAC Self Training Tool without Guided Exploration (WSTT) and WebOPAC Traditional (T) method.

In addition, another purpose is to investigate the effects of these instructional methods on high logical thinking (HLT) students and low logical thinking (LLT) students in information literacy skill. The study is further investigated if there are significant differences between the high logical thinking (HLT) students and low logical thinking (LLT) students on information literacy skill in WSTTG, WSTT and T group method.

RESEARCH QUESTIONS
With regards the research objectives, the research main question for this study are as follow:

1) Is there any significance difference in the scores between students taught via WSTTG, WSTT and via T methods in IL skills?
2) Is there any significant difference in the scores between students with HLT and LLT for IL skills?
3) Is there an interaction effect between instructional methods and logical thinking for IL skills?

Other secondary research questions include:

1) Are the effects of instructional methods factors moderated by the logical thinking factors?
   a) For students taught via WSTTG, is there a significant difference in the scores between HLT students and LLT students for IL skills?
   b) For students taught via WSTT, is there a significant difference in the scores between HLT students and LLT students for IL skills?
   c) For students taught via T method, is there a significant difference in the scores between HLT students and LLT students for IL skills?
2) Are the logical thinking factors affected by instructional methods?
   a) For HLT students, is there a significant difference in the scores between students taught via WSTTG, student taught via WSTT and students taught via T methods for IL skills?
   b) For LLT students, is there a significant difference in the scores between students taught via WSTTG, student taught via WSTT and students taught via T methods for IL skills?

RESEARCH HYPOTHESES
The hypotheses were given with respect to the main effects, interaction and the simple effects. The following null hypotheses for main effects were formulated from the above research questions. The hypotheses were stated in a null hypotheses form because principally it is better fitted to the statistical techniques, which are aimed at measuring the likelihood that a difference found is truly greater than zero (Gall, Gall, & Borg, 2007). The probability gain scores of 0.05 was used to test statistical significance.

H_1:   *There is no significant difference in the gain scores for the IL skill between students taught via WSTTG, student taught via WSTT and students taught via T methods.*

H_2:   *There is no significant difference in the gain scores for IL skill between students with HLT students and LLT students.*

For the interaction effect, the following hypothesis was formulated.

H_3:   *There is no interaction effect between instructional method and students' logical thinking skills for IL skill.*

Further hypotheses were formulated for pos-hoc tests depending on the result from H_1. The hypotheses for the simple main effects include:

H_4:   *There is no significance difference in the scores for students taught via WSTTG method between HLT students and LLT students for IL skills.*

H_5:   *There is no significance difference in the scores for students taught via WSTT between HLT students and LLT students for IL skills.*

H_6:   *There is no significance difference in the scores for students taught via T method between HLT students and LLT students for IL skills.*

H_7:   *For HLT students, there is no significant difference in the scores for students taught via the three instructional methods for IL skills.*

H_8:   *For LLT students, there is no significant difference in the scores for students taught via the three instructional methods for IL skills.*

METHODOLOGY

Research design

The present study was compared three instructional methods, i.e. (a) WebOPAC Self Training Tool with Guided Exploration (WSTTG), (b) WebOPAC Self Training Tool with Non Guided Exploration (WSTT), and (c) traditional (T) instructional method without WebOPAC Self Training Tool either Guided Exploration or Non Guided Exploration. This is a quasi-experimental study posttest only nonequivalent groups design (Shadish & Cook, 2002) to investigate the effects independent variables (WSTTG, WSTT and T) on one dependent variable (information literacy gain score) with logical thinking skill as the moderating variables. Slavin (1996) recommended the use of such research design because it enables researchers to hold constant all factors other than the ones being studied.

This is a posttest only design with nonequivalent groups where all groups are intact classrooms where the assignments of X1, X2 and X3 were random and under the experimenter's control (Gall, Gall, & Borg, 2007). In this study, mortality factor was not being a threat since the duration of the study was not more than 2 weeks. The researcher was also obtained demographic information about the participants' groups at the beginning of the study, identify the participants that may contribute to mortality effect and remove them from the groups.

Pretests of the three dependent variables were administered to the experimental and control groups. Treatments were given only to the experimental group as the treatments relates to matter pertaining the process during the experimental period. This design is recommended when it is not possible to locate a suitable pretest or when there is a possibility that the pretest has an effect on the experimental treatment (Borg et al., 2007). In this case, the pretest would have been irrelevant. The steps involved in this posttest design with nonequivalent groups were as follows: (1) non-random assignment of subjects to the groups, (2) administer the treatment to the two experimental groups but not to the control group, and (3) administer the posttest to three groups (Borg et al., 2007). Even though the study was done using quasi-experimental design, there was some degree of randomness of sampling of the three groups. Three campuses were randomly selected from the thirteen UiTM campuses. Two classes were randomly selected from the two selected campuses which have more than three classes. For the third campus, as it has only two classes, both intact groups were chooses as the sample.

A 3x2 factorial design was used to investigate the effects of the independent variable on the one dependent variable at each of the two levels of a moderating variable. The research design is illustrated as in Table 1.

Table 1: Research design

Moderating Variable (logical thinking level)	Independent Variable (Instructional Method)		
	WSTTG (X1)	WSTT (X2)	T (X3)
High (Y1)	Cell 1	Cell 2	Cell 3
Low (Y2)	Cell 4	Cell 5	Cell 6

R	O	XI (Y1)	O	(Cell 1)
R	O	X2 (Y1)	O	(Cell 2)
R	O	X3 (Y1)	O	(Cell 3)
R	O	X1 (Y2)	O	(Cell 4)
R	O	X2 (Y2)	O	(Cell 5)
R	O	X3 (Y2)	O	(Cell 6)

Where,

X1:	WSTTG
X2:	WSTT
X3:	T
R:	Random assignment of subjects to groups
O:	Posttest

Instrument and measurement

Two major instruments are used to assess students' information literacy skill in using WSTTG, WSTT and T method. Group Thinking of Logical Thinking Test (GALT) was use to assess students' logical thinking level which being used as a moderating variable in this research for the Pretest and Posttest analysis. A WebOPAC Training Assessment Information Literacy Skill (WTAILS) was used to measure information literacy skills among students based on ACRL standards for the posttest analysis.

a)   Group Thinking of Logical Thinking Test (GALT)

The assessment on student's logical thinking level in the study are based on instrument that has been used in prior research to measure the student's level of logical thinking i.e. Roadrangka's Group Assessment of Logical Thinking (GALT) (Roadrangka, Yeany, & Padila, 1983). The adoption of this instrument assured that the logical thinking test would maintain items that had been previously reported as valid measure of logical thinking ability. The GALT had a reliability of 0.85 and validity of 0.80 (Roadrangka et al., 1983). This study used the GALT instrument that was based from the revised 12-item GALT that was translated into Malay language by Syed Anwar Aly (2000) in his study. The reliability values of GALT was found in his study are 0.59 (pre-test) and 0.688 (posttest). Therefore the test is adequate to distinguish between groups of students functioning at concrete and formal stages of development.

The GALT instrument consisted of 12 items measuring conservation of weight and volume displacement, proportional thinking, identification and control of variables, probabilistic thinking, correlational thinking, and combinatorial thinking posed in a pencil- and-paper format. Appendix B gives a breakdown of the thinking skill in GALT according to student's level of logical thinking defined by Roadrangka et al. (1983). The instrument used double answers for each question; multiple choice formats for presenting options for answers, and a justification or reason for each answer. The justification for answers provided more insight into student's logical thinking ability as well as greatly reducing the 'guess factor'. The student was given one point for each item for which a correct response was given for both answer and justification.

The instrument should be completed in 25 minutes but students will give one hour class period for the test. The test items in GALT instrument used pictorial representations of objects and the reading level was suitable for university students. Students with a score of 0 to 6 were considered to be low logical thinking student. Students who accumulated score from 7 to 12 points were classified as high logical thinking student.

b)   WebOPAC Training Assessment Information Literacy Skills (WTAILS)

A WebOPAC Training Assessment Information Literacy Skills (WTAILS) was used to measure information literacy skills among students based on ACRL standards for the posttest analysis. The WTAILS was designed to evaluate student learning in four content areas of the ACRL Information Literacy Competency Standards for Higher Education. This instrument was designed to assist institutions in identifying students' ability to locate, evaluate, and use information effectively when it is needed (ACRL, 2011, 2000). At the same time, it measures the scores of information literacy skills that are needed by the students in daily learning process. It is a multiple choice question test that must be completed in an hour. Items those are used to measure lower-order skills with the remaining one-third measuring higher-order skills (as defined in the Information Literacy Competency Standards).

According to ACRL (2011, 2000), information literacy skills was measured with five ACRL standards. However, one of the standards is not compatible with a multiple-choice item format which is standard four. This standard four refers to students who can use the information effectively to accomplish a specific purpose, the concern would be more reasonable skill assessed by examination or presentation of products produced by the students. Therefore, the item of WTAILS has been developed to measure Standard One, Two, Three and Five which is based to the ACRL standards. Based on the ACRL (2011, 2000), the standard two and three should receive a greater emphasis on the test, because it has shown that students' scores understanding of Information Literacy. Standard One and Standard Two are shown a lower order of logical thinking skill and for the Standard Three onwards it declined to the higher order of logical thinking skill.

The WTAILS was designed to evaluate student learning in four content areas of the ACRL Information Literacy Competency Standards for Higher Education. This instrument was designed to assist institutions in identifying students' ability to locate, evaluate, and use information effectively when it is needed (ACRL, 2011, 2000). At the same time it measures the scores of information literacy skills which students need to have the skills in everyday learning.

The data collected with the WTAILS also can be used to provide information about the scores of student learning and at the same time can improve the scores of information literacy among students. The results of the WTAILS can be used and has been successful in meeting the efficiency of student's information literacy performance.

Population, sampling and data collection

The target population of this study were about 2500 first year degree students enrolled for a degree program in various field at thirteen Universiti Teknologi MARA (UiTM) campuses. Three campuses were randomly selected from the thirteen UiTM campuses. The sample consisted of 150 male and female students who studied in first year degree program and were selected from three different UiTM campuses i.e., two classes randomly selected from each campus understudy. In each of these branch campuses, all the new students are required attend the library orientation program during orientation week on the first semester. At the beginning, the targeted samples were 180 students where 60 students were randomly selected to each group. Due to the attrition amongst student, the size of the sample was decreased to 150 students. However, the size of the classes in each campus was approximately similar. Students in the selected branches were from approximately equivalent academic status as defined by the university. The students were randomly selected by the Head of Degree Programs into different course according to the alphabetical name listing provide from the Academic Division at each UiTM campuses.

Three librarian as a facilitators, one from each campus were involved in the study and each taught two groups. All the facilitators have similar levels as education (Degree of Library & Information Management) with more than seven years of experience in conducted library orientation program. The facilitators who taught the experimental groups were exposed to one day training on the instructional methods. The facilitators were informed that the purpose of this study was to examine different library orientation services and strategies that may help in the improvement of students' information literacy skills.

DATA ANALYSIS AND RESEARCH FINDINGS

The analyses were carried using one-way analysis of variance (ANOVA) and the post hoc pair wise comparison using ANOVA post hoc Tukey HSD test. The data were compiled and analysed using the Statistical Package for the Social Science (SPSS) Version 22.

The Homogeneity Test

Homogeneity test was conducted to test equivalency between the three groups of participants in terms of academic status as defined by the university. This test was done because the three groups were from three different campuses. Although similarity between different campuses is assumed as the criteria for intake of students is the same for these campuses, the test will statistically prove or disprove this assumption. The Homogeneity test result was conducted using Box's M Test of Equality of Covariance Matrices to determine the equivalence between the three groups WebOPAC Self Training Tool with Guided Exploration (WSTTG), WebOPAC Self Training Tool with Non-Guided Exploration (WSTT), and Traditional (T) instructional method. The mathematics and science of Malaysian Education Certificate (SPM) grades for Mathematics, Physics and Chemistry subjects were used for the testing of homogeneity as these subjects contribute in measuring the student's logical thinking skill.

The scores of mathematics across the three groups had relatively similar means, 1.04, 1.30, and 1.19 for WSTTG, WSTT and T respectively. The scores of three groups on Physics were close, (1.94, 2.22 and 2.73 for WSTTG, WSTT and T respectively). The scores of the three groups on Chemistry were also very close, (1.92, 2.68 and 2.87 for WSTTG, WSTT and T respectively).

The results also shows that are no significant difference between the means of each groups *(F= 1.012; p= 0.434; p > 0.05)*. This means that there were no statistically significant differences in the academic status across the three groups. Therefore, the assumption that the academic status across the three groups in terms of equivalency based on MEC grades was met.

The Internal Reliability Test

The experimental study was carried out across the three groups (WSTTG, WSTT and T) and the scores from the study tests; (i) Group Assessment of Logical Thinking (GALT) and (ii) WebOPAC Training Assessment Information Literacy Skill (WTAILS), were collected and a set of reliability tests were conducted to determine the Cronbach's Alpha reliability coefficients. The results were obtained which show that the instruments in the study were satisfactory reliable. The reliability values of the instruments are as follows: (i) GALT: 0.804 and (ii)

WTAILS: 0.782. In this study, all instruments had alpha values above 0.6, which were considered as satisfactory reliable .

The Experimental Study Results

Descriptive Statistics
Table 2 presents the descriptive statistics of dependent variable as well as the interaction between the instructional methods and the logical thinking level.

Table 2: Descriptive statistics on dependent variable (IL) by the instructional between instructional method and logical thinking level

Dependent variable	Instructional method	Logical thinking	Mean	SD	N
Information Literacy Skill (IL)	WSTTG	HLT	21.13	4.014	40
		LLT	14.38	14.38	8
		Total	20.00	4.463	48
	WSTT	HLT	19.50	2.064	28
		LLT	14.05	1.397	22
		Total	17.10	3.265	50
	T	HLT	15.88	0.835	8
		LLT	11.95	3.027	44
		Total	12.56	3.140	50
	Total	HLT	19.97	3.544	76
		LLT	12.64	2.679	74
		Total	16.45	4.759	150

Testing of Hypothesis 1
There is no significant difference in the gain score for the information literacy skill between students taught via WSTTG, students taught via WSTT and students taught via T instructional methods.

To examine if there were statistically significance differences in instructional methods, the first analysis of one-way analysis of variance (ANOVA) was conducted. Table 3 present summary of one-way analysis of variance (ANOVA) which shows the *F*-value, *p*-value of dependent variable by the instructional methods, WSTTG, WSTT and T, effect size and the observed power.

Table 3: Summary of one-way analysis of variance (ANOVA) IL for instructional method

Source	Dependent Variable	*F*-value	*p*-value	Result	Effect Size	Observed Power
Method WSTTG WSTT T	IL	13.409	0.000	*Sig*	0.414	0.998
Level HLT LLT	IL	83.252	0.000	*Sig*	0.254	1.000
Method * Level	IL	**1.638**	**0.198**	**Not Sig**	**0.022**	**0.341**

Note
* The mean difference is significant at the 0.05 level.

The ANOVA results for comparing the three instructional method groups on the dependent variable indicated that there were statistically significant differences between the three groups on the dependent variable. The ANOVA results of comparing the three groups were statistically significant for WebOPAC Training Assessment Information Literacy Skill (WTAILS*): F*-value is 13.409 and *p*-value is 0.000 (< 0.05), effect size is 0.414 and the power is 99.80%. This means that there were statistical differences on the dependent variable.

Therefore, the researcher further investigated the univariate statistics results analysis of variance (ANOVA) by performing post hoc pairwise comparison using the ANOVA post hoc Tukey HSD test for dependent variable in order to identify where the significant differences in the mean difference resided. According to Morgan and Griego (1998), many statisticians recommended a middle of road test such as the Tukey honestly significant difference (HSD) test compared to LSD post hoc test which is quite liberal and the Scheffe test which is quite conservative. Table 4 is a summary of post hoc pairwise comparison between the instructional methods and dependent variable.

Table 4: Summary of post hoc pairwise comparisons between the instructional methods and information literacy

Comparison Group	Dependent Variable: Gain Score WTAILS		
	Mean Difference	**P-value**	**Result**
WSTTG VS. WSTT	2.90	0.000 (p <0.05)	*Sig*
WSTTG VS. T	7.44	0.000 (p< 0.05)	*Sig*
WSTT VS. T	4.54	0.000 (p<0.05)	*Sig*

Note:
* The mean difference is significant at the .05 level.

Table 4 displays the mean differences, and p-value of different comparison groups by the dependent variable. The table shows that there are statistical mean differences among the three comparison groups and the dependent variable. The summary of testing hypothesis 1 is presented below.

There is a significant difference in the gain scores for the WTAILS between students taught via WSTTG group, students taught via WSTT group and students taught via T group (F- value = 13.409, p- value = 0.000). Post-hoc test was further formulated and the results show significant difference in the gain scores for the WTAILS between students taught via WSTTG group and students taught via WSTT group (Mean difference = 2.90, p-value = 0.000).

There is a significant different in the gain scores for WTAILS between students taught via WSTTG group and students taught via T group (Mean difference = 7.44, p- value = 0.000). There is also significant difference for the WTAILS between students taught via WSTT group and students taught via T group (Mean difference = 4.54, p-value = 0.000) which is also significant different. This means that all the three group had significant different which are the WSTTG group significantly outperformed the WSTT group (WSTTG > WSTT) and WSTTG group also significantly outperformed the T group (WSTTG > T) in information literacy skill. WSTT group also significantly outperformed the T group (WSTT > T).

Testing of Hypothesis 2
There is no significant difference in the gain scores for the information literacy skill between HLT and LLT students.

To examine if there were statistically significant differences in information literacy skills between HLT and LLT students, the second analysis using one-way analysis of variance (ANOVA) was conducted. The ANOVA results of comparing the two groups (HLT and LLT) on the moderating variable indicated that there were statistically significant different between the two groups (HLT and LLT) and the dependent variable (IL). Table 1.4 presents the summary of one-way analysis of variance (ANOVA) which shows the *F*-value and *p*-values of dependent variable by the instructional methods (WSTTG, WSTT, and T).

The ANOVA results of comparing the two groups on the moderating variable indicated that there were statistically significant differences between the two groups (HLT and LLT) and the dependent variable (IL). There is a significant difference in the gain scores for the information literacy (IL) skill between HLT and LLT students (*F*-value = 83.252, *p*-value = 0.000).

Testing of Hypothesis 3

> *There is no interaction effect between instructional method and students' logical thinking skills for information literacy skill.*

The results of the first in univariate analysis of variance (ANOVA) model analysis, showing the differences for the interaction between instructional method and logical thinking level effect on the one dependent variable. The ANOVA results of the interaction effects on the dependent variable was statistically significant which is *F*-value= 1.638 and *p*-value = 0.198.

Figure 1 shows the interaction graph between the instructional method and the students' logical thinking level across the three groups on information literacy skills (IL).
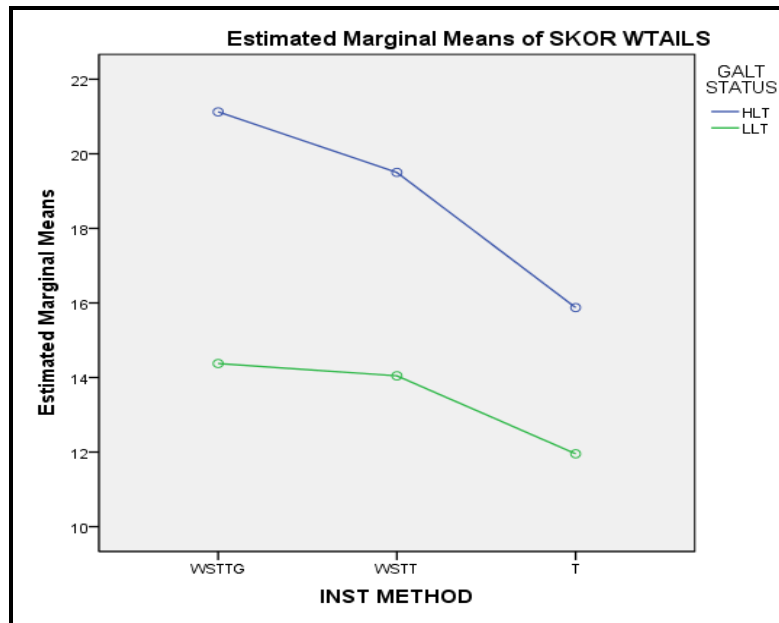
Figure 1: Interaction effect the between instructional methods and students' logical thinking levels on information literacy skill (IL)

Figure 1 shows that the LLT students taught via WSTG group benefited more than the HLT students taught via the same instructional method in information literacy skills. There is an interaction effect between the instructional method and the student's logical thinking level on information literacy skills across the three groups (*F*-value= 1.638, *p*-value= 0.198). Therefore, this inconsistent result was significant as analysed. In other words, HLT and LLT students taught via WSTTG, WSTT and T instructional methods benefited equally in information literacy skill. Therefore, the effect of the instructional methods on IL depends on the logical thinking level.

Testing of Hypothesis 4

> *There is no significant difference in the gain scores for information literacy skill between HLT and LLT students taught via WSTTG instructional method.*

To examine if there were statistically significant differences in information literacy skills between HLT and LLT students taught via the three instructional methods, a second analysis using univariate statistics results analysis of variance (ANOVA) by performing post hoc pairwise comparison using the ANOVA post hoc Tukey HSD test for the particular dependent variable in order to identify significantly where the differences in the mean difference resided for the particular group.

Table 5: Summary of post hic pairwise comparisons between the instructional and the logical thinking level (HLT and LLT)

Dependent Variable			Information Literacy Skill (IL)
Instructional Method	**Logical Thinking Level**		
WSTTG	HLT vs	Mean Difference	6.75

	LLT	Significant	0.000
WSTT	**HLT**	**Mean Difference**	5.45
	vs		
	LLT	**Significant**	0.000
T	**HLT**	**Mean Difference**	3.93
	vs		
	LLT	**Significant**	0.011

Note.
The mean difference is significant at the .05

Table 5 above presents the summary of post hoc pairwise comparisons between the WSTTG method and the logical thinking level (HLT and LLT) which shows the mean difference and the p-value of dependent variable.

There is a significant difference in the gain scores for information literacy skill between HLT and LLT students taught via WSTTG instructional method (Mean$_{HLT-WSTTG}$: 21.13; Mean$_{LLT-WSTTG}$: 14.38; Mean difference= 6.75, *p*-value= 0.000).

Testing of Hypothesis 5
There is no significant difference in the gain scores for information literacy skill between HLT and LLT students taught via WSTT instructional method.

To examine of there were statistically significant differences in information literacy skills (IL) between HLT and LLT students taught via WSTT instructional method, the result from the second analysis using univariate ANOVA analysis was used. The researcher further investigated the univariate statistics results (analysis of variance ANOVA) by performing a post hoc pairwise comparison using the ANOVA post hoc Tukey HSD test for the particular dependent variable in order to identify significantly where the differences in the mean difference resided for the particular group.

Table 5 above presents the summary of post hoc pairwise comparisons between the instructional and the logical thinking level (HLT and LLT) which shows the mean difference and the p-value of dependent variable. There is a significant difference in the gain scores for information literacy skill between HLT and LLT students taught via WSTT instructional method (Mean$_{HLT-WSTT}$: 19.50; Mean$_{LLT-WSTT}$: 14.05; Mean difference= 5.45, *p*-value= 0.000)

Testing of Hypothesis 6
There is no significant difference in the gain scores for information literacy skill between HLT and LLT students taught via T instructional method.

To examine of there were statistically significant differences in information literacy (IL) skills between HLT and LLT students taught via T instructional method, the result from the second analysis using univariate ANOVA analysis was used. The researcher further investigated the univariate statistics results (analysis of variance ANOVA) by performing a post hoc pairwise comparison using the ANOVA post hoc Tukey HSD test for the particular dependent variable in order to identify significantly where the differences in the mean difference resided for the particular group.

Table 5 above presents the summary of post hoc pairwise comparisons between the T method and the logical thinking level (HLT and LLT) which shows the mean difference and the p-value of dependent variable. There is no significant difference in the gain scores for information literacy skill between HLT and LLT students taught via T instructional method (Mean$_{HLT-WSTTG}$: 15.88; Mean$_{LLT-WSTT}$: 11.95; Mean difference= 3.93, *p*-value= 0.011).

Testing of Hypothesis 7
For HLT students, there is no significant difference in the gain scores for information literacy skill between students taught via WSTTG, WSTT and T instructional methods.

The result from the second analysis using univariate analysis ANOVA analysis was again used to examine if there were statistically significant differences in information literacy (IL) skills between HLT students across the three instructional methods (WSTTG, WSTT, and T). The researcher further investigated the univariate statistics result (analysis of variance ANOVA) by performing pairwise comparison using the ANOVA post hoc Tukey

HSD test for the dependent variables in order to identify significantly where the differences in the mean difference resided in every comparison groups for the HLT students.

Table 6: Summary of post hoc pairwise comparisons between HLT students across the three groups

Dependent Variable		
Information Literacy (IL) Skill		
Comparison Group	**Main Difference**	**Significant**
WSTTG vs WSTT	1.63	0.105
WSTTG vs T	5.25	0.000
WSTT vs T	3.63	0.017

Table 6 above presents the summary of post hoc pairwise comparisons between HLT students across the three groups which shows the mean difference and the p-value of dependent variable.

For HLT students, there is no significant difference in the gain score for information literacy skill between students taught via WSTTG and WSTT instructional methods (HLT_{WSTTG} vs HLT_{WSTT}, $Mean_{HLT - WSTTG}$: 21.13, $Mean_{HIT-WSTT}$: 19.50 ; Mean Difference = 1.63, p-value= 0.105).

However, there is a significant difference in the gain scores for information literacy skills between students taught via WSTTG and T instructional method and also between students via WSTT and T instructional method. This means that the HLT students taught via the WSTTG instructional method and students taught via WSTT instructional method significantly performed higher than the HLT students taught via the T instructional method (HLT_{WSTTG}>HLT_T and HLT_{WSTT} vs HLT_T)
(HLT_{WSTTG} vs HLT_T, Mean Difference= 5.25, *p*-value= 0.000)
(HLT_{WSTT} vs HLT_T, Mean Difference= 3.63, *p*-value= 0.017)

Testing of Hypothesis 8
For LLT students, there is no significant difference in the gain scores for information literacy skill between students taught via WSTTG, WSTT and T instructional methods.

The result from the second analysis using univariate analysis ANOVA analysis was again used to examine if there were statistically significant differences in information literacy (IL) skills between LLT students across the three instructional methods (WSTTG, WSTT, and T). The researcher further investigated the univariate statistics result (analysis of variance ANOVA) by performing pairwise comparison using the ANOVA post hoc Tukey HSD test for the dependent variables in order to identify significantly where the differences in the mean difference resided in every comparison groups for the LLT students.

Table 7: Summary of post hoc pairwise comparisons between LLT students across the three groups

Dependent Variable		
Information Literacy (IL) Skill		
Comparison Group	**Main Difference**	**Significant**
WSTTG vs WSTT	0.33	0.945
WSTTG vs T	2.42	0.036
WSTT vs T	2.09	0.005

Table 7 above presents the summary of post hoc pairwise comparisons between LLT students across the three groups which shows the mean difference and the p-value of dependent variable.

For LLT students, there is no significant difference in the gain score for information literacy skill between students taught via WSTTG and WSTT instructional methods (LLT_{WSTTG} vs LLT_{WSTT}, $Mean_{ILT - WSTTG}$: 14.38, $Mean_{LIT-WSTT}$: 14.05; Mean Difference = 0.33, p-value= 0.945, >0.05)

However, there is a significant difference in the gain scores for information literacy skills between students taught via WSTTG and T instructional method and also between students via WSTT and T instructional method. This means that the LLT students taught via the WSTTG instructional method and students taught via WSTT instructional method significantly performed higher than the LLT students taught via the T instructional method. (LLT$_{WSTTG}$ > LLT$_T$ and LLT$_{WSTT}$ > LLT$_T$)

(LLT$_{WSTTG}$ vs LLT$_T$, Mean Difference= 2.42, p-value= 0.036)
(LLT$_{WSTT}$ vs LLT$_T$, Mean Difference= 2.09, p-value= 0.005)

DISCUSSION

Both the WSTTG and WSTT instructional methods have significant positive overall effects on the dependent variable, namely the student's information literacy skills. Students taught via the WSTTG and WSTT method significantly outperformed the students taught via the T method in information literacy skills. Meanwhile, students taught via the WSTTG also significantly outperformed the students taught via the WSTT method in information literacy skills. There were significant effects between WSTTG, WSTT and T instructional methods on information literacy skills as shown in Table 4.

For the effects of instructional methods on information literacy skills' mean scores, there were two major findings. First, the results showed that the overall means score for information literacy skills for the students taught via WSTTG method was higher than WSTT group who, in turn, higher than the students taught via T method (Mean $_{WSTTG}$ > Mean $_{WSTT}$ > Mean $_T$). Second, both HLT and LLT students' means scores in information literacy skills for WSTTG method were higher compared to WSTT and T methods. Hence, the WSTTG method is preferred for HLT and LLT students compared to WSTT and T methods.

The results of the study also showed that the difference between HLT and LLT students among the three instructional methods were significant in information literacy skills. It supported Edzan (2008) study where the results from her study revealed that the elements of cognitive and logical thinking skills revealed a high correlation between the student's logical thinking level and their information literacy skills.

Further analysis revealed that the HLT students taught via WSTTG, WSTT and T instructional methods significantly outperformed the LLT students taught via the same method in information literacy skills. Working cooperatively with the LLT students, all the three method gave an opportunity the HLT students to discuss, clarify and evaluate each other ideas.

The findings of this study also showed the HLT students taught via both the WSTTG and WSTT methods significantly outperformed the students taught via the T method in information literacy skills. However, there were no significant differences in the mean gain score between HLT and LLT students taught via both the WSTTG and WSTT methods in information literacy skills. Moreover, for the LLT students taught via WSTTG and WSTT method significantly outperformed the students taught via T method in information literacy skills. This is to say that HLT and LLT students taught via WSTTG and WSTT method performed equally in information literacy skills. Thus, it can be concluded that WSTTG and WSTT methods significantly support HLT and LLT students in improving their information literacy skills. In studies on the information literacy skills development Bundy (2004) and Thornes (2012) report that content, skills and processes is needed that different levels of thinking skills are associated with various learning outcomes.

These are the reason why students form both WSTTG and WSTT methods were outperformed their counterpart in the T method in information literacy skills. Based on the result from the study, the following recommendations are given for library user interested in using WSTTG in their instructions.

CONCLUSION

While this study has successfully achieved its objectives, it is however not without any limitation. The first limitation of this study chiefly revolves around the context and scope of the research. Instead of collecting data from various university academic libraries, this study only covered students enrolled in three UiTM campuses. Given these limitations, the results obtained are narrowed in terms of generalizability. The implications of this study can be viewed from both theoretical and practical perspectives. From the theoretical viewpoint, this study has developed a constructivist learning strategy which helps the students to fully benefit from the use of WSTTG method. WebOPAC self-training tool without guided exploration manual (WSTT) as the instructional method, is inadequate strategy as compare to WSTTG method. In this study, focusing was on the assessment of information literacy skills among first year degree students. Alternatively, the study can be further extended by investigating information literacy skills among final year degree and postgraduate students. From the practical viewpoint, the learning strategy that has been developed can be used as a the online tutorial for WebOPAC services and

directed the students' attention to use, understand and evaluate the information needs, which help them to access the WebOPAC services provided in the library.

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