A Study of Applying Research-Based Learning to a Digital Collection Development and Preservation Course for Digital Information Management Undergraduate Students at Walailak University

การศึกษาผลการใช้วิจัยเป็นฐานในรายวิชาการพัฒนาและการสงวนรักษาดิจิทัลคอลเลกชัน สำหรับนักศึกษาปริญญาตรี หลักสูตรการจัดการสารสนเทศดิจิทัล มหาวิทยาลัยวลัยลักษณ์

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ABSTRACT

The aims of this research were to explore students' learning achievements, satisfaction levels and attitudes regarding the use of research-based learning (RBL) approach in a Digital Collection Development and Preservation course. Participants of the study are 17 Digital Information Management (DIM) undergraduates registered in the course in the second semester of 2016 at Walailak University, Thailand. The instruments used were pre- and post-attitude questionnaires, and questionnaire measuring levels of students' satisfaction. The results indicated that 1) students passed the learning achievement test at a rate of 58.82 %; 2) their overall satisfaction with RBL was generally high, and 3) students' attitudes towards RBL were significantly higher after its use than before, specifically regarding their perceptions of enhancing analysis and critical thinking skills, and the extent to which RBL will be helpful in their future careers. Additionally, the students also reported they were happy to study in this type of course.

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บทคัดย่อ

การวิจัยครั้งนี้ มีวัตถุประสงค์ดังนี้ คือ 1) เพื่อศึกษาผลสัมฤทธิ์ทางการเรียนของการใช้วิจัยเป็นฐานในรายวิชาการพัฒนาและการสงวนรักษาดิจิทัลคอลเลกชัน สำหรับนักศึกษาปริญญาตรี หลักสูตรการจัดการสารสนเทศดิจิทัล ชั้นปีที่ 2 มหาวิทยาลัยวลัยลักษณ์ 2) เพื่อศึกษาความพึงพอใจของนักศึกษาที่มีต่อการจัดการเรียนรู้โดยใช้วิจัยเป็นฐาน ในรายวิชาฯ และ 3) เพื่อวัดเจตคติของผู้เรียนที่มีต่อการเรียนรายวิชาฯ กลุ่มประชากรที่ใช้ในการศึกษาครั้งนี้ เป็นนักศึกษาระดับปริญญาตรี ที่ลงทะเบียนเรียนรายวิชาการพัฒนาและการสงวนรักษาดิจิทัลคอลเลกชัน ในภาคการศึกษาที่ 2 ปีการศึกษา 2559 จำนวน 17 คน เครื่องมือที่ใช้ได้แก่ แบบสอบถามเจตคติก่อนและหลังเรียน แบบสอบถามความพึงพอใจ ผลการวิจัยพบว่า 1) นักศึกษาสอบวัดผลสัมฤทธิ์ทางการเรียนผ่านเกณฑ์คิดเป็นร้อยละ 58.82 2) ผลประเมินของนักศึกษาในภาพรวมที่มีต่อการเรียนในรายวิชาฯ อยู่ในระดับมาก และ 3) เจตคติของนักศึกษาที่มีต่อการเรียนของนักศึกษาที่มีต่อรายวิชาฯ สูงกว่าก่อนเรียน คือ เพิ่มการคิดอย่างเป็นระบบ พัฒนาการคิดวิเคราะห์อย่างมีวิจารณญาณ เป็นวิชาที่มีส่วนช่วยในการประกอบอาชีพในอนาคตและมีความสุขในการเรียน

Introduction

Background

Educational organizations are increasingly recognizing the importance of possessing more sophisticated skillsets, such as the ability to filter huge amounts of data rapidly, the ability to extract valuable information and make decisions, and the ability to access, analyze, synthesize, and evaluate information and understand ethical issues (Dede, 2010).

Fisher (2004) argued that research, critical thinking, analytical problem solving, and communicative skills are among the generic skills required for positions in the library and information sciences. Additionally, a great variety of competencies are necessary for roles in the information professions.

The Council of Europe has identified “competency” as “the set of knowledge and skills that enable an employee to orient easily in a working field and to solve problems that are linked with their professional role” (Webber, 1999, p. 28). To efficiently and effectively deliver client assignments, it is therefore important to be able to research, analyze and synthesize information into actionable steps to derive accurate answers. Managing information services and resources is therefore one of the key competencies required by information professionals in the 21st century. For instance, Jones (2003, p.1) stated that “In the information and knowledge age, information professionals play a unique role in gathering, organizing, creating, analyzing, synthesizing and coordinating access to the best available information sources for the organization as a whole”. Moreover, the development of higher order thinking skills, such as critical thinking and problem solving, is important not only for undergraduates but also for postgraduates (Miri, David, and Uri, 2007).

In Digital Information Management (DIM) education, Digital Collection Development and Preservation is offered as part of the undergraduate program. It is a compulsory course for second

year DIM undergraduates in the School of Informatics, Walailak University, Thailand. This course constitutes one of the main concepts of DIM, covering the definitions and functions of digital collection; developing digital collections; tools, technologies, and standards of compression and transformation of digital collections; and the preservation and management of digital resources. The students need to learn both the theory and practice in this subject. The course syllabi are based on the Thai Qualifications Framework (TQF) for Higher Education. It is therefore anticipated that students on this course will develop the ability to think in a logical way when applying knowledge, theory, and their own experience to solve problems in the workplace. Moreover, research skills and the ability to adapt to new and emerging technologies are now essential prerequisites for professionals working in the library and information sciences.

However, the results in this course over the last year have shown that, in some cases, students' poor performance in exams stems from their lack of key research skills such as the ability to define a problem, gather information, analyze and synthesize information, and engage in critical thinking. Learning from content-based theories in class might therefore not be sufficient. They also lack familiarity with English technical vocabularies. This is because most teaching and reference materials are in English, especially materials in English textbooks, and the students experience clear difficulties in reading English. Additionally, the author conducted lectures in a traditional classroom, using a teacher-centered approach, over the same period. In this context, the students were not given the chance to express their opinions, ask questions, or direct their own learning styles ("Which is Best: Teacher-Centered or Student-Centered Education?," 2017). Consequently, the learning experience has often become boring and limited in terms of subject matter– leaving the students demotivated. The students are also required to engage in independent study through a regular review of academic papers and new research findings and increase the amount of active learning in the class.

Research objectives

Three research objectives were therefore addressed:

1. To investigate the effect of research-based learning (RBL) on academic achievement on the Digital Collection Development and Preservation course;
2. To investigate the satisfaction levels of students at the end of the course in terms of learning environment, learning activities and benefits of research-based learning in the course
3. To investigate students' attitudes towards the use of RBL in the course both at the start and at the end of the course.

The three research questions guiding this study included:

1. What is the effect of research-based learning on academic achievement on the Digital Collection Development and Preservation course?
2. What is the satisfaction level of students at the end of the course in terms of learning environment, learning activities and benefits of research-based learning in the course?
3. Is there a significant difference in students' attitudes towards the use of RBL in the course both at the start and at the end of the course?

Literature review

RBL provides an environment in which students are given the opportunity to develop their research skills by conducting research independently, becoming involved in the research process and applying reviews of research to classroom teaching (Khammani, 2005). By linking teaching and research in the classroom, RBL can improve various research skills, such as thinking skills, problem solving skills, time management skills, communication skills, computer skills, and lifelong learning skills. Additionally, they develop the ability to seek information, study theory, define problems, find solutions, gather and analyze data, and apply knowledge in real life situations (Chantavanich, 2005). RBL has become increasingly popular as a form of Active-Learning instruction in traditional classes used to enhance teaching and learning. In Thailand, several RBL skills have been integrated into various disciplines. For example, in languages, integrated units form the basis of a research-based approach towards teaching the French language to undergraduate students at Thammasat University (Dejamonchai, 2012). In sciences, RBL has been used to teach chemistry to Grade 12 students (Ponork, 2011). In education, an RBL has been developed for the Educational Research Course offered to students in the Faculty of Education, Prince of Songkla University, Pattani campus (Thammachart, 2012). Finally, in health, an RBL model has been developed for the Public Health course at Naresuan University (Kiyreerawutiwong and Saetan, 2013). However, despite the proliferation of RBL in higher education in Thailand, little in the way of RBL-based research has been conducted on student achievement, satisfaction levels, and other attitude ratings in the field of library and information sciences.

Conceptual Framework

This research aimed to develop learning and research skills in Digital Collection Development and Preservation by integrating RBL into teaching activities for undergraduate students enrolled on

the DIM major in the School of Informatics, Walailak University, Thailand. The conceptual framework for this study was as follows.

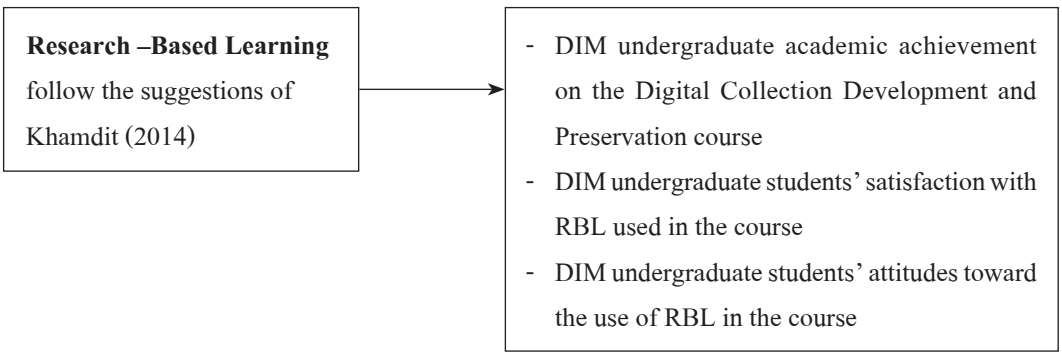

Figure 1 Conceptual framework for the study

Methodology

Participants

17 participants enrolled on the course in the second semester of a DIM Major in the School of Informatics, Walailak University, Thailand, were recruited.

Pedagogical Manipulation

Learning plans. The processes involved in developing learning plans were as follows:

1. To study and analyze course contents, comprising 7 units in total:
   Unit 1: Introduction to digital collection; Unit 2: Planning and managing digitization projects; Unit 3: Selecting material for digitization; Unit 4: Metadata strategy; Unit 5: Digitizing material; Unit 6: Designing a user interface for digital collection, and Unit 7: Digital preservation.
2. The learning plans aim to provide a holistic integration of content knowledge, critical thinking, team work, communication skills, and research process skills.
3. Instruction strategies were applied based on Pitiyanuwat and Boonterm's (1997) guidelines. These included giving students an opportunity to study basic theory from textbooks, documentation, and other resources, and to search for and review research papers by themselves.
4. Monitoring the quality of lesson plans and questionnaires was achieved through discussion with three professional academics who were experienced in the computer,

information sciences and information management fields. The results of the evaluation confirmed the validity of the questionnaires.

5. Adjusting learning plans to integrate RBL before practice was conducted.

Instruments

The data were collected using two questionnaires. Content validity was assessed by three experts who awarded an item-objective congruence (IOC) to each questionnaire.

The experts were also asked to check, comment on the content, as well as to rate each item so as to see whether it was congruent with the objective. Then, the Item-Objective Congruence (IOC) Index was calculated by assigning scores to three kinds of answers: congruent = 1, questionable = 0, incongruent = -1. In this study, all items were rated higher than 0.5 of the IOC index, indicating that they were acceptably congruent with the objectives. Its content validity measured by the IOC Index was between 0.66-1.00.

The questionnaires were then modified prior to use. The first questionnaire evaluated students' attitudes towards RBL. First, the participants were asked to grant their official consent to proceed with the study. Then, they were required to complete this questionnaire at the start and at the end of the course. The students, who were all enrolled on the course, took an average of six to eight minutes to complete the questionnaire. The first questionnaire was split into two parts: the first part eliciting demographic information from participants (name, age, and level of studies), and the second part assessing students' attitudes towards RBL. Students responded to each item using a 1 to 5 Likert scale.

The second questionnaire also consisted of two parts: the first part once again eliciting demographic information from the participants (name, age, level of studies), whilst the second part measuring students' satisfaction levels during the course. Like the first questionnaire, responses to each item were given on a 1-5 Likert scale. The second questionnaire also included open-ended questions where students were able to comment or offer suggestions for improving the course in the future. At the end of both questionnaires, a clear explanation was given as to the nature of the research. They were also assured that all data would be treated confidentially.

Procedures

The instruction of the course comprised the following steps:

1. Following the suggestions of Khamdit (2014), the author searched and summarized

relevant research articles for students to read and analyze as part of their homework.

2. The author gave an overview of research as a topic area, including a consideration of the meaning of research and an explanation of the way in which research papers are structured (research problems, objectives, scope, methodology, results, discussion, and conclusions).
3. Students were asked to read the abstract of each research paper.
4. Students were asked to read the articles in full and then discussed these papers. They were then invited to participate in collaborative activities in class using active learning strategies such as playing games, spreading information in a round-robin fashion, and using a jigsaw strategy.

Rosenshine (2012, p.12) noted that "the more effective teachers do not overwhelm their students by presenting too much new material at once". The first English language research paper presented to the students was therefore divided into seventeen equal parts. Each student was asked to read one part of the paper and discuss it with the other students in the group. This helps reduce the memory load for students. Additionally, they were also less likely to give up when reading an English language research paper for the first time.

5. After completing each unit, the students were instructed to record their learning notes and carry out their homework. They were asked to use concept mapping as a tool to represent the knowledge gained from each lesson unit. Moreover, when reading English language research articles, they were instructed to record technical vocabulary into their notebook and to submit this at the end of each lesson.
6. Examinations assessed academic achievement in terms of their comprehension of knowledge, critical thinking skills, and problem-solving abilities.

Data analysis

Descriptive statistics were calculated to ascertain the mean and standard deviation (S.D.) of each demographic variable. Students' satisfaction with the course was measured using the second questionnaire and scored as follows for each item:

- Strongly disagree (the lowest agreement) = 1.00-1.49
- Disagree (low agreement) = 1.50-2.49
- Moderate (medium agreement) = 2.50-3.49
- Agree (high agreement) = 3.50-4.49
- Strongly agree (the highest agreement) = 4.50-5.00

Using SPSS, a Wilcoxon Signed Rank test was employed to analyze the responses in Part II of the questionnaire. Statistical significance was accepted at an alpha level of $p < .05$.

Results

1. Demographic Characteristics

The dataset ($N = 17$) comprised 7 females (41.2%) and 10 males (58.8%), all of whom were undergraduate DIM major students studying at Walailak University.

The main results are presented in three parts, based on the research objectives.

2. Part I Research Objective 1: To investigate the levels of academic achievement when undertaking research-based learning

After completing the course, achievement levels were assigned using the grading system for DIM majors in the School of Informatics, Walailak University (See Table 1).

Table 1. The levels of academic achievement assigned using grading system for DIM majors, School of Informatics, Walailak University

Percentage	Grades	Description	No. of Students (%)
80-100	A	Excellent	4 (23.53)
75-79	B+	Very Good	1 (5.88)
70-74	B	Good	3 (17.65)
65-69	C+	Fairly Good	2 (11.76)
60-64	C	Fair	5 (29.41)
55-59	D+	Poor	1 (5.88)
50-54	D	Very Poor	1 (5.88)
0-49	F	Failure	-

The results revealed that more than half of the students (58.82 %) passed with a score between 60 and 100, defined as a “Fair” level.

3. Part II Research Objective 2: To investigate the satisfaction levels of students at the end of the Digital Collection Development and Preservation course

To address this objective, three categories of RBL evaluation were considered: learning environment, learning activities, and the benefits of the research-based learning course (See Table 2). Each category contained a list of information, and the respondents were asked to assess their

respective value. The results show that the students generally agreed (high agreement) with the application of RBL in the course. For the learning environment category, all the scores were higher than 3 (the midpoint) indicating a "Fair" level of satisfaction among students. The item, "The learning environment gives the opportunity for students to engage in activities" received the highest score of 4.71, followed by "the learning environment forces students to take responsibility for themselves and their groups" and "the learning environment can stimulate students' creative thinking" which received scores of 4.35 and 4.24, respectively. For the learning activities category, the item "learning activities are relevant to the content in the course" received the highest score of 4.47, followed by the items "encouraging collaborative learning in the class" and "supporting students to exchange their knowledge with others" which received scores of 4.41 and 4.24, respectively.

Regarding the benefits of RBL, the items "the learning method helps students to improve their critical thinking skills" and "gives the students opportunities to work with others" both received the highest score of 4.41, while the items "providing students with information on how to apply learning methods to other subjects" and "allowing students to know each other in the class" received scores of 4.24 and 4.21, respectively.

Table 2. Students' satisfaction with a course based on RBL ($N = 17$)

	Statements	Mean (*S.D.*)	Interpret
No.	**Learning Environment**		
1	Learning environment gives opportunities for students to engage in the activities	**4.71** (0.47)	Strongly agree
2	Learning environment forces students to take responsibility for themselves and their groups	4.35 (0.61)	Agree
3	Learning environment increases students' motivation in the class	4.18 (0.64)	Agree
4	Learning environment allows students to engage freely in activities	4.18 (0.88)	Agree
5	Learning environment can stimulate students' creative thinking	4.24 (0.56)	Agree
		4.33 (0.63)	**Agree**
No.	**Learning activities**		
1	Learning activities are relevant to content in the course	**4.47** (0.62)	Agree
2	Learning activities support students in exchanging their knowledge and ideas with others	4.24 (0.66)	Agree
3	Learning activities support thinking and decision making	4.18 (0.73)	Agree
4	This course helps me to be assertive	4.06 (0.43)	Agree
5	Learning activities allow students to express their ideas	4.12 (0.49)	Agree

Table 2. Students' satisfaction with a course based on RBL ($N = 17$) (con.)

	Statements	Mean (*S.D.*)	Interpret
6	Learning activities help students understand the content	4.06 (0.75)	Agree
7	Learning activities encourage students to learn together in the class	4.41 (0.71)	Agree
		4.22 (0.63)	**Agree**
No.	**Benefits of research-based learning in the course**		
1	Makes the content easy to understand	**4.18** (0.81)	Agree
2	Helps me to remember the content easily	4.00 (0.61)	Agree
3	Allows me to construct my knowledge by myself	4.12 (0.86)	Agree
4	Provides me with information on how to apply learning methods to other subjects	4.24 (0.83)	Agree
5	Encourages me to improve my thinking ability	4.06 (0.66)	Agree
6	Helps to improve my critical thinking skills	4.41 (0.80)	Agree
7	Allows me to get to know other people in the class	4.21 (0.90)	Agree
8	Gives me the opportunity to work with others	**4.41 (0.71)**	**Agree**
		4.20 (0.77)	**Agree**
	Overall Satisfaction	**4.25 (0.68)**	**Agree**

4. Part III Research Objective 3: To investigate students' attitudes towards RBL in the course. Students were asked to complete this questionnaire both at the start and at the end of the course

Table 3. Wilcoxon-signed rank test results for students' attitudes before and after completing the course ($N = 17$)

Statements	Pre-questionnaire		Post-questionnaire		Wilcoxon-signed rank test
	Mean	*S.D.*	Mean	*S.D.*	
1. I feel that the course is interesting	4.00	0.61	4.18	0.53	.32 NS
2. I am in a bad mood when I study on the course	2.47	0.80	2.76	1.25	.52 NS
3. This course helps me to increase my systematic thinking	3.82	0.53	4.47	0.51	.01*
4. This course improves my critical thinking	3.88	0.49	4.35	0.61	.03*
5. This course is not useful	2.53	0.87	2.59	1.33	.92 NS
6. I feel uncomfortable when I am in the class	2.24	0.83	2.12	0.86	.59 NS
7. This course is difficult to learn	3.12	0.49	2.82	0.81	.10 NS
8. This course improves my creative thinking	3.82	0.64	4.06	0.43	.21 NS
9. This course is helpful for my future career	3.94	0.66	4.41	0.71	.04*
10. I am happy to study on this course	3.71	0.69	4.29	0.69	.02*

Note: NS= no significant; an asterisk (*) = significance using Wilcoxon-signed rank test. The significance level is $p <= .05$ (unless otherwise stated).

Having taken part in research-based learning, students' attitudes were significantly higher than they were before taking part in relation to increased systematic thinking ($Z = -2.653$, $p = .01$, $p < .05$), improvements in critical thinking ($Z = -2.138$, $p = .03$, $p < .05$), and being helpful for future careers ($Z = -2.000$, $p = .04$, $p < .05$). Students were also happy to study on this course ($Z = -2.352$, $p = .02$, $p < .05$).

Discussion

An RBL approach can develop and enhance students' research skills, such as analysis and critical thinking skills, information retrieval, and so on. However, the results showed that more than half of the students (58.82 %) passed with a score between 60 and 100, defined as a "Fair" level. These results were inconsistent with those of Ponork (2011), who studied problem solving skills and learning achievements among grade 12 students undertaking research-based learning in a high school Chemistry course on the topic of biomolecules; his results showed these students were motivated and had fun during the course. Overall, 86.49 % of the students passed a test of problem-solving ability and 83.48 % passed a learning achievement test, both exceeding the school's criterion of 70 %. The lower results in the current research can be explained by the fact that some parts of the content may have been quite difficult for students due to the use of technical English terms. This problem could be solved by providing video lessons online, using a flipped-mastery approach, or through blended learning. This could help students understand the key concepts and attain sophisticated 21st Century skills and knowledge (Bergmann and Sams, 2012).

Most of the students, however, seemed to be satisfied with RBL in the classroom. This finding corresponded with that of Dejamonchai (2012), who also found that most students seemed to be satisfied with RBL. These students felt that, in using RBL they could gain more knowledge, benefit from research, and enhance their research skills, including critical thinking, analytical skills, systematic thinking, and problem solving. In terms of attitudes, students responded most positively to RBL in terms of a perceived increase in systematic and critical thinking, perceived helpfulness in relation to their future career, and their level of happiness after finishing the RBL course. These results suggest the DIM students have a positive attitude toward RBL, consistent with Banchonhattakit's (2012) findings that students' knowledge, attitudes, practice, and satisfaction levels at the end of an RBL-based course were higher than they were at the beginning. This might be because students recognize the importance and benefits of research work. This will help them improve their study skills and apply this knowledge in their future careers. Additionally, participating in group activities provides students with the opportunity to get to know each other, have fun, and thus increases their motivation.

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Conclusion

This study investigated the effect of using RBL on student achievement, satisfaction levels, and attitude ratings in an undergraduate Digital Collection Development and Preservation course at Walailak University in Thailand. Research-based learning can enhance academic achievement and develop their research skills. Therefore, the School of Informatics should integrate RBL into its courses, as well as active learning activities into its classrooms. Additionally, collaborative learning activities give students a chance to collaborate with others to develop their communication and negotiation skills. Furthermore, additional resources, such as short videos, need to be used in this course to enhance students' comprehension of the content. Additionally, blended learning, which combines asynchronous (i.e., text-based Internet) with synchronous (i.e., face-to-face) learning experiences, can be incorporated into this course in the next semester. Blended learning provides students with flexible learning activities outside the classroom, such as discussions, asking questions, submitting their homework, and receiving teacher feedback on assignments using internet-based applications. Such applications encourage more interaction among students and teachers. Feedback from teachers when correcting their work is especially important for students as it ensures their learning becomes more efficient and effective.

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