

Lifelong Learning Application: Mobile Application to Promote Lifelong Learning and Introduce Educational Institutions

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ABSTRACT

Education is the raising of the thinking process and developing the mind in a broader perspective. However, education that is comprehensive and appropriate to the individual according to its potential, ability and skill is too hardest to describe. Thus, matching and referral institutions, including education model that suits the person's behavior has been receiving attention. The purpose of this research is to study and develop the applications that support the development of the learner's education process with the highest degree of achievement. The material and method are consisting of five main processes, including 1) requirement definition, 2) system and software design, 3) implementation and unit testing, 4) integration and system testing, and 5) operation and maintenance. The data collection were collected from 431 samples, which divided into 4 targets; 186 high school students at Phadungnaree School, Maha Sarakham province, 191 university students at Rajabhat Mahasarakham University, 12 head of institutions at Phadungnaree School and Rajabhat Mahasarakham University, and 42 secondary teachers and university lecturers at Phadungnaree School and Rajabhat Mahasarakham University. According to the results of research, it is indicated that the total satisfaction toward the application are highest, which is equal to 4.32, and the groups with the highest levels of satisfaction are university students, which is equal to 4.43. It can be concluded that the application is appropriate and it is advisable for students who wish to study at university.

1. Introduction

Nowadays, scientific and technological progress than in the past, it seems that everything around them with the facilities and the living is easy. Technology can provide support and resolve problems in every field of knowledge. Transferring of technology and know-how is fast and comprehensive for various purposes and reasons.

Even so, justice and equality in accessing development and knowledge of the individual remain questions. According to the Sustainable Development of the United Nations (UN), it mentioned that the need for "A world with equitable and universal

access to quality education at all levels, to health care and social protection, where physical, mental and social well-being is assured [1]". Many questions arise from this mission, such as how to achieve the goals, what are the main hurdles, where to solve the problem, who to deal with, and many more.

One of the ways to achieve this, the international community has focused on health, education and social reforms involving individuals, systems and information enormously. The 2015 World Education Forum held at Incheon, South Korea, been shown that the future education vision is fully taken up with an offer of equal and fair quality to educational institutions as well as the promotion of lifelong learning opportunities for all learners [2].

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These two ideas discuss the relationship with Goal 4 of the United Nations Sustainable Development Goal, which is quality education and ensures that quality in education is equal and promotes equality. Everybody's lifelong learning opportunity [3, 4]. Based on the importance of the above, the research team studied the components of the recommendations for selecting the right university for the right student, and developed it as an application on the device, which is the intention of the international community, as shown in Figure 1.



Figure 1. The importance of the research

Figure 1 illustrates the importance and relevance of research development to the goals of the international community, which is a complex problem when attempting to match the most appropriate student to the institution. Moreover, this research is an extension of Nuankaew's research [5], which reflects the research problem as shown in Figure 2 and Figure 3.

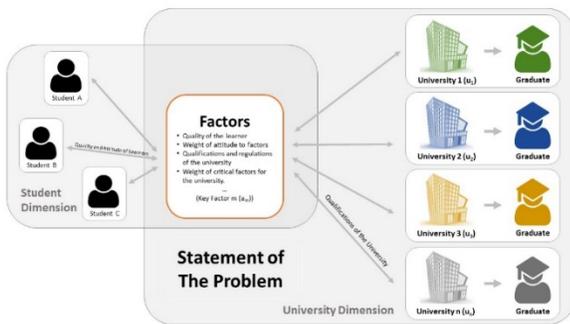


Figure 2. The Research Problem [5]

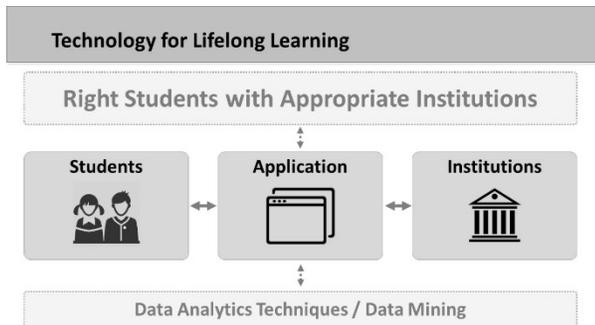


Figure 3. Using Modern Technology for Lifelong Learning

Once the research is done, the final step before publishing the application to the public is known and applied, the team has evaluated the performance and satisfaction of the application, which consists of five parts: 1) requirement definition, 2) system and software design, 3) implementation and unit testing, 4) integration and system testing, and 5) operation and maintenance

as demonstrated in Figure 4. The details of each topic are clearly described in the material and methods sections.

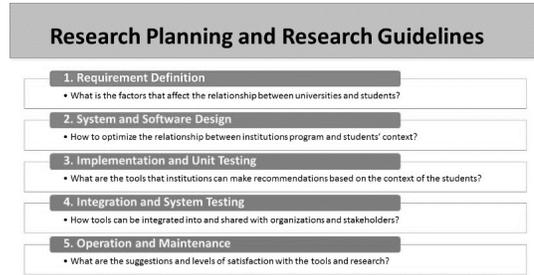


Figure 4. Research Planning and Research Guidelines

To complete the research work, the structure of the document is as follows: Literary review is compiled and presented in Section II. Section III defines and describes the variables, including a summary of all operational procedures. Section IV presents the results of the operation and discusses. Finally, Section V provides conclusions and future works, respectively.

2. Literature Review

Research and development tools for educational application consist of a combination of disciplines, including science, social sciences, education, engineering, and technology that can develop potential and success. From the research problem needed to solve the problem of matching learners to appropriate institutions. The research team summarized and collected relevant literature to present the ideas in the following topics.

2.1. Students' Academic Achievement

Measurement of student success can be done in several ways and factors. According to the research of Dougherty and Sharkey [6], it was found that factors contributing to the improvement of student achievement were three parts: grade point averages (GPAs), emotional competence, and social support. It offers a model of path analysis for mediation models with social support and emotional ability that reflects students' impact on GPA and achievement.

While the invisible academic relationship between students and institutions is contributing to academic achievement [7]. It clearly demonstrates that attitudes toward academia, along with their academic achievements, contribute to institutional decision-making and academic success. Another example of research related to academic achievement are dimension of learning styles and students' academic achievement [8]. It is suggested that an appropriate learning style could help students to achieve a good academic record in any subject they learned.

Therefore, it is concluded that the development of students to attain academic achievement must be in every dimension including the students, the learning environment, the education system and the stakeholders [9-11].

2.2. Educational Technology and Students' Performance

Students' performance refers to the academic performance of a student, which encompasses the processes that promote student success in education. While technology enables life and education is easy. Various tools and methods are used consists in teaching and learning in the classroom, including using of a mobile learning management system with online students [12], an applications on

the mobile to introduce the appropriate institution [5], prediction of students' academic failure [13], and using an educational computer program to enhance student performance [14].

No matter what tools or technologies are used to support education. Educational measurement and educational standards are still needed as a basis for the student's developmental and educational success. Therefore, the choice of tools must take into account the learning goals and achievement that will occur with the students.

2.3. Education System and Limitations

It cannot be denied that education is not only in the classroom, although education is attempting to develop a structure or form that is appropriate for the learner's age and environment. But, the out-of-class study and self-learning are surprisingly remarkable. Meanwhile, getting the knowledge and answers from the Internet can be easy and convenient. But there are few percent verified and accepted. Therefore, the education system must integrate modern technology and limit the scope of finding the correct and appropriate knowledge for the learners.

Some researches offer a dimension of education related to the education system in Thailand. Based on the research report of Sithipon Art-in [15], it was found that the current situation and need in learning management for developing the analytical thinking of teachers in basic education of Thailand as overall in the high level. The problem with the lowest level of performance is that teachers have the ability to design and create learning plans to develop students' analytical thinking.

While research on patterns and methods of education affecting students has been discussed [16]. It is concluded that the students should be allowed to construct the body of knowledge by themselves through the Open Approach, which they are interested in and motivated to face of the problem situation. Therefore, in order to understand Thailand's education system and education structure, the following topics are divided into 2 main themes: 1) Thailand's formal education system, and 2) lifelong learning style.

2.3.1. Thailand's Formal Education System

In the public domain of Thailand, the education system is free and takes 12 years to complete. The study structure follows the "6-3-3" project, with 6 years of primary education, 3 years of lower secondary level and 3 years of upper secondary level. As displayed in Figure 5, elementary education is classified as Prathom 1-6, which correlates to Grades 1-6. While, secondary education is classified as Matthayom 1-6 and correlates to Grades 7-12.

Stage	Level / Grade	Typical Age	Notes	
Basic Education	Early Childhood (Kindergarten)	Variable	4	
		(Typically Anuban 1-3)	5	
			6	
	Elementary		Prathom 1	7
		Prathom 2	8	
		Prathom 3	9	
		Prathom 4	10	
		Prathom 5	11	
		Prathom 6	12	
	Lower-Secondary	Matthayom 1	13	
		Matthayom 2	14	
		Matthayom 3	15	
	Upper-Secondary	General	Vocational	16
		Matthayom 4		Vocational Certificate
		Matthayom 5		Matthayom 6 (3 years)
	Matthayom 6	17		
	18			
	Higher Education	Variable	...	

Figure 5. Thailand's Formal Education System

2.3.2. Lifelong Learning Style

In view of its success, to learn what love is one of the factors. It can be supported by Cabi's research [17]. It is recommended that students find out their own learning styles and choose the most effective strategies for their learning. It is important to learn for lifelong learning. In the definition of learning style, it is a set of techniques that make it easy for individuals to learn about yourself and learn to make the learning process information in a manner that is stable.

Theories of learning styles are continually evolving from the past. One popular theory is that Kolb's learning model, in which individual learning styles are cyclical [18]. There are four learning style in this cycle, including Abstract Conceptualization (AC), Active Experience (AE), Concrete Experience (CE), and Reflective Observation (RO). The student learning model is represented by four basic types of learning, and the individual's score indicates the most appropriate learning style as shown in Table I.

Table I. Four basic types of learning styles

Types	Elements	Meaning
Accommodating	AE and CE	Engage in real experiences and enjoy learning from exploration and application and search. They are open for strange thoughts.
Assimilating	AC and RO	They like structured and systematic knowledge. The knowledge presented must be detailed, structured and include visual and audio components.
Converging	AC and AE	The details are very important for those individuals and they are trying to understand by studying each section first. They learn to new knowledge first, then use it and not be afraid to make mistakes while learning.
Diverging	CE and RO	They like learning by observing real experiences instead of joining them. Need systematic presentation of knowledge on various topics. These individuals will be successful from the perspective of real cases.

Learning styles have a significant relationship to the nature of teaching and learning [18]. Therefore, teaching and learning management has an impact on the educational system. Laal, et al. [19] summarizes a group of lifelong learning and education systems, consisting of three main groups: formal learning, non-formal learning, and informal learning as details are shown in Table II.

Table II. Education systems

Categories	Definitions and Examples
Formal Learning (Formal Education)	It is learning that takes place in an organized and structured context. Examples: • Study in school or academic institutions • Training in a workplace or through an expert • Learning with curriculum or structured courses
Non-Formal Learning (Non-Formal Education)	It is driven by activities that are not clearly defined. Examples: • Short course training • Training in communities • Groups of adjustment according to students' needs.
Informal Learning (Informal Education)	It relates to learning from the daily activities of family and work. It is often called experiential learning. Examples: • Family activities • Education to improve individuals

2.4. Technology Support and Solutions

This section provides information and literature about applying technology related to education in three topics: 1) Data mining in education, which refers to the use of data mining technology for educational research. 2) Mobile web application technology, which offers technology to support and develop research tools. 3) Software development methodology, which is a process and step to develop an effective and complete application.

2.4.1. Data Mining in Education

Data mining technology is searching for patterns and processes that have values from a large number of data. In the education system, vast amounts of information being analyzed and synthesized for the main purpose is to develop the capacity of students and learners' potential, to achieve the academic achievement of the learner.

Examples of research such as Costa's research, which presents the results of evaluating the effectiveness of educational data mining techniques for early prediction of students' academic failure [13]. Natek's research demonstrates the application of data mining technologies to the analysis and development of decision models for planning and management in higher education institutions [20]. And the important example is an institution recommender system based on student context and educational institution in a mobile environment [5] that extends to this research. This work has been carried out to complete the process of the System Development Life Cycle (SDLC), which consists of seven steps: problem recognition, feasibility study, analysis, design, construction, conversion, and maintenance.

2.4.2. Mobile Web Application Technology

Nowadays, access to information and the internet is easy with the communication device everyone has. It is a mobile phone. Many applications have been developed and used to support educational systems.

For example, Briz-Ponce's research [21], which presents research findings on different drivers and factors that may affect student needs with mobile technology for learning. Yoo and Lee's research [22] uses a mobile application technology to develop knowledge and teaching for nursing students. Simonova and Poulouva's research [23] applied mobile technology for learners' preferences in mobile-assisted higher education.

From the examples that bring mobile computing technology into use in various fields. As well as, the research team was interested in developing tools to support education, it developed a mobile for introducing appropriate institutions to students [5]. The research was extremely interesting, and the research team further developed the research that was proposed to assess application satisfaction and efficiency, which is presented in the next section.

2.4.3. Software Development Methodology

In software engineering, software development methodology is software development. It is a different procedure which consists of activities that are intentionally planned and managed better. It is often perceived as a subset of the development life cycle. Such methods may include predefined definitions of deliverables and inventions defined by project teams to develop or maintain programs. There are several software development methodology such as waterfall, prototyping, iterative and incremental

development, spiral development, rapid application development, extreme programming and various types of agile methodology.

In this research, the waterfall model is used to assemble processes to develop applications and software for quality and performance, which consisting of five components: requirements engineering, design and implementation, testing, release, and maintenance as shown in Figure 6.

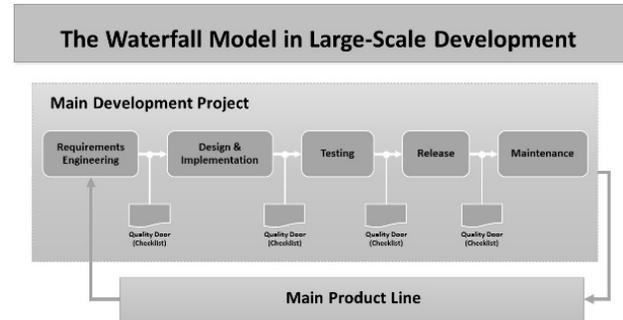


Figure 6. The Waterfall Development

2.4.3.1. Requirements Engineering

At this stage, the needs and significance of the problem are identified and documented at the abstract level. After that the specifications will be refined so that they can be used for design and operation. Specifications are stored in the required repository, and the requirements to be applied are selected from the repository. A number of requirements, depending on the resources available for the project. The quality will check that all terms are understood and agreed upon and documented. It also requires monitoring relevant stakeholders and solutions to support strategies and objectives.

2.4.3.2. Design and Implementation

At the stage of architectural design was created documented. After that, system development started. Developers also perform basic unit tests before code development during the testing phase. The quality checklist verifies that the architecture has been evaluated for deviation from the specifications compared to predetermined quality decisions.

2.4.3.3. Testing

In this period, integration has been tested on quality and functionality. In order to decide whether the system is usable, it will measure performance in the lab such as throughput. Because the goal is to solve the problem perfectly, then the test will be performed on a variety of different configurations. Phase results will be reviewed according to a checklist to track whether the system has been validated.

2.4.3.4. Release

In the release phase the product is returned into a shippable state. The release documentation is the final step, which contains documentation for installation and usage for the user. In addition, creating instructions for the system must be programmed. The build guide can be used to enable and disable features of the main line product to customize the system to meet the specific needs of the target. Quality must ensure that the response meets the needs of the target. The final result is delivered for the intended purpose and meets the quality requirements.

2.4.3.5. Maintenance

After the product has been released, it must be maintained. That is, if the user encounters a problem in the product, the report is developed and encouraged to solve the problem. If the problem is due to an error in the product package, the system update will be sent to the user.

3. Material and Methods

After gathering the literature and scope of the research area, this step details the material and the method. It consists of five main stages: 1) requirement definition, 2) system and software design, 3) implementation and unit testing, 4) integration and system testing, and 5) operation and maintenance as shown in Figure 7.

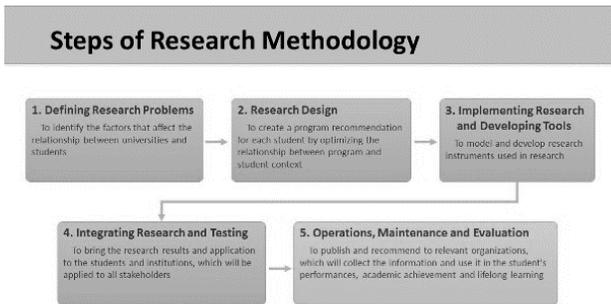


Figure 7. Steps of Research Methodology

3.1. Defining Research Problems

The objective of this step is to identify the factors that affect the relationship between universities and students [24]. This process was conducted by designing a questionnaire asking for opinions and attitudes from 256 students at two universities: University of Phayao and Rajabhat Maha Sarakhm University. After receiving information from the respondents, the text mining process was analyzed to model and identify factors that are important to students and institutions.

The results show that the performance of the model employs two important factors; education system and interested in study, which are used to predict student's interest in higher education. While, the decision tree model with two depth levels was most appropriate with 81.46% accuracy as shown in Figure 8.

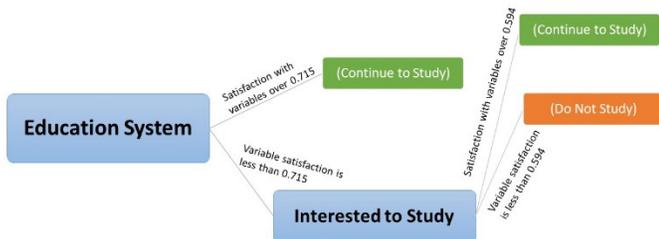


Figure 8. Decision Tree Model to Predict Student's Interest [24]

3.2. Research Design

After discovering that the education system and student interest have a bearing on the decision to study in higher education, the research team studied the characteristics of attitudes that resulted in the selection of educational programs, as well as educational

institutions. Based on the data collected from 885 students of three higher educations, including Rajabhat Mahasarakham University, Mahasarakham University, and University of Phayao and the results of model analysis, the accuracy points out 19 significant factors; 15 factors of student context and 4 factors of program context, which is appropriate used to introduce institutions for the style and attitude of the students as show in Table III.

Table III. Summary of significant factors

Characteristics	Features
Student's Interests	<ul style="list-style-type: none"> Interest in studying Career path Identity of the University Obtained knowledge Education system
Student's Characteristics	<ul style="list-style-type: none"> Ability Skills Knowledge Learning style
Student's Environment	<ul style="list-style-type: none"> Social capital and Economic Trust in institutions Personal decision Family income Community Purpose of study
Programs' Context	<ul style="list-style-type: none"> The popularity of the University Curriculum Education standard Quality assurance

In addition, the model has 76.50 % accuracy, showing that the generated model represents the appropriate relationship between student's context and programs' context for the proposed program recommendation, with 53 rules as shown in Figure 9.

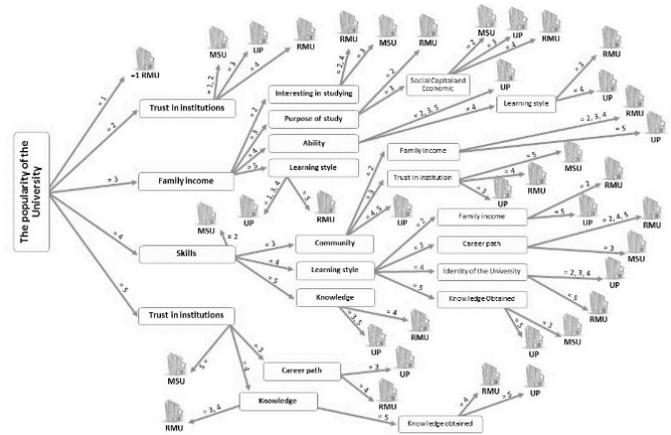
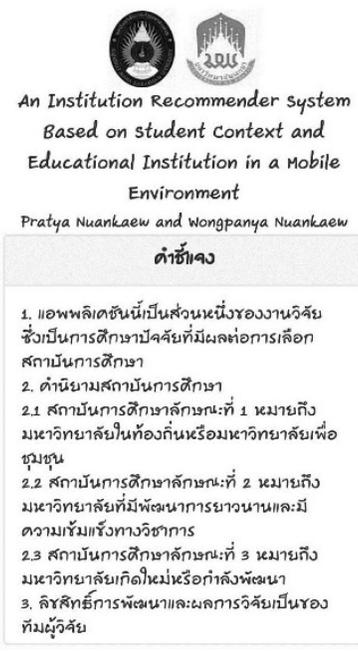
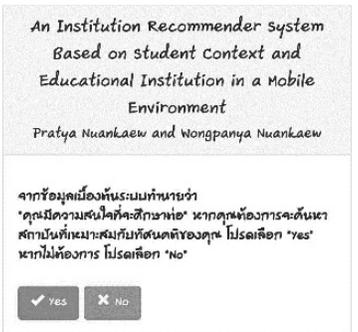


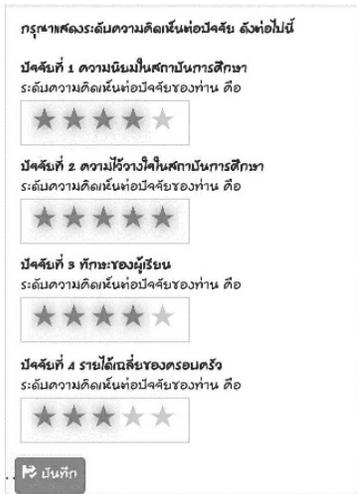
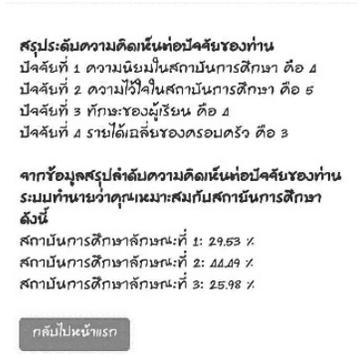
Figure 9. Decision Tree Model to Introduce Institutions

3.3. Implementing Research and Developing Tools

After knowing and discovering the factors that can be used to predict an interest in further education and behavioral characteristics that are consistent with, and appropriate educational programs and institutions. The application for introducing educational institutions based on student's context and educational institution in a mobile environment has been developed, which using the mobile web apps function [5]. It was applied to 1,109 students from 3 campuses; Rajabhat Mahasarakham University, Mahasarakham University, and University of Phayao to conduct and test the application, which the interface of the application is shown in Table IV.

Table IV. Application interface

Interface	Function
 <p>An Institution Recommender system Based on student Context and Educational Institution in a Mobile Environment Pratya Nuankaew and Wongpanya Nuankaew</p> <p>คำชี้แจง</p> <ol style="list-style-type: none"> 1. แอปพลิเคชันนี้เป็นส่วนหนึ่งของงานวิจัย ซึ่งเป็นการศึกษาปัจจัยที่มีผลต่อการเลือกสถาบันการศึกษา 2. ดำเนินการศึกษาลักษณะที่ 1 หมายถึง มหาวิทยาลัยในท้องถิ่นหรือมหาวิทยาลัยเพื่อชุมชน 2.2 สถาบันการศึกษาลักษณะที่ 2 หมายถึง มหาวิทยาลัยที่มีพัฒนาการยาวนานและมี ความเข้มแข็งทางวิชาการ 2.3 สถาบันการศึกษาลักษณะที่ 3 หมายถึง มหาวิทยาลัยกิดใหม่หรือกำลังพัฒนา 3. ลิขสิทธิ์การพัฒนาและผลการวิจัยเป็นของ ทีมวิจัย 	<p>This page aims to clarify the purpose and explain the details of the research.</p>
 <p>An Institution Recommender system Based on student Context and Educational Institution in a Mobile Environment Pratya Nuankaew and Wongpanya Nuankaew</p> <p>กรุณาเลือกค่าคอมที่ตรงกับข้อเท็จจริงเกี่ยวกับความคิด เห็นของท่าน</p> <p>เพศ : <input type="radio"/> ชาย <input type="radio"/> หญิง</p> <p>คุณมีความพึงพอใจต่อระบบการศึกษาอยู่ในระดับใด</p> <p>★★★★★★★★</p> <p>บันทึก</p>	<p>This page store user information and ask for feedback on the educational system.</p>
 <p>An Institution Recommender system Based on student Context and Educational Institution in a Mobile Environment Pratya Nuankaew and Wongpanya Nuankaew</p> <p>กรุณาเลือกค่าคอมที่ตรงกับข้อเท็จจริงเกี่ยวกับความคิด เห็นของท่าน</p> <p>คุณมีความพึงพอใจที่จะศึกษาต่ออยู่ในระดับใด:</p> <p>★★★★★★★★</p> <p>บันทึก</p>	<p>This page requests the level of satisfaction to study at university.</p>
 <p>An Institution Recommender system Based on student Context and Educational Institution in a Mobile Environment Pratya Nuankaew and Wongpanya Nuankaew</p> <p>จากข้อมูลเบื้องต้นระบบทำนายว่า 'คุณมีความสนใจที่จะศึกษาต่อ' หากคุณต้องการจะค้นหา สถาบันที่เหมาะสมกับทัศนคติของคุณ โปรดเลือก 'yes' หากไม่ต้องการ โปรดเลือก 'no'</p> <p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>	<p>This page shows the results of interest analysis of users who wish to study at university.</p>

Interface	Function
 <p>กรุณาเลือกระดับความคิดเห็นต่อปัจจัย ดังต่อไปนี้</p> <p>ปัจจัยที่ 1 ความนิยมในสถาบันการศึกษา ระดับความคิดเห็นต่อปัจจัยของท่าน คือ</p> <p>★★★★★</p> <p>ปัจจัยที่ 2 ความไว้วางใจในสถาบันการศึกษา ระดับความคิดเห็นต่อปัจจัยของท่าน คือ</p> <p>★★★★★</p> <p>ปัจจัยที่ 3 ทักษะของผู้เรียน ระดับความคิดเห็นต่อปัจจัยของท่าน คือ</p> <p>★★★★★</p> <p>ปัจจัยที่ 4 รายได้เฉลี่ยของครอบครัว ระดับความคิดเห็นต่อปัจจัยของท่าน คือ</p> <p>★★★★★</p> <p>บันทึก</p>	<p>This page aims to gather attitudes towards additional factors in predicting the appropriate university for respondents.</p>
 <p>สรุประดับความคิดเห็นต่อปัจจัยของท่าน</p> <p>ปัจจัยที่ 1 ความนิยมในสถาบันการศึกษา คือ 4 ปัจจัยที่ 2 ความไว้วางใจในสถาบันการศึกษา คือ 5 ปัจจัยที่ 3 ทักษะของผู้เรียน คือ 4 ปัจจัยที่ 4 รายได้เฉลี่ยของครอบครัว คือ 3</p> <p>จากข้อมูลสรุประดับความคิดเห็นต่อปัจจัยของท่าน ระบบทำนายว่าคุณเหมาะสมกับสถาบันการศึกษา ดังนี้</p> <p>สถาบันการศึกษาลักษณะที่ 1: 29.53 % สถาบันการศึกษาลักษณะที่ 2: 44.49 % สถาบันการศึกษาลักษณะที่ 3: 25.98 %</p> <p>กลับไปหน้าแรก</p>	<p>This page shows results and universities that fit the respondents.</p>
 <p>An Institution Recommender system Based on student Context and Educational Institution in a Mobile Environment Pratya Nuankaew and Wongpanya Nuankaew</p> <p>ขอขอบคุณสำหรับความร่วมมือและข้อมูล.</p> <p>กลับไปหน้าแรก</p> <p>หมายเหตุ: แอปพลิเคชันนี้เป็นส่วนหนึ่งของการศึกษาวิจัยที่มีผล ต่อการเลือกสถาบันการศึกษา ซึ่งผลการทำนายมีความ ถูกต้องอยู่ที่ 69.03%</p>	<p>Thank you page</p>

3.4. Integrating Research and Testing

To bring the application to the students, institutions and all stakeholders. The research team applied the application to the university's public relations activities and curriculum promotion activities. At the same time, the research team collected the survey data on attitudes and academic achievement of students in the upper secondary school that represent the academic relationship between academic achievement and institutions [7].

The survey found that the Grade Point Average (GPA), and school types had an impact and affects the attitudes toward the

selection institutions, which is consistent to student's attitude, their academic achievement and research's factors.

3.5. Operations, Maintenance and Evaluation

This step is the final stage of the research process, which is a key topic in the research process. The goal of this step is to publish and recommend to relevant organizations, which will provide the application and use it in the student's performances development, development of learning achievement and promoting lifelong learning.

The process at this stage consists of promoting the application and evaluation of applications in all dimensions, including finding the level of satisfaction toward the application, and evaluate the performance of the application, as elements as shown in Figure 10.

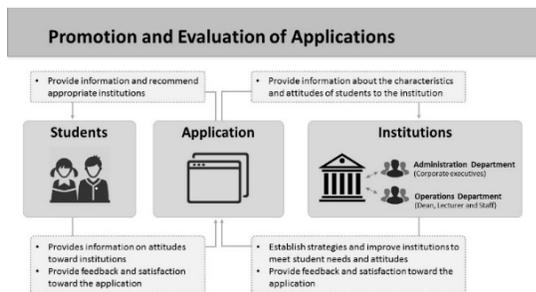


Figure 10. Process of Promotion and Evaluation of Applications

From Figure 10, it shows the process of promotion and evaluation of applications, which consist of two dimensions, including the student dimension and the institution dimension.

To carry out the full procedure as planned, the research team had planned operation consists of four stages: 1) promoting and introducing the application, 2) providing results and information from the application, 3) collecting feedback and satisfaction from the users, and 4) summary of suggestions and analyze the level of satisfaction. The details of each step is explained in the next section.

3.5.1. Promoting and Introducing the Application

The samples were selected to promote the application consists of 4 groups, including 186 high school students at Phadungnaree School, Maha Sarakham province, 191 university students at Rajabhat Mahasarakham University, 12 head of institutions at Phadungnaree School and Rajabhat Mahasarakham University, and 42 teachers and lecturers at Phadungnaree School and Rajabhat Mahasarakham University.

3.5.2. Providing Information from the Application

After presenting and introducing the application, when the user provides information, attitudes, and level of satisfaction to the application. The application performs data synthesis and presents all results to the user.

For example, students enter the attitude toward the key factor. After that, the application calculates the predictive function and introduces the appropriate institution to the student. Another example is that the application provides an overview of the user feedback to the university, each of which factors the institution can use to improve its potential. At the same time, the research team was able to gather information, attitudes and opinions to further improve and develop the research.

3.5.3. Collecting feedback and satisfaction

Gathering feedback and satisfaction levels on the application, the research team has designed and constructed a questionnaire to evaluate and ask satisfaction, which consists of four key areas to ensure compliance with software quality including 1) functional requirement test, 2) functional test, 3) usability test, and 4) security test.

However, user and volunteer participation is strictly voluntary. Apart from the results and the predictions of the application, the participants do not receive any compensation or items for participation. Participants were asked to honestly score statements on a 5-point Likert scale, ranging from 1 to 5, with 1 indicating little to no agreement and 5 indicating high agreement with statements.

3.5.4. Analyze the Level of Satisfaction

At this stage, data analysis from the sample is based on simple statistical analysis, which includes the average and standard deviation. Then analyze the results and summarize key points from the recommendations and suggestions.

4. Results and Discussion

According to the research team has designed the research protocol into five parts, The process has been completed in four stages [5, 7, 24]: 1) defining research problems [24], 2) research design, 3) implementing research and developing tools [5], and 4) integrating research and testing [7]. There is still another important step, the final step is operation, maintenance and evaluation.

Therefore, this section is divided into two parts: reporting on the results of the final stage of the research methodology and discussion topics.

4.1. Results of operations, maintenance and evaluation

The reported results of operations are presented survey results were compiled from four sample groups: 1) high school students, 2) university students, 3) head of institutions, and 4) secondary teachers and university lecturers. It has a variety of views and opinions as summarized in Table V.

Table V. Summary of sample groups

Sample Groups	Number and Source
Gender	228 female (52.90%) and 203 male (47.10%)
High School Students	186 students (43.16%) from Phadungnaree School, Maha Sarakham province, Thailand
University Students	191 students (44.32%) from Rajabhat Mahasarakham University, Maha Sarakham province, Thailand
Head of Institutions	12 school administrators (2.78%) from Phadungnaree School and 10 administrators, department heads and deans from Rajabhat Mahasarakham University.
Secondary Teachers and University Lecturers	42 teachers (9.74%) from Phadungnaree School and lectures from Rajabhat Mahasarakham University.
Total:	431 Samples

From Table V, it shows the details of the sample and the data collected. The data obtained from the survey is based on a

questionnaire with questions on four main perspectives as shown in Table VI.

Table VI. Four main perspectives of the questionnaire

Perspectives and Functions	Sub-topics and Details
Functional Requirement Test	<ul style="list-style-type: none"> • Stage 1: The system's ability to predict and recommend institutions • Stage 2: System capabilities in service and user management • Stage 3: System capabilities in data management • Stage 4: System capabilities in reporting and performance
Functional Test	<ul style="list-style-type: none"> • Stage 5: The accuracy of the results of the processing • Stage 6: The speed of processing of the application • Stage 7: Reliability of the program • Stage 8: Coverage of programs developed for the enterprise
Usability Test	<ul style="list-style-type: none"> • Stage 9: Ease of use and user friendliness • Stage 10: Appropriateness of color, size and font of the application • Stage 11: The appropriateness of using text to describe and convey meaning • Stage 12: The appropriateness of using the symbols or images • Stage 13: Standards and design criteria for the user interface • Stage 14: Appropriateness of interaction with users
Security Test	<ul style="list-style-type: none"> • Stage 15: Controlling access to systems, authorizing, and data access control • Stage 16: System failure prevention and data entry

After designing the questionnaire and conducting the survey on selected samples, survey results are analyzed and summarized in Table VII.

Table VII. Overview of application satisfaction

Perspectives and Functions	Sample Groups				Total:
	High School Students	University Students	Head of Institutions	Teachers and Lecturers	
Functional Requirement Test					
• Stage 1	4.36 (0.51)	4.55 (0.65)	4.33 (0.49)	4.31 (0.52)	4.44 (0.58)
• Stage 2	3.55 (0.57)	4.23 (0.76)	4.00 (0.60)	3.74 (0.59)	3.91 (0.74)
• Stage 3	3.62 (0.55)	4.42 (0.68)	4.00 (0.60)	3.83 (0.58)	4.00 (0.72)
• Stage 4	3.95 (0.28)	4.35 (0.74)	3.83 (0.39)	3.93 (0.51)	4.12 (0.57)
Functional Test					
• Stage 5	4.24 (0.44)	4.42 (0.60)	4.50 (0.52)	4.43 (0.50)	4.35 (0.53)
• Stage 6	4.81 (0.41)	4.50 (0.66)	4.75 (0.45)	4.71 (0.51)	4.66 (0.56)
• Stage 7	3.76 (0.51)	4.33 (0.76)	3.50 (0.52)	3.91 (0.62)	4.02 (0.70)
• Stage 8	3.84 (0.42)	4.33 (0.70)	3.83 (0.39)	3.91 (0.48)	4.06 (0.61)
Usability Test					
• Stage 9	4.90 (0.30)	4.61 (0.64)	4.92 (0.29)	4.98 (0.15)	4.78 (0.50)
• Stage 10	4.59 (0.49)	4.48 (0.59)	4.67 (0.49)	4.50 (0.51)	4.54 (0.54)
• Stage 11	4.12 (0.38)	4.47 (0.60)	4.25 (0.45)	4.10 (0.37)	4.28 (0.52)
• Stage 12	4.00 (0.27)	4.38 (0.67)	4.00 (0.43)	4.14 (0.35)	4.18 (0.53)
• Stage 13	4.76 (0.47)	4.41 (0.70)	4.83 (0.39)	4.69 (0.47)	4.60 (0.61)
• Stage 14	4.54 (0.54)	4.41 (0.67)	4.67 (0.49)	4.50 (0.51)	4.49 (0.60)
Security Test					
• Stage 15	4.18 (0.51)	4.43 (0.66)	3.92 (0.52)	4.17 (0.49)	4.28 (0.59)
• Stage 16	4.21 (0.50)	4.52 (0.64)	4.17 (0.72)	4.19 (0.55)	4.35 (0.60)
Total:	4.22 (0.61)	4.43 (0.67)	4.26 (0.63)	4.25 (0.60)	4.32 (0.65)

From Table VII, it can be seen that the overall satisfaction of the application is at a high level (4.32). The highest satisfaction level was the student in the University, with the satisfaction level at 4.43. The second highest satisfaction level was the group of head of institutions, with the satisfaction level at 4.26. And the lowest level of satisfaction was high school student's satisfaction, at 4.22.

However, the recommendations from the survey can be summarized as important issues, such as how to publish the information to the stakeholders, how to use of data and the results of research into concrete action, future research will be carried out commercially or not, and how to monitor and evaluate learners in the long term.

4.2. Discussion

Refer to research process and research objectives, this research has completed all the stages from problem study to research evaluation. At every stage, the research team publishes the results in a step-by-step manner. All the published research, it has been expertly investigated and reviewed by a specialist. So the research results are truly qualitative, beneficial and useful. However, in the research discussion, the results were based on recommendations from experts who had received research feedback and comments from the participants from the survey to the discussions.

From the feedback and comments, it was found that the recommendations of the experts encouraged the research team to develop in-depth research that related to the research in education data mining. Because, most educators use knowledge-based learning processes for learners, there is a lack of tools that support and track student achievement. While the viewpoint of the general user, it is consistent with the ideas of the experts who need the tools and technology that can support, monitor, and predict students' achievement.

In future research, the research team clearly recognizes the required for substantial studies and development into concrete actions. Research focused on tracking the educational achievement of students at all levels, including the connections and relationships between the boundaries of each education level, resolving dropout rates during education, and increasing the promotion and development of lifelong learning.

5. Conclusions

After the research team has implemented and completed five main processes, including 1) the process of requirement definition, 2) the process of system and software design, 3) the process of implementation and unit testing, 4) the process of integration and system testing, and 5) the process of operation and maintenance.

The information that has been used in the research is composed of four groups: 186 high school students at Phadungnaree School, Maha Sarakham province, 191 university students at Rajabhat Mahasarakham University, 12 deans at Phadungnaree School and Rajabhat Mahasarakham University, and 42 secondary teachers and university lecturers at Phadungnaree School and Rajabhat Mahasarakham University.

The results indicated that the total satisfaction are highest, which is equal to 4.32, and the group with the highest level of satisfaction is group of university students, which is equal to 4.43. It can be concluded that the application is appropriate and it is advisable for students who wish to study at university.

By referring to the purpose of the research, the team can conclude that this research has been very successful. The developed applications are appropriate and should be widely disseminated. In the future, the research team has the idea to use this application to promote sustainable learning that is consistent with the personality of the individual.

Conflict of Interest

The authors declare no conflict of interest.

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