Evaluating the Effectiveness of User’s Interests and User’s Nationality for Cultural Heritage Guidance as Informal Learning

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ABSTRACT

Evaluation is a crucial to determine the feasibility of context-aware mobile learning application in enhancing learning. This study investigates the effect of user’s interests and user’s nationality context in cultural heritage learning escalation. Therefore, we propose an evaluation model based on meaningful learning theory which represented into five characteristics, i.e. constructive, active, authentic, intentional and interactive. The characteristics of the evaluation model are discussed with a special focus on how the contexts can be used for suitable, valuable and enjoyable cultural heritage learning. Then, we conducted an experiment by asking some users to practice with our application namely NaCHL (Nationality-based Cultural Heritage Learning System), follow the learning tasks and write down their feedback after usage. Finally, the result of the analysis shows that the average value of participants who gave agreement with NaCHL is 81.5 percent. It proves the achievement of NaCHL in enhancing learning meaningfully.

KEYWORDS

cultural heritage, context-aware, user’s interests, user’s nationality, meaningful learning.

1 INTRODUCTION

The proliferation of Information and Communication Technology (ICT) opens an opportunity to support visitors to learn cultural heritage objects through mobile devices without time and space limitation. Context-aware mobile learning has been applied in cultural heritage field, especially for informal education [1, 2, 4, 12, 17]. In developing a worthy context-aware mobile learning application, it is necessary to evaluate its effectiveness [7, 8]. The evaluation phase is required to ensure the validity and the value of the application.

Previous works, we built an adaptive cultural heritage learning guidance system by adopting user’s interests [1] and user’s nationality context [2] for serving appropriate information to the users. However, comprehensive and systematic user evaluations were missing, which are crucial to verify the effectiveness of our cultural heritage learning system.

In this study, we developed an evaluation model based on meaningful learning which has five characteristics i.e. constructive, active, authentic, intentional and interactive as measurement instruments. Our assumption, the characteristics are potential to evaluate the effectiveness of our system in enhancing learning.

We then conducted an experiment to assure whether our system, namely Nationality-based Cultural Heritage Learning System (NaCHL) is meaningful in informal education or not and created a questionnaire according to the aforementioned characteristics. Participants are asked to fill out the questionnaire after doing some learning activities via NaCHL mobile application.

The outline of the paper as follows. Section 2 explains what is NaCHL and why NaCHL is needed in heritage tourism as a guidance for enhancing learning in informal education. Some sample scenarios are created to clarify the reason and a UML based model is proposed for further development. Section 3 emphasizes meaningful learning concept as urgent factor to evaluate learning application and introduces five characteristics of NaCHL evaluation model. Section 4 presents the evaluation implementation including the procedure and the results of NaCHL evaluation. Finally, in section 5 we conclude our work and describe the future directions.
2 NATIONALITY-BASED CULTURAL HERITAGE GUIDANCE AS INFORMAL LEARNING

2.1 NaCHL system: Engaging learner through user’s interests and nationality context

Learning is an individual act for acquiring knowledge or skill which may lead to a potential change of attitude or behavior, as a result of the individual’s own experience in his/her interaction with the environment. Informal learning is a type of learning activities which taken outside the curriculum of formal educational institutions and programs and heavily rely on intrinsic motivation [5]. Recently, the marriage between ICT and informal learning in the specific field of cultural heritage is particularly fecund, which means that the institutions of informal education (such as museums and cultural centers) could intensify their ability to attract visitors and involve them in more interesting and meaningful experiences [11].

Cultural heritage is the legacy of tangible, intangible and natural objects from past generations which are considered valuable to be preserved for the future generations. The existence of cultural heritage objects are potential for the development of heritage tourism. Culture has understood as an important marketing tool to attract travelers with special interests in heritage and arts. Heritage tourism is the fastest growing segment of the tourism industry because there is a trend toward an increase specialization among tourists [21]. The trend is triggering a challenge, ‘how to motivate tourists to involve in cultural heritage learning in more interesting and meaningful way according to their special interests by using the support of ICT tools?’.

Context-aware mobile learning seems a promising way to conquer the challenge. It has been applied in the cultural heritage domain to engage user for interesting learning such as serious games [12] and augmented reality [17]. However, due to a wide variety of tourist profiles, considering a personalized experience is important. Facilitating users based on their needs (interests, knowledge, and other personal characteristics) will support for having valuable cultural heritage experience [3]. Cultural heritage categorization i.e. tangible, intangible and natural heritage may become a new invention for attracting tourist’s attention. The categorization could be a reasonable input model that can feed an adaptive system for cultural heritage learning. Tourist as a user/a learner can select heritage objects according to his/her interests.

Other considerations, visitors of the cultural heritage object are local and international visitors. Poria et al. found the link between tourist and heritage object, namely tourist’ perception [20]. It is the perception that the visitors are motivated to visit the cultural object because of emotional reason (feeling of belonging as a part of the heritage). Indirectly, we can assume that local tourists have an emotional relationship to the local heritages. This fact encouraged us to find out how to evoke emotional relationship between international tourists with the local heritages. The idea comes up by involving nationality, a part of tourist perception to attract international visitors for cultural heritage learning. The assumption is people tend to be interested in the objects which have a relationship with their own personality such nationality.

Based on this point of views, we developed an adaptive context-awareness model for providing cultural heritage information based on user’s profile, interests and current location in GPS [1] and extended our work by involving nationality context to engage international visitors to learn the visited cultural object [2]. The interactive learning interfaces were built to facilitate the user to explore deep cultural heritage experiences. The system also is equipped with Multiple Choice Questions (MCQ) as summative assessment which is accessible by learners if they want to know their learning achievement. Our approach opens a new paradigm that the visitor will able to informally learning other country’s cultures in terms of their relationship with visitor’s nationality.

For detail explanation let us see the scenario in figure 1. In scenario 1, a visitor comes to an area X. According to the location, there are 8 heritages are detected. However, based on the input transactions such interests, nationality and visiting purpose, the system selects and presents
4 heritages which are relevant to the input transactions. In this study, the heritage interests are divided into 3 categories, i.e. tangible, intangible and natural heritage. Tangible heritage is divided into four subcategories, i.e. artifacts and monuments, buildings, shrine and work of arts. Intangible heritage is divided into three subcategories; folklore, traditions, language, and knowledge. Natural heritage is divided into two subcategories, i.e. landscapes, and biodiversity.

Scenario 1: A learner is visiting area ‘X’

Suppose the visitor chooses heritage Y from 4 available heritages like figure 2 shows, the system will provide information according to the visiting purpose which has been input before. There are two kinds of visiting purpose, i.e. the visiting & learning purpose which serves the detail information and just visiting purpose which provides the summary information of the selected heritage.

Scenario 2: A learner is choosing cultural object ‘Y’

2.2 Summative assessment through Multiple Choice Question (MCQ)

Assessment is a process of describing, collecting and interpreting information about learning, usually in measurable terms. The goal of the assessment is to determine whether the learner has learning improvement or not. The assessment is distinguished into two, i.e. formative and summative assessment. MCQ is one the several methods of summative assessment. It is suitable for large groups of people and can provide quick feedback. This work, we adopted a summative approach by presenting MCQ as the assessment’s tool. A carefully designated MCQ test will lead to assess learning even at the highest level of Bloom’s Taxonomy of Educational Objectives [15].

Scenario 3: A learner is evaluating his experience

Figure 3 shows the scenario of NaCHL assessment activity. This activity only available if the learner choose ‘Visiting & Learning’ as his/her visiting purpose. As we informed earlier, there are two options to support learner in visiting purpose function i.e. Visiting & Learning and Just Visiting. A bank database of questions will automatically select in randomly by the system according to the related context. The assessment will not become a binding rule. It is optional preference. However, we keep trying to engage user in the assessment activity by involving a variety of interactive questions such images, texts, and their combinations. At the end of the assessment, our system presents the score and the amount number of correct
answer. The learner also obtains feedback on incorrect answers.

2.3 Unified Modeling Language (UML) diagrams of NaCHL

UML is a common language to help developers in describing, specifying and designing software systems by using graphical notations. We describe NaCHL model with UML based approach and present three diagrams i.e. use case diagram, activity diagram and class diagram as it representation.

Figure 4. Use Case Diagrams of NaCHL

Figure 4 describes the interaction between actors and use case. Use case diagram is used to determine the function inside NaCHL and who is entitled to use the function. It contains 3 actors and 12 use cases. The actors are Visitor, Admin, and Google Maps. The functions are Detect Location, User’s Nationality & Interests, Nationality of User, Categories of Cultural Heritage, Visiting & Learning, Just Visiting, Multiple Choice Questions, Result of Cultural Heritage, Manage of Cultural Heritage, Add Cultural Heritage, Update Cultural Heritage, and Remove Cultural Heritage. ‘Detect Location’ is useful for detecting the position of visitor based on Google Maps; ‘User’s Nationality & Interests’ is useful for providing user friendly interface which concern in ‘Nationality of User’ and ‘Categories of Cultural Heritage’; ‘Visiting & Learning’ is useful for learning heritage including taking quiz from ‘Multiple Choice Questions’; ‘Just Visiting’ is useful only for learning heritage without quiz; ‘Result of Cultural Heritage’ is useful for providing information in accordance with the cultural heritage location that has been detected and presented the output in the form of text, images and maps; ‘Manage of Cultural Heritage’ is useful for managing cultural heritage data and it is a generalization of parts of ‘Add Cultural Heritage’, ‘Update Cultural Heritage’ and ‘Remove Cultural Heritage’.

Figure 5. Activity Diagrams of NaCHL

Figure 5 presents the logic procedure of NaCHL from one action to another action. An action is a node on the activity diagram, whereas activity refers to a series of action.

We described our activity diagram as follows: starting from initial state (a black circle notation), the system detect visitor’s location in action node ‘Get Location’ (rounded rectangle notation). Then, visitor performs an activity ‘User’s Nationality, Interests & Visiting Purpose’ to input his/her nationality and heritage categories as his/her interests, and visiting
purpose. The action 'Result of Cultural Heritage' displays text, images, and maps information based on location, nationality, and interests of the user. Furthermore, based on visiting purpose which has been selected before, visitor who select 'Visiting & Learning' action can follow the Multiple Choice Questions quiz activity. Otherwise, 'Just Visiting’ action will return to the action of 'Result of Cultural Heritage'. Finally, action 'Close NaCHL’ denotes the end state of the activity (The black circle that looks like a selected radio button).

Figure 6. Class Diagrams of NaCHL

Figure 6 describes NaCHL structure by showing system’s classes, their attributes, operation (or methods), and the relationship among objects.

The class diagram consists of 6 classes as our conceptual: ‘User’, ‘Location’, ‘Interests’, 'ManageCH’, ‘Questions’, and 'CulturalHeritage'.

The association symbols in our class diagram divided into 3 categories. First, association of 1..* to 1 means one or more instances associated with exactly one instance, for example the association of 'Interests’ class with 'User’ class.

Second, association of 1..* to 1..* means one or more instances associated with one or more instances, for example the association of 'ManageCH’ class with 'CulturalHeritage’ class. Third, association of 1 to 1 means one instance associated with exactly one instance like association of 'User’ class with 'Location’ class.

3 MEANINGFUL LEARNING-BASED EVALUATION
3.1 Principle of Meaningful Learning

Meaningful learning concept is pioneered by David Ausabel which pointed out two necessary things, i.e. (1) the content must be potentially meaningful, and (2) the learner must relate it in a meaningful way to his or her prior knowledge [22].

In other words, meaningful learning is a process of linking a new information that learners acquired which relevant to their own cognitive structures. Not only possess relevant information, learners also can utilize the information to solve problems or understand new concept. It means, the learners can transfer their idea to new idea and new learning situation from their previous information.

There are several studies of the characteristics of meaningful learning such table 1 shows and from those characteristics, we select five characteristics to evaluate NaCHL application as shown in figure 7.

We assume that these characteristics are determinant factors for assessing the effectiveness of NaCHL in enhancing learning. In the following section, the evaluation model is described with a special focus on learning cultural heritage with mobile application as informal education.

3.2 NaCHL Evaluation Method
3.2.1 Constructive

Meaningful learning can occur when learners integrate their new information with their previous knowledge or they set goals for what they need to learn in order to understand what they are observing [9].

This definition is broaden up by Karppinen [16]. He embedded individual concept in constructivist learning and argued that learners have their individual style and strategies for learning. Learning is always influenced by the
Table 1. Studies of Elements of Meaningful Learning

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<tbody>
<tr>
<td>Constructive and Individual</td>
<td>Active</td>
<td>Active</td>
<td>Active</td>
<td>Engaging</td>
<td>Active</td>
</tr>
<tr>
<td>Collaborative and Conversational</td>
<td>Authentic</td>
<td>Authentic</td>
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<tr>
<td>Contextual</td>
<td>Cooperative</td>
<td>Cooperative</td>
<td>Informal Learning</td>
<td>Constructive</td>
<td>Cooperative</td>
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<tr>
<td>Guided</td>
<td>Personalized</td>
<td>Intentional</td>
<td>Interactive</td>
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<tr>
<td>Emotionally Involving and Motivating</td>
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Figure 7. NaCHL Evaluation Framework

Meaningful learning requires learners who are actively engaged in a meaningful task, where they can manipulate objects and parameters of the environment they are working in and observing the results of their manipulations [9]. Getting the learner’s attention is necessary to engage learning. Martin et al. [10] stated that engaging learners in the context can cause meaningfual learning. Emotional context in the learning process able to engage learners [16]. NaCHL is a context-aware mobile learning application. Learner’s interests and perception as part of emotional context become our contexts to motivate learner to play an active role in cultural heritage learning activities. Hence, we choose active as the second element of NaCHL evaluation.

3.2.3 Authentic

Most contemporary research on learning has shown that learning tasks which are situated in some meaningful real-world task or simulated in some case-based or problem-based learning environment are not only better understood but also are more consistently transferred to new situations [9]. Information and communication technology can support meaningful learning through mobile devices. The mobile devices are available to be used in any context, and can draw on those contexts to enhance the learning experience [10]. Visitor who visit a place can acquire a lot of cultural heritage information. NaCHL mobile...
application allows visitors (learners) to maintain their attention according to the interests and nationality contexts as a guidance in cultural heritage learning environment. We emphasis authentic for the evaluation model as the third element.

3.2.4 Intentional

Human acts to fulfill some goals. When learners are actively and willfully trying to achieve a cognitive goal, they think and learn more because they are fulfilling an intention [9]. NaCHL is designated for enjoyable cultural heritage learning which applicable outside the curriculum. Hence, it is categorized as informal learning. Informal learning refers to learning that takes place naturally and without directed effort [10]. Mobile technology is able to work within specific context and learning environment. Hence, it has the ability to increase the ease of informal learning.

There are three forms of informal learning which proposed by [6] i.e. self-directed learning, incidental learning and socialization learning. Self-directed is occurring when the learner intentionally wants to involve in the learning process even before the process begins, and the learner is aware that he/she has learned something. Thus, it intentional and conscious. Rather incidental and socialization learning are unintentional.

When learners use technologies to doing some tasks or to find out the solution of a problem, they are intentional and learning meaningfully [9]. Intentional is chosen as the fourth element of NaCHL evaluation.

3.2.5 Interactive

One way to attract learner’s attention is creating and maintaining interactive interface. Interactive interface can allow learner to direct their own pace of learning, input their own views and ideas [16]. It means that learners has visual and physical interaction through the interface [7].

By using a constructivist development approach when developing educational interactive interface will guide for learning, where the learner is guided towards building his or her own structured knowledge of the content. Interactive allow learners to control what elements are to be delivered and when they are to be delivered through the interface [14]. Hence, providing the effective and easy-to-follow interface in to assist the learner for a deep cultural experience is highly needed. Interactive is selected as the fifth element of NaCHL evaluation.

4 EVALUATION IMPLEMENTATION

4.1 Participants and Procedures

The participants have consisted of 15 adult people with different nationalities; Indonesian (7), Chinese (5), Korean (2), and Japanese (1). The evaluation experiment is conducted within two weeks in the middle of July 2017 at Fukuoka. The participants were invited to do some learning activities via NaCHL mobile application with 5-10 minutes briefly explanation for all the functions in the software. After learning, the participants were asked to fill out a questionnaire to know their perceptions regarding of the feasibility of the system in providing meaningful learning. A participant spent 20-30 minutes to practice the learning application and to fill out the questionnaire. The questionnaire has 13 questions as seen in table 2. The questions are the representation of five elements of the evaluation framework.

<table>
<thead>
<tr>
<th>Table 2. Questions of evaluation</th>
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<tr>
<td><strong>Constructive</strong></td>
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<td>(A1) I can conduct learning based on my interests</td>
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<tr>
<td>(A2) I can learn objects related to my nationality</td>
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<tr>
<td>(A3) The app serves adaptive learning for individual person</td>
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<tr>
<td><strong>Active</strong></td>
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<tr>
<td>(B1) I can play an active role in the learning activity</td>
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<tr>
<td>(B2) I can choose my learning type</td>
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<tr>
<td><strong>Authentic</strong></td>
</tr>
<tr>
<td>(C1) I can conduct learning with authentic environment</td>
</tr>
<tr>
<td>(C2) I can learn related objects in authentic environment</td>
</tr>
<tr>
<td>(C3) The content is presented in understandable way</td>
</tr>
<tr>
<td><strong>Intentional</strong></td>
</tr>
<tr>
<td>(D1) I can check my learning achievement via quiz</td>
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<tr>
<td>(D2) I understand what I have learned</td>
</tr>
<tr>
<td>(D3) The learning served meaningful information</td>
</tr>
<tr>
<td><strong>Interactive</strong></td>
</tr>
<tr>
<td>(E1) The app is using interactive interfaces</td>
</tr>
<tr>
<td>(E2) I enjoyed using the app</td>
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In this experiment, NaCHL system provides cultural heritage information around Dazaifu area. It is a famous city and has dozens of heritage places in Fukuoka prefecture. Figure 8
is showing the sample layouts of NaCHL application.

![Figure 8. The layout of NaCHL](image)

### 4.2 Results and Discussion

The questionnaire is presented into the Likert scales from 1 to 5, i.e. 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree.

The values are indicating the degree of user application acceptance in meaningful learning related to their perceptions.

#### 4.2.1 Constructive Element

Figure 9 exhibits three charts which are the representation of perceptions for constructive element.

![Figure 9. Participants Perception for Constructive](image)

Question A1: 100% participants approve they have learned objects appropriate with their interests. Question A2: 60% participants agree that they are able to learn objects related to their nationality, 26.7% are skepticism and 13.3% are disagree. Question A3: 80% participants admit that NaCHL serves them with adaptive individual learning system.

Even though there are skepticism and disagree opinions, in general participants have positive perceptions which convince that NaCHL is able to satisfy users in the constructive element.

#### 4.2.2 Active Element

Figure 10 shows that NaCHL satisfies users in active perception. It is proven from the graph of question B1 and B2, 80% participants admit that they are playing an active role in NaCHL system.

#### 4.2.3 Authentic Element

Figure 11 describes participants perception related to the authentic element. Question C1: 80.6% participants approve that they conducted learning in the authentic environment, 6.7% are skepticism and 6.7% are disagree. Question C2: 73.3% participants agree that they are able to learn objects related in the authentic environment. Question C3: 60% participants agree that the content in NaCHL is understandable, 20% are skepticism and 20% are disagree.
4.2.4 Intentional Element

Figure 12 presents graphs of participants perception about the intentional element. More than 70% of participants agree that they understand what they learned, they can check their learning achievement and the system serves meaningful information.

4.2.5 Interactive Element

Figure 13 shows that according to question E1 and E2, 93.3% participants have a confession that they enjoyed using NaCHL. It means NaCHL satisfies users in interactive perception.

In summary, according to the chart results of all characteristics, the goal of meaningful learning is achieved. The average calculation of NaCHL evaluation for the agreement perceptions is equal to 81.5%, average disagreement is equal to 3.1% and average skepticism is equal to 15.4%.

Even though the average percentage of disagreement and skepticism can be categorized as lower percentage, we investigate further why the participants conveyed disagree and skepticism perceptions especially for constructive and authentic elements. The reasonable arguments are; the explanation of software functions are too briefly, there is no heritage object related to participant interests and...
nationality, misunderstood with the authentic definition.

5 CONCLUSION AND FUTURE WORKS

5.1 Conclusion

This study presents the feasibility of NaCHL to help learners improve their cultural heritage knowledge in terms of its historical relationship between learner’s country and the visited country. We proposed an evaluation framework which consists of five elements; constructive, active, authentic, intentional, interactive and used these elements to measure the learning effect whether is meaningfully or not. Based on evaluation results, NaCHL is proven feasible for meaningful learning application.

5.2 Future Works

This study provides some future works which have not been covered due to the time limitation. The most important and interesting issues are pointed out as follows:

1. NaCHL application shall be implemented in another country which has rich cultural histories such Indonesia. According to the data from Ministry of Education and Culture of Indonesia in 2015, there are 6238 intangible objects, 434 museums, 979 cultural heritage, 5754 arts, and 7894 belief and traditions [18].

2. Adding more user’s perception context such religion. According to UNWTO (United Nations World Tourism Organization), 300 to 330 million tourists visit the world’s key religious sites every year, with approximately 600 million national and international religious voyages in the world, 40 percent of which take place in Europe [19]. Being key tourism destinations, religious heritage sites not only drive international tourism and economic growth but also provide important meeting grounds for visitors and host communities, making vital contributions to tolerance, respect and mutual understanding between different cultures.

3. NaCHL evaluation is using five characteristics: constructive, active, authentic, intentional, and interactive. However, the other kind of meaningful learning characteristics i.e. cooperative is still uncovered due our focus is personal learning achievement. In the future, we intend to explore this characteristic further.

4. NaCHL application was built on Android platform. It means the application is accessible by the mobile device with Android OS. However, this application might be developed to run on a different platform such IoT and Windows Mobile by using codeshare facilities.

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