Identifying learning effectiveness of context-aware ubiquitous learning with the phenomenological method

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1. Introduction

- Context-aware ubiquitous-learning (u-learning) refers to one kind of e-learning environment, where users interact with the contexts through sensor technology and receive information from mobile devices.

- Learning effectiveness in a web-based learning environment is composed of the learning climate and learner satisfaction (Chou & Liu, 2005), and includes elements such as the whole learning context and learner achievements.
1. Introduction

- To date, most u-learning studies aimed at the applications in different academic and industrial fields (Hwang et al., 2009; Hwang et al., 2010) however, few studies focused on the analysis and formation of learning models in u-learning.

- In order to give a clear theoretical concept of u-learning for future educational research and development, we collected u-learning studies published in 2005-2011, and interviewed 5 u-learning designers; moreover, we analyzed the data and identified the essence in u-learning to initiate a u-learning design model.
2. Relevant Studies on Learning Effectiveness and U-learning

Learning Environments

- U-learning utilizes mobile devices, and the highly personalized nature of such devices fosters a unique platform for developing learner-centered educational experience through personalized information and services (Low & O’Connell, 2006).

- The combination of personalization and contextualization that such system offer has important effects for knowledge acquisition and interaction, since the system provides instant feedbacks to learners, which is valid information in an authentic context and that reinforces the learners’ comprehension of the topics being taught (Zimmermann et al., 2005).
2. Relevant Studies on Learning Effectiveness and U-learning

Learning Strategies

- U-learning has a number of unique learning strategies, such as location-aware learning, collaborative learning and task-aware supervised learning (Shih & Tseng, 2009).

- Cooperation among learners is important, and students that work together can have better learning performance than those that operate alone. Some researchers use GSM (Global System for Mobile Communications) to support cooperative activity awareness (Liu et al., 2008).

- Task-aware supervised learning refers to learning during the process of solving problems. Some researchers argue that the environments used in u-learning have too many parameters, and this may lead to cognitive overloading for learners, since they have to receive information from both the real and digital worlds simultaneously (Hwang et al., 2010).
2. Relevant Studies on Learning Effectiveness and U-learning

Learners’ Memory

- Research shows that a u-learning context where users can control their learning schedule based on their cognitive load is effective for recall of contextual events and supporting memorization (Kawamura et al., 2007).

- Some researchers combine other educational tools, like contextualized blogging with a u-learning context to provide learners with an opportunity to annotate real world contexts based on their personal perspectives with the hope that the real application context enable knowledge transfer and reinforce internalized long-term memory (De Jong et al., 2007).
2. Relevant Studies on Learning Effectiveness and U-learning

Learning Achievement

Table 1. Learning Achievement in Different U-learning Applications

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Learning Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>learning with ubiquitous games</td>
<td>improving English listening and speaking (Liu &amp; Chu, 2010)</td>
</tr>
<tr>
<td>conducting complex science</td>
<td>achieving more systemic and economic learning (Hwang et al., 2009)</td>
</tr>
<tr>
<td>science experiments</td>
<td></td>
</tr>
<tr>
<td>learning in museums</td>
<td>utilizing the learning resource more efficiently (Chiou et al., 2010)</td>
</tr>
<tr>
<td>learning outdoor natural science</td>
<td>promoting creativity (Liu, Tan, &amp; Chu, 2009)</td>
</tr>
<tr>
<td></td>
<td>improving learners’ ability to explore new knowledge (Tan et al., 2007)</td>
</tr>
</tbody>
</table>
2. Relevant Studies on Learning Effectiveness and U-learning

Learning Motivation

- The following features of u-learning all enhance the likelihood that students will have increased and prolonged learning motivation:
  - The **novel learning devices**, like smartphones, attract learners’ attention (Liu et al., 2008).
  - The **hyperlinks** give more relevant resources to users who want to know more about a specific topic (Chen & Chao, 2008).
  - The **varied resources** offered promote learner creativity (Liu et al., 2009).
  - The combination of **collaborative learning** enhances learning efficiency (Tan et al., 2007).
3. Research Questions

- The purpose of the study was to find out the essence in u-learning from the u-learning designers’ understanding and experiences. The following research questions (RQ) were formulated to achieve the purpose of this study:

**RQ 1: What components of learning effectiveness can be identified in u-learning?**

**RQ 2: From the identified components of learning effectiveness in u-learning, what is the learning design model for u-learning?**
4. Method

1. Breaking the Phenomenon
   • The researchers read u-learning studies to identify the major contributors of u-learning effectiveness.

2. Collecting Interview Data
   • We invited 5 people who have experiences in u-learning designs to participate in this study.

3. Identifying Meaningful Statements
   • We analyzed empirical data and highlighted the claims from participants’ experiences.

4. Giving Meanings to those Statements
   • We sorted the meanings and gave correspondence based on categorical aggregation.

5. Creating Thick Descriptions
   • We synthesized the data in order to develop categorized information and shed light on the contributions.

Outcome
   • We summarized the main points and initiated a learning design model for u-learning.

Figure 1. The Research Design Based on Randolph’s (2009) Phenomenological Method
4. Method - Procedure

(1) Bracketing the Phenomenon

Before the interviews were conducted, the researchers read u-learning studies to identify the major contributors of u-learning effectiveness. The researcher collected 22 studies, which were conducted from 2005 to 2011 and were relevant to u-learning (see Appendix A), and identified the learning effectiveness in the u-learning phenomenon.

Moreover, the researchers had the experiences in participating and designing the u-learning projects, from the researcher experiences, we bracketed the learning effectiveness in the u-learning phenomenon into two phrases: the external input through u-learning systems and the internal learning frame from learners’ perspective (Liu & Hwang, 2010).
4. Method - *Procedure*

(2) Collecting Interview Data

<table>
<thead>
<tr>
<th></th>
<th>Participant 1</th>
<th>Participant 2</th>
<th>Participant 3</th>
<th>Participant 4</th>
<th>Participant 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Age</td>
<td>29</td>
<td>26</td>
<td>23</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>Educational Level</td>
<td>a Ph. D. candidate</td>
<td>a master student</td>
<td>a master student</td>
<td>a Ph. D. candidate</td>
<td>a master student</td>
</tr>
<tr>
<td>Majors</td>
<td>u-learning &amp; m-learning (mobile learning)</td>
<td>u-learning &amp; m-learning</td>
<td>m-learning</td>
<td>e-learning</td>
<td>e-learning</td>
</tr>
<tr>
<td>Months in U-learning Design</td>
<td>48 months</td>
<td>24 months</td>
<td>18 months</td>
<td>24 months</td>
<td>8 months</td>
</tr>
</tbody>
</table>

Note: The differences among 3 types of majors (u-learning, m-learning, and e-learning) are based on the ideas from Liu and Hwang’s paper in 2010.
4. Method - *Procedure*

(3) Identifying Meaningful Statements

- **Step 1: Immersion in the Data** (Patton, 2002): To understand each participants’ experiences of the u-learning design, the researcher listened to the MP3-recordings repeatedly and noted the meaningful statements about u-learning, including keywords and ideas.

- **Step 2: Sorting the Transcriptions** (Löfmark, Morberg, Öhlund, & Ilicki, 2009): The researcher sorted the meaningful statements into the different categories based on the relevancy.
4. Method - *Procedure*

(4) *Giving Meanings to those Statements*

- In this stage, the researcher adopted categorical aggregation (Stake, 1995) to categorize the similar statements and gave correspondences.

(5) *Creating Thick Descriptions*

- The last step in phenomenological method is to give thick descriptions from interviewees’ lived experiences to describe the essence from the phenomenon. In this study, the researchers synthesized the data in order to develop categorized information and shed light on the contributions.
5. Results

Theme A: Personalized Learning Environments

- From the interview data, the meaningful statements were identified by the researcher. The meaningful statements are “recording personal learning process”, “receiving personalized feedback”, and “controlling their learning process”.

- The record of learning process, which includes learning assessments and learning progress, and individualized feedback (such as location-aware feedback and adaptive feedback) enable learners control their learning schedule or set up their learning goals.
5. Results

Theme B: Strategy-Driven Learning

- Collaborative learning strategies, task-based learning strategies, and situational learning strategies are appropriate for the u-learning design, since the u-learning system gives instant information to learners and it is convenient for learners to share their knowledge. Moreover, the situational strategies are utilized in the u-learning setting, since the u-learning system can construct an authentic learning environment for learners and help learners in receiving procedural knowledge.
5. Results
Theme C: U-learning and Learners’ Memory

- The arrangement of the activities and the anchored instructions increase learners’ frequency of interaction with the environment, and affect learners’ recall. Moreover, the functions of the u-learning system improve learners’ memory, such as the record function and the multimedia input.
5. Results
Theme D: Learning Achievement

- The design of learning activities increases learners’ cognitive load and forces learners to pay more attention to the activities, and then affects their learning achievement. As to the authentic environment, the learning achievement would not be enhanced without the construction of wireless Internet and the sensor technology.
5. Results

**Theme E: Learning Motivation**

- In the initial learning stage, learners’ motivation is triggered by the learning gadgets, and knowing the meaning of the learning activity helps learners in getting a clear concepts for the activity. To list learners’ motivation, the well-designed learning contents and competition among peers are crucial.
6. Discussion

RQ 1: What components of learning effectiveness can be identified in u-learning?

- The emphasis on personal needs distinguishes u-learning from classroom-based learning, and learners become more self-directed in u-learning, and the learning effectiveness is not only from their process of pursuing their personal learning goals based on their accumulated knowledge, but also from their self-regulation.

- Our finding indicated that u-learning allows learners receive real information, which is appropriate for collaborative and task-based learning strategies, and the significance of collaboration in a u-learning activity is based on giving real time learning information and engaging in discussions with peers (Liu, Tao, & Nee, 2008).
6. Discussion

RQ 1: What components of learning effectiveness can be identified in u-learning?

- U-learning activities are designed for task-aware and task-based learning and thus specific knowledge elements are provided to the learners (Hwang et al, 2010). The task-aware and specific knowledge elements increase learning effectiveness by lowering the cognitive load faced by.

- With contextual interaction improving the effectiveness of recall (De Jong et al, 2007), the participants stated that the appropriate framework of the learning design, includes coherent tasks and a learning portfolio, help learners in recall.

- The key step in moving knowledge from the short-term to long-term memory is related to mastering a task.
6. Discussion

RQ 1: What components of learning effectiveness can be identified in u-learning?

- The wireless Internet allows learners access to instant feedback (Kai et al, 2010), as well as exchange information and share their reflections, and they construct their knowledge with peer supports, and learners thus obtain more chances to clarify any ambiguities they encounter.

- Learners perceive themselves do not have the relevant experiences in engaging u-learning activities, and the u-learning gadgets and designs arouse learners’ motivation. Once they are familiar with u-learning, knowing the learning purpose makes them perceived the meaning of their learning goal, and promotes their motivation (Keller, 2008).
6. Discussion

RQ 2: From the identified components of learning effectiveness in u-learning, what is the learning design model for u-learning?

![Learning Design Model for U-learning](image)

Phrase 1. The External Input from U-learning

Phrase 2. The Internal Learning Frame from Learners in U-learning
7. Conclusion

This study presents a learning model and the main factors of learning effectiveness in u-learning, and it is believed that u-learning can improve learning effectiveness and that educators can benefit from the analysis of u-learning designs. Through these new learning activities, multiple learning dimensions, like site-learning or language learning, are expected to develop and allow learners to engage in more interesting and effective learning environment.

For future studies, it is suggested that a similar approach be used to examine learners’ experiences within the u-learning setting, and researchers are encouraged to explore the relevant essence or parameters in the applications of u-learning, such as interoperability, with regard to both learners’ perspectives and their lived experiences.
Questions & Comments

Thank you for your listening!

photo by Po-chung Chang