Demonstration of Mobile Learning Studies in Specific Disciplines from Research Design Aspects

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Key to the success for implementing mobile learning research

- Determine a good research topic
  - Knowing the features of mobile technologies
  - Knowing what have been done
  - Finding a research topic with innovations

- Proper experimental design
  - Determining participants, measuring tools and experimental procedure

- Good presentation of research results
Evidences from Previous Mobile and Ubiquitous Learning Studies in seven SSCI journals in 2008-2012

- Selected SSCI journals
  - Educational Technology & Society (ETS)
  - Computers & Education (C&E)
  - British Journal of Educational Technology (BJET)
  - Innovations in Education and Teaching International (IETI)
  - Educational Technology Research & Development (ET R&D)
  - Journal of Computer Assisted Learning (JCAL)
  - Interactive Learning Environments (ILE)

- In 2008-2012, there were 214 papers related to mobile learning out of 2674 e-learning studies.
Number of mobile learning studies published from 2008 to 2012

Most previous studies have reported that

- Mobile learning is helpful to students in improving their learning achievements
- Mobile learning is helpful to students in promoting their learning motivation
- Mobile learning is helpful to students in increasing their learning interests
Add innovations to m-learning studies

- **Leading in new technologies** (e.g., AR, wearable devices)
- **Investigating seldom-discussed issues** (e.g., problem-solving ability, behaviors)
- **Proposing or Leading in new strategies or tools** (e.g., problem-posing strategies or knowledge construction tools, or both)
- **Applying m-learning approaches to seldom-considered subjects** (e.g., gifted students, working adults, students with different learning styles)
- **Applying m-learning approaches to seldom investigated domains** (e.g., art, design, business, chemistry, physics, nursing education, and enterprise training)
Suggestions to researchers 1/3

- Designing a series of research topics based on your superiorities
  - such as the theories, methodologies, courses or technologies you are familiar with
- For example, the topic of my PhD dissertation is related to “repertory grid”
  - Repertory grid as a Mindtool for improving students’ m-learning performances in natural science courses
  - Repertory grid as a Mindtool for improving students’ m-learning performances in nursing courses
  - A collaborative repertory grid approach....
  - A repertory grid-based gaming approach to supporting in-field mobile learning activities
Suggestions to researchers 2/3

- Knowing and using the existing measures or questionnaires in your research designs
- Frequently adopted measures or questionnaires for mobile learning
  - Learning motivation, learning attitudes, self-efficacy
  - Cognitive load
  - Awareness of problem solving, critical thinking, communication, collaboration and creative thinking
  - Cognitive styles and learning styles
- Measuring students’ learning achievement is usually needed
Suggestions to researchers 3/3

- Carefully designing an experiment to show the effectiveness of your approach

- A “meaningful” experimental group
  - The learning strategy is new (in the application)
  - The researchers know why the learning strategy could benefit the students in the mobile learning activity (not a test-water trial).

- A “reasonable” control group
  - The students are fairly treated (e.g., time, teacher)
  - The students learn with a conventional and quality approach
Leading in new technologies
Effects of an Augmented Reality-based Educational Game on Students’ Learning Achievements and Attitudes in Real-World Observations

- A competition game (i.e., board game) is implemented.
- Students are asked to throw a dice to determine how many steps to move in the game.
• Each gaming location is associated with a real-world learning targets.
• When player arrive at a location, a corresponding gaming task (i.e., a question or a mini game) is presented.
Gaming mission: find the imago of this butterfly

Scanning QR-code when finding the target

Completed mission

Uncompleted mission

Gaming mission summarization graph
In some particular gaming location, the players are asked to play mini-games (e.g., AR-based shooting and matching game); for example, they need to fight the enemies of specified butterflies.

Via the AR technology, virtual targets are presented in the relevant ecology area.
Experimental design

Instruction for basic knowledge of butterflies and the use of the AR-based mobile learning system

Pre-test and pre-questionnaire

Experimental group (n=30)

AR-based mobile gaming approach

Control group (n=27)

AR-based mobile learning approach

Post-test

Post-questionnaire
Experimental Results

Descriptive data and ANCOVA of the post-test results

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Adjusted Mean</th>
<th>Std.Err or.</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
<td>30</td>
<td>51.23</td>
<td>13.25</td>
<td>50.76</td>
<td>1.98</td>
<td>2.24*</td>
</tr>
<tr>
<td>Control group</td>
<td>27</td>
<td>43.78</td>
<td>11.53</td>
<td>44.31</td>
<td>2.09</td>
<td></td>
</tr>
</tbody>
</table>

*<p> <0.05

`t-test result of the students’ attitudes toward science learning

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group</td>
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<td>4.45</td>
<td>0.60</td>
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<tr>
<td>Control group</td>
<td>23</td>
<td>4.06</td>
<td>0.68</td>
<td></td>
</tr>
</tbody>
</table>

*p <0.05
Discussion

- Similar approach can be applied to other courses in universities, such as science, social science, language, art and design courses.
- The real-world learning environment can be a museum, scientific park, laboratory, factory, or ecological area.
Other new technologies

- The Internet of things
- Wearable technologies (e.g., google glasses)
- Body signal detecting devices
- Educational robots
- Personalization or adaptive mechanisms
- Learning diagnosis and recommendation mechanisms
Investigating new or seldom-discussed issues
Behavioral patterns and tendency toward critical thinking and problem solving after learning with mobile games

- Location: Campus of an elementary school

- Measuring students’
  - learning achievements
  - learning motivation
  - behavioral patterns
  - tendency toward critical thinking and problem solving
The real-world learning environment

A real-world learning park, in which each plant is a gaming target in the game.

Observe the real world targets

Scans a QR code to obtain information of the target

Observe follow the gaming contexts
The gaming interface

Location of the students

A gaming target associated with a plant in the real world

Current score of each group

Prompt of the gaming task

Discussion forum
Description of the gaming task

The comparisons of Algal Blooms and Eutrophication.
Example of the guidance for a learning team during the gaming process

- **Hint for guiding the students to observe**
- **Complete the observation**
- **Agree with the answer**

The answer proposed by the group members.
The Experiment Procedure

101 sixth graders from 4 classes

Learn basic concepts of Biodiversity

Take pre-test and questionnaires

Experimental group

Mobile gaming approach

Control group

Conventional mobile learning

Receive post-test, questionnaires and interview
Experimental results

- The mobile gaming approach improved the students’
  - learning achievement
  - intrinsic motivation
  - tendency toward critical thinking and problem solving
<table>
<thead>
<tr>
<th>Code</th>
<th>Behavior</th>
<th>Description</th>
<th>Example</th>
<th>Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Selection of a task</td>
<td>Scan a QR-Code and start a new gaming task.</td>
<td>Choose the stage of the “Hostile Water”.</td>
<td>Touch a “game stage” button</td>
</tr>
<tr>
<td>S2</td>
<td>Field observation</td>
<td>Observe the key characteristic of the creature or environment.</td>
<td>Please pay attention to the growth of algae and the color of the water.</td>
<td>Touch a blue shield</td>
</tr>
<tr>
<td>S3</td>
<td>Clue search</td>
<td>Obtain some key clues.</td>
<td>Please observe the circumstance of the territorial waters, including surface waters and deep waters.</td>
<td>Contact a sage</td>
</tr>
<tr>
<td>S4</td>
<td>Comparison</td>
<td>Observe a comparative creature or environment with counter characteristic.</td>
<td>Please scan the QR code next to the aquarium in the natural science classroom.</td>
<td>Touch a red shield</td>
</tr>
<tr>
<td>S5</td>
<td>Data search</td>
<td>Start a web search engine.</td>
<td>Look for the solutions to the problem on the Internet</td>
<td>Touch a crystal ball</td>
</tr>
<tr>
<td>S6</td>
<td>Reading supplementary materials</td>
<td>Provided with the relationship between the creature and environment.</td>
<td>Illustrates the relationship between Algal Blooms and Eutrophication</td>
<td>Read a treasury</td>
</tr>
<tr>
<td>S7</td>
<td>Review the task</td>
<td>Review the task of the stage.</td>
<td>Please explain the cause or effect of eutrophication</td>
<td>Contact an owl</td>
</tr>
<tr>
<td>S8</td>
<td>Pose a method</td>
<td>Submit an answer.</td>
<td>Reducing phosphates</td>
<td>Press the “submit” button</td>
</tr>
<tr>
<td>S9</td>
<td>Correctly recognize a creature / environment</td>
<td>Correctly answer a multiple-choice question of the basic relationship between the creature and environment.</td>
<td>What is the color of the water with eutrophication?</td>
<td>Submit a right answer</td>
</tr>
<tr>
<td>Code</td>
<td>Behavior</td>
<td>Experimental group (n)</td>
<td>Mean</td>
<td>Control group (n)</td>
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<tr>
<td>------</td>
<td>----------------------------------------------------</td>
<td>------------------------</td>
<td>------</td>
<td>-------------------</td>
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<tr>
<td>S1</td>
<td>Selection of a task</td>
<td>350</td>
<td>7.00</td>
<td>357</td>
</tr>
<tr>
<td>S2</td>
<td>Field observation</td>
<td>155</td>
<td>3.10</td>
<td>40</td>
</tr>
<tr>
<td>S3</td>
<td>Clue search</td>
<td>66</td>
<td>1.32</td>
<td>45</td>
</tr>
<tr>
<td>S4</td>
<td>Comparison</td>
<td>95</td>
<td>1.90</td>
<td>30</td>
</tr>
<tr>
<td>S5</td>
<td>Data search</td>
<td>109</td>
<td>2.18</td>
<td>58</td>
</tr>
<tr>
<td>S6</td>
<td>Reading supplementary materials</td>
<td>140</td>
<td>2.80</td>
<td>184</td>
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<td>S7</td>
<td>Review the task</td>
<td>85</td>
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<td>1</td>
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<td>S8</td>
<td>Pose a method</td>
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<td>312</td>
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<tr>
<td>S9</td>
<td>Correctly recognizing a creature / environment</td>
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<td>357</td>
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<tr>
<td>S10</td>
<td>Correctly comparing a creature / environment</td>
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<td>7.00</td>
<td>357</td>
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<tr>
<td>E1</td>
<td>Lack of patience</td>
<td>10</td>
<td>0.20</td>
<td>26</td>
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<tr>
<td>E2</td>
<td>Trial and error</td>
<td>15</td>
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<td>24</td>
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<tr>
<td>E3</td>
<td>Incorrectly identifying a creature / environment</td>
<td>57</td>
<td>1.14</td>
<td>80</td>
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<tr>
<td>E4</td>
<td>Incorrectly comparing a creature / environment</td>
<td>113</td>
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<td>125</td>
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<td>E5</td>
<td>Suspending the learning activity</td>
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<td>0.00</td>
<td>0</td>
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<td></td>
<td>Total</td>
<td>2384</td>
<td>47.68</td>
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<td>Variable</td>
<td>Group</td>
<td>N</td>
<td>Mean</td>
<td>S.D.</td>
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<tr>
<td>-------------------------------</td>
<td>-------</td>
<td>----</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Field observation</td>
<td>Exp</td>
<td>50</td>
<td>3.10</td>
<td>2.88</td>
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<td></td>
<td>Con</td>
<td>51</td>
<td>0.78</td>
<td>1.06</td>
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<tr>
<td>Clue search</td>
<td>Exp</td>
<td>50</td>
<td>1.32</td>
<td>1.35</td>
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<tr>
<td></td>
<td>Con</td>
<td>51</td>
<td>0.88</td>
<td>1.28</td>
</tr>
<tr>
<td>Comparison</td>
<td>Exp</td>
<td>50</td>
<td>1.90</td>
<td>2.48</td>
</tr>
<tr>
<td></td>
<td>Con</td>
<td>51</td>
<td>0.59</td>
<td>0.88</td>
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<tr>
<td>Data search</td>
<td>Exp</td>
<td>50</td>
<td>2.18</td>
<td>2.18</td>
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<tr>
<td></td>
<td>Con</td>
<td>51</td>
<td>1.14</td>
<td>1.28</td>
</tr>
<tr>
<td>Reading supplementary materials</td>
<td>Exp</td>
<td>50</td>
<td>2.80</td>
<td>3.80</td>
</tr>
<tr>
<td></td>
<td>Con</td>
<td>51</td>
<td>3.61</td>
<td>3.12</td>
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<tr>
<td><strong>Total</strong></td>
<td>Exp</td>
<td>50</td>
<td>11.30</td>
<td>6.73</td>
</tr>
<tr>
<td></td>
<td>Con</td>
<td>51</td>
<td>7.00</td>
<td>4.74</td>
</tr>
</tbody>
</table>

**p < 0.01; ***p < 0.00**
Experimental group’ behavior transfer relationships
Control group’ behavior transfer relationships
Differences between the learning behaviors of the two groups

- The experimental group had the significant behavioral sequence S1 (select a task) \(\rightarrow\) S2 (observe) and S8 (propose an answer) \(\rightarrow\) S2
  - They interacted more with the real-world targets after receiving a task than the control group.

- The control group had S8 (propose an answer) \(\rightarrow\) S6 (read materials) and E2 \(\rightarrow\) E2
  - They tended to read “supplementary materials” after posing an answer.
  - They frequently had “trial and error” actions.
Discussion

Similar approach or other learning analytics methods can be applied to the learning activities of other courses if one the following item is recorded:

- The students’ logs of using the learning system
- The dialogues between students and teachers
- The students’ learning diaries, annotations or works
- The articles submitted by the students
Other issues to be investigated

- Students’ question-raising ability
- Students’ question-answering ability
- Students’ higher order thinking performances (e.g., critical thinking, problem solving, and creativity)
- Students’ performances of collaboration and communication
- Students’ conceptions and strategies of learning
Leading in new strategies or tools
The Interactive Concept Mapping approach for mobile learning

- Educators have indicated that awareness and reflection can help develop students’ meta-cognition to enhance their learning
  - It is important to provide feedback mechanisms to engage students in reflective thinking

- A concept mapping approach with an instant feedback mechanism is proposed to support in-field mobile learning
  - In traditional concept mapping approach, it might takes several days or a week for teachers to evaluate students’ concept maps and provide feedback
Developing concept maps based on the knowledge learned from the text books

Observing in the field and revising concept maps

Concept map comparison and feedback mechanism

Supplementary materials

Teacher’s concept map

Computer classroom
Mobile Learning Studies in Specific Disciplines from Research Design Aspects
Hint: Are you sure that the relationship “pupas belong to chrysalis” is correct?

Press the “GO” button to access the supplementary materials.
One of the problematic propositions

Submit the modification request

Original proposition

Modified proposition

“Modify” bottom

1st Concept

2nd Concept

Relationship
Teachers conduct traditional teaching

Pre-test and pre-questionnaire

Experimental group (n=15)  Control group (n=15)

Interactive concept map-oriented mobile learning
Conventional concept map-oriented mobile learning

Post-Questionnaire

Post-test

Teachers conduct traditional teaching

Pre-test and pre-questionnaire

Experimental group (n=15)  Control group (n=15)

Interactive concept map-oriented mobile learning
Conventional concept map-oriented mobile learning

Post-Questionnaire

Post-test

Teachers conduct traditional teaching

Pre-test and pre-questionnaire

Experimental group (n=15)  Control group (n=15)

Interactive concept map-oriented mobile learning
Conventional concept map-oriented mobile learning

Post-Questionnaire

Post-test
Table 1. $t$-test result of the post-test scores

<table>
<thead>
<tr>
<th></th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Mean</td>
<td>76.00</td>
<td>66.80</td>
</tr>
<tr>
<td>SD</td>
<td>9.92</td>
<td>13.51</td>
</tr>
<tr>
<td>$t$</td>
<td>2.12*</td>
<td></td>
</tr>
<tr>
<td>$d$</td>
<td>0.78</td>
<td></td>
</tr>
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</table>

* $p < .05$

Table 2. $t$-test result of the concept map scores rated by the two teachers

<table>
<thead>
<tr>
<th></th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Mean</td>
<td>47.53</td>
<td>33.4</td>
</tr>
<tr>
<td>SD</td>
<td>16.23</td>
<td>12.15</td>
</tr>
<tr>
<td>$t$</td>
<td>2.69*</td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$

Table 3. $t$-test result of the students’ attitudes toward science learning before and after the activity

<table>
<thead>
<tr>
<th>Attitudes toward</th>
<th>Experimental group (N=15)</th>
<th>Control group (N=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>$t$</td>
</tr>
<tr>
<td>Before</td>
<td>5.12 (0.64)</td>
<td>3.66*</td>
</tr>
<tr>
<td>After</td>
<td>5.54 (0.48)</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05
SPSML (Scaffolding Participatory Simulation for Mobile Learning)

- Help students learn conceptual knowledge in the classroom.
- Goal-based and scaffolding approaches to participatory simulations are integrated into the design to enhance students’ experiential learning.
  - Students are situated in augmented reality by playing different participatory roles in mobile simulations in the micro-world on the mobile device
  - Students interact with people in the real world to enhance understandings of conceptual knowledge
- An experiment was conducted in the computer algorithms course of a university in Japan
Participatory simulation

- Participatory simulations provide models of real world settings for students to construct knowledge through active participation in learning activities (Klopfer & Squire, 2008; Patten et al., 2006).
- Context-aware participatory simulation encourages more active participation and interaction among students.
- Students “do not just watch the simulation, they are the simulation” (Naismith, 2004, p.13).
The SPSML framework

Configure
Feedback
Teacher
Assessment
Give tasks

Participatory Simulation

Tasks
Objectives
Roles
Rules
Initial

Concrete experience
Scaffolding Fading
Observe and reflect
Abstract conceptualization
Testing in new situations

Play a role
Collaboration
Learners

Mobile Learning Studies in Specific Disciplines from Research Design Aspects
Step 1 - Initial process

- The teacher set up rules and participant roles to configure the system.
- The teacher explain to the students the general ideas of concepts to be learned in face-to-face classrooms.
- The teacher explain the learning objectives of the activity and how to use the system on their mobile devices.
Step2 - Concrete experience

- The teacher assigns different tasks and roles for individual students to play in the simulation.
- Students start experiencing and acting.
- The m-learning system guides the students to do the tasks and provide assistance if necessary.
Step 3 - Observation and reflection

- The students carry out discussions and reflections.
- They reflect on (a) what they have learned, and (b) how well they have understood, and what else they want to learn.
Step 4 - Abstract conceptualization

- The student experience in the participatory simulation is recorded and converted to a video for review.
- This step helps the students transform their learning experience and construct conceptual knowledge to achieve their learning goals.
Step 5 - Testing in new situations

- The students try out the concepts in their real life situations to deepen their understanding of the conceptual knowledge.
Experiment design

- Forty-one graduate students participated in the study.
  - Experimental group (N=21): sorting algorithm learning system with participatory simulation
  - Control group (N=20): sorting algorithm learning system

- They need to learn four sorting algorithms via the m-learning system: bubble sort, insertion sort, selection sort, and quick sort.
(A) teacher

- Help message
- Error check
- ASC

Sorting: Select it pls
People number: Select it pls

OK  Cancel  Save  Next

(B) student

User Name: user1
LOOP: 0

Your Num:
Position: P1

From the first compare with the neighbor while not in descending order

P1  P2  P3  P4  P5  P6
86  60  79  98  54  50
Example of the Quick sort simulation

- The system generates a set of numbers randomly and sends them to the students.
- All the students stand in a line with a mobile device, which displays their numbers and positions in a table, and also displays the Pivot.
- The system guide the students to chance position following the quick sort algorithm
- The system evaluate the change of positions and send an error message if the change is done incorrectly.
- The teacher turns on the option with error checking and help messages, and the students can discuss with each other, so it is in the scaffolding mode.
### Experimental results

<table>
<thead>
<tr>
<th></th>
<th>Group</th>
<th>N</th>
<th>MAR(%)</th>
<th>SD</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bubble Experiment</td>
<td>21</td>
<td>93.29</td>
<td>5.60</td>
<td>0.95</td>
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</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>91.35</td>
<td>7.34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insertion</td>
<td>21</td>
<td>90.33</td>
<td>7.91</td>
<td>1.25</td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>86.85</td>
<td>9.94</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selection</td>
<td>21</td>
<td>89.35</td>
<td>8.99</td>
<td>1.78</td>
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</tr>
<tr>
<td>Control</td>
<td>20</td>
<td>83.10</td>
<td>12.84</td>
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<td></td>
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<td>Quick Experiment</td>
<td>21</td>
<td>81.86</td>
<td>10.12</td>
<td>9.73**</td>
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<tr>
<td>Control</td>
<td>20</td>
<td>52.30</td>
<td>9.29</td>
<td></td>
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</tr>
</tbody>
</table>

*Note. N: Number of students; MAR: Mean of Accuracy Rate; SD: Standard Deviation; ** p<0.01*
Percentage of each type of scaffold used by the students in the experiment group

- Discussion: 48%
- Illustration: 16%
- Hint: 12%
- Point out mistakes: 21%
- Teacher’s help: 3%
Other possible learning strategies

- Inquiry-based learning
- Problem-based learning
- Project-based learning
- Peer assessment
- Question posing
- Other forms of Mindtools (e.g., spreadsheets, simulation software)
- The integration of the above
Applying m/u-learning approaches to particular users/learners
Analysis of a ubiquitous performance support system for teachers

- Develop of a Ubiquitous Performance Support System from Teachers’ aspect (UPSST)
- An iterative process of analysis, design, development, and evaluation was conducted.
- Two high-school homeroom teachers were the initial users during the development process of UPSST.
- Twelve teachers were recruited for evaluating the functions and interface design of the UPSST.
Developed by taking the daily routines, special needs, and working environments of homeroom teachers into account.
Interface of the “student record” function
- based on the students’ learning diary, communication book, and their behaviours the in class

Add record
Name
Date

Time: 10AM
Location: Student Affairs Office
Problem: Learning difficulty
Method: Interview
Results
Personal issues: Physiological problems; accidents; complex peer relationships; family tensions, etc.

Schooling/social factors:
- Influence of inappropriate information
- complex peer relationships
- resistant to discipline
- bad interpersonal relationships

Other factors: other
Student responses: full cooperation
Counselling results: keeping monitoring

□ Negative family atmosphere
□ bad parent-child interaction
□ insufficient discipline
□ difficult economy
□ overly high expectations of parents
□ no stable dwelling
Illustrative example of the “conduct-record management” function

UPSS is reminding you: A student was late for school today. There were 0 students scoring below standard this week. No special incidents. No more reminders.
Illustrative example of the “academic-record management” function

The student’s test scores for Chinese, English, Mathematics, Social Science, Biology, Art and P.E. for two exams.

The student’s test scores for two exams in comparison with the scores of the classmates.

The student’s score is 34 points lower than the average score of the students who scored in the bottom 1/2 group in the most recent test.
Percentages of 12 homeroom teachers’ agreement levels on the survey items (% this is a study conducted in 2009)

<table>
<thead>
<tr>
<th>Item Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Agree+ Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The schedule function is useful for time management.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>16.67%</td>
<td>41.67%</td>
<td>33.33%</td>
<td>75.00%</td>
</tr>
<tr>
<td>2. The UPSST can help teachers detect students’ unusual academic performance.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>16.67%</td>
<td>50.00%</td>
<td>25.00%</td>
<td>75.00%</td>
</tr>
<tr>
<td>3. With the UPSST, teachers can better understand students’ behaviour in school.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>0.00%</td>
<td>41.67%</td>
<td>50.00%</td>
<td>91.67%</td>
</tr>
<tr>
<td>4. The graphic representations in the UPSST are helpful for comprehending data instantly.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>0.00%</td>
<td>41.67%</td>
<td>50.00%</td>
<td>91.67%</td>
</tr>
<tr>
<td>5. The UPSST is valuable for managing the data of student counselling.</td>
<td>8.33%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>58.33%</td>
<td>33.33%</td>
<td>91.67%</td>
</tr>
<tr>
<td>6. The UPSST facilitates the communication with parents.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>41.67%</td>
<td>41.67%</td>
<td>8.33%</td>
<td>50.00%</td>
</tr>
<tr>
<td>7. The UPSST can help novice or practicing teachers become experienced more quickly.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>16.67%</td>
<td>41.67%</td>
<td>33.33%</td>
<td>75.00%</td>
</tr>
<tr>
<td>8. The function of sending reminders can reduce information loads.</td>
<td>8.33%</td>
<td>8.33%</td>
<td>16.67%</td>
<td>41.67%</td>
<td>25.00%</td>
<td>66.67%</td>
</tr>
<tr>
<td>9. Overall, the UPSST can improve the performance of homeroom teachers.</td>
<td>9.09%</td>
<td>0.00%</td>
<td>27.27%</td>
<td>45.45%</td>
<td>18.18%</td>
<td>63.64%</td>
</tr>
<tr>
<td>10. The graphic and text representations are consistent.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>25.00%</td>
<td>33.33%</td>
<td>33.33%</td>
<td>66.67%</td>
</tr>
<tr>
<td>11. I can easily find the function I need.</td>
<td>8.33%</td>
<td>0.00%</td>
<td>33.33%</td>
<td>41.67%</td>
<td>16.67%</td>
<td>58.33%</td>
</tr>
<tr>
<td>12. It is easy to navigate between pages.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>8.33%</td>
<td>50.00%</td>
<td>33.33%</td>
<td>83.33%</td>
</tr>
<tr>
<td>13. The screen layout is intuitive.</td>
<td>0.00%</td>
<td>9.09%</td>
<td>27.27%</td>
<td>45.45%</td>
<td>18.18%</td>
<td>63.64%</td>
</tr>
<tr>
<td>14. The messages are simple and clear.</td>
<td>0.00%</td>
<td>8.33%</td>
<td>0.00%</td>
<td>58.33%</td>
<td>33.33%</td>
<td>91.67%</td>
</tr>
<tr>
<td>15. Overall, the UPSST is easy to operate.</td>
<td>8.33%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>66.67%</td>
<td>25.00%</td>
<td>91.67%</td>
</tr>
</tbody>
</table>
It should be noted that…

- In 2009, the limitations of mobile computing devices, such as small screen sizes and inconvenient input and output methods could be the reasons prohibiting teachers from accepting the use of mobile technology in school settings.

- The situation could be quite different nowadays.
Training courses for knowing the equipment and environment of Intensive Care Unit (ICU) in hospitals

- The learners of the mobile learning system are the family of the patients in ICU.

- The objectives of the study
  - to reduce the anxiety of the family during the patients’ recovery process.
  - to help the family learn to take care of the patients.
Main menu of the interactive e-book

- Rules in the sickroom
- Equipment
- Take care of the patient
Menu of the "rules of the sickroom"
住院須知

探病時間
上午10:30 ~ 11:00；下午17:00 ~ 17:30；
晚上19:30 ~ 20:00 除依病人特殊情況，可有探病會客外，逢客客會客時間，家屬請勿進入
讓病人能獲得充分休息

探訪前
1. 請先洗手，按床號由護理中收取隔離衣，
請勿穿著時在戶外
2. 請關閉行動電話，並請注意說話音量，
互相尊重病室安寧的需求以免影響病床

病房規則
住院須知

儀器設備

安撫病人

探病須知
休息室須知
感染管制

Hospitalisation
Video
text
图中显示了几个仪器设备的图像，包括脉搏氧合器、呼吸器和静脉输液泵。图中还标注了心率HR、血压BP和呼吸频率Resp的正常范围。心率范围为60-100（平均72），血压范围为120/80，呼吸频率范围为16-18次/分。图片展示了这些设备在移动学习中的应用，特别适合于医学领域的特定学科从研究设计方面进行学习。
Assessment and feedback - multiple choice question

From who will you take advice when requiring medicine and nutrition suggestions?

(A) 護士 (B) 營養師 (C) 藥師
Assessment and feedback - matching question

Find the name of each equipment
Assessment and feedback- re-ordering question

The correct procedure of hand washing
Perceived usefulness of the family of patients

<table>
<thead>
<tr>
<th>group</th>
<th>N</th>
<th>mean</th>
<th>S.D.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>34</td>
<td>4.25</td>
<td>0.44</td>
<td>2.105*</td>
</tr>
<tr>
<td>Control</td>
<td>46</td>
<td>4.00</td>
<td>0.58</td>
<td></td>
</tr>
</tbody>
</table>

*P<.05
Perceived ease of use of the family of patients

<table>
<thead>
<tr>
<th>group</th>
<th>N</th>
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<th>S.D.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>34</td>
<td>4.27</td>
<td>0.64</td>
<td>2.022*</td>
</tr>
<tr>
<td>Control</td>
<td>46</td>
<td>3.97</td>
<td>0.68</td>
<td></td>
</tr>
</tbody>
</table>

*P<.05
Other issues related to the characteristics of learners

- M-learning performances of the students with different cognitive/learning styles
- M-learning performances of gifted students (i.e., mathematics, language or art)
- M-learning performances of high/low learning anxiety/achievement/motivation students
Applying m-learning approaches to seldom investigated domains
A Prompt-based Annotation Approach to Conducting Mobile Learning Activities for Architecture Design Courses

- One objective of architecture design courses is to foster students the ability of designing buildings with the features specified by the teacher.

- Students need to observe the features of specified buildings (e.g., churches in 18 century) before designing the building.
In traditional architecture design activities, in addition to taking photos of the target buildings, students need to take notes on printed materials.

It is difficult to organize the collected information (i.e., photos and notes) during the field trip.
The proposed approach

- A prompt-based annotation approach is proposed for supporting in-field architecture design activities.
- An experiment was conducted by assigning 56 freshmen randomly to an experimental group and a control group.
Prompt-based Annotation Approach

Learning sheet

Chartres Cathedral

夏特爾教堂以其巨大華麗之玫瑰窗著稱，請拍照並說明其玫瑰窗設計之特徵。

Camera

Take photos and annotations

Save annotations

Annotations by students

在夏特爾的另一項特色，則是由玫瑰窗搭配尖頂長窗的組合，透過圖像故事、奉獻者形象、聖母故事等作為主題。
Prompt-based annotation mobile learning system

- Student profile
- Annotation database
- Learning material database

Annotation system
- Photo-acquiring and note-taking unit
- Prompting unit

Learning system
- Discussion area
- Learning material browsing area
- Homework area
Mobile Learning Studies in Specific Disciplines from Research Design Aspects
Mobile Learning Studies in Specific Disciplines from Research Design Aspects
Figure 3. Diagram of experiment design

Mobile Learning Studies in Specific Disciplines from Research Design Aspects
Post-test scores

- The post-test consisted of five design items for the “architecture design” dimension with a perfect score of 100.
- For each design item, the students needed to design a part (e.g., windows or doors) of an example of Gothic architecture and describe the conception and innovation of their work.

Table 1. The $t$-test result of the post-test scores of the two groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>$t$</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test</td>
<td>Experimental group</td>
<td>28</td>
<td>77.89</td>
<td>5.16</td>
<td>2.70*</td>
<td>0.71</td>
</tr>
<tr>
<td></td>
<td>Control group</td>
<td>23</td>
<td>73.96</td>
<td>5.21</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05
Two-way ANOVA of the students’ self-efficacy
Other seldom-investigated domains

- Art courses
- Medical or nursing courses
- Mathematics
- Chemistry
- Physics
- Astronomy
- Business courses
Check list of a research design

- What is the innovation and contribution in this study?
  - New strategy, application, subjects or issues?
- What are the learning content and objectives (e.g. course unit)?
- Who are the participants or subjects of the experiment (e.g., age, grade, number, gender)?
- What are you going to measure? What are your research questions?
- Why do you think your approach could be effective?
Practice
Design a mobile learning research by referring to the mobile learning studies presented in the seminar and workshop

- The course and selected unit
- Objectives of the unit
- Research questions (what to measure)
- Subjects (background of the students)
- The role of mobile or other technologies
- The learning strategy or tool adopted
- How can the strategy/tool benefit the students?
- What is the experimental procedure? Control group and experimental group
Questions and Answers