Key to the success of e-learning studies- Strategies of finding innovative research topics

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Criteria for implementing successful research of e-learning

- **Determine a good research topic**
- Have a proper experimental design
- Write a quality paper to present the research findings and implications
- Submit the paper to a suitable journal

A paper is directly rejected owing to the following reasons:

- **No innovation (i.e., no academic contribution)**
- Problematic experimental design
- Out of the scope of the journal
- Poor written
- Failing to follow the format or rules (e.g., length limitation) of the journal

Key to the success of a study- adding innovations to the study

Two problems:

- **How to Judge whether a research topic is innovative or not?**
- **How to find innovations for our studies?**

A simple test

- Examples of research projects approved by MOST in 2010

謝X隆	從WEB 2.0到WEB 3.0：資訊科技對學習動機、歷程與評量的影響 **From Web2.0 to Web 3.0: Impacts of information technologies on students' learning motivation, learning process and performances**
陳X溥	遊戲式學習之動機設計與成效評估 執行起迄： **20100801～20130731** **Motivation-oriented Design and performance evaluation for game-based learning**
邱X慧	導入「惡魔代言人（故意唱反調的人）」角色對學童參與線上合作論證及發展論證能力的影響 執行起迄： **20100801～20110731** **Impacts of the lead-in of Demon spokesperson (a character who always proposes opposite opinions) on young students' participation in collaborative argumentation and development of argumentation ability**
洪X昭	iPhone之互動式行動學習系統遊戲開發計畫 執行起迄： **20101001～20110930** **Development of iPhone-based interactive mobile gaming systems**

魏X貞	數位化幼兒情緒能力發展系統檢測平台建置及效益評估 執行起迄： **20100801～20110731** **Implementation and evaluation of an emotional intelligence assessment platform for preschool children**
莊X嚴	認知風格對數位遊戲中推理能力訓練之影響 執行起迄： **20100801～20130731** **Impacts of students' cognitive styles on their reasoning performances in digital games**
林X鏘	運用眼動分析於無所不在擴增實境數位學習系統之使用性評估 執行起迄： **20100801～20110731** **The Usability Evaluation of Employing Eye Movement Analysis in AR-based Digital Learning System**
林X志	擴增實境融入之教學發展與成效評估 執行起迄： **20100801～20110731** **Evaluating the effectiveness of incorporating AR into teaching design**

Add innovations to e-learning studies

- Adopting **new technologies** (e.g., IOT, wearable devices) or **using technologies in an innovative way** (AR in flipped classrooms)
- Proposing **new learning strategies** or **using the existing strategies in new contexts** (e.g., concept map-based gaming approach)
- Applying e-learning approaches to **seldom-considered subjects** (e.g., gifted students, working adults, students with different high anxiety)
- Applying e-learning approaches to **seldom investigated domains** (e.g., art, design, business, nursing education, and enterprise training)
- Investigating **seldom-discussed issues** (e.g., problem-solving ability, reasoning performance, learning behaviors)

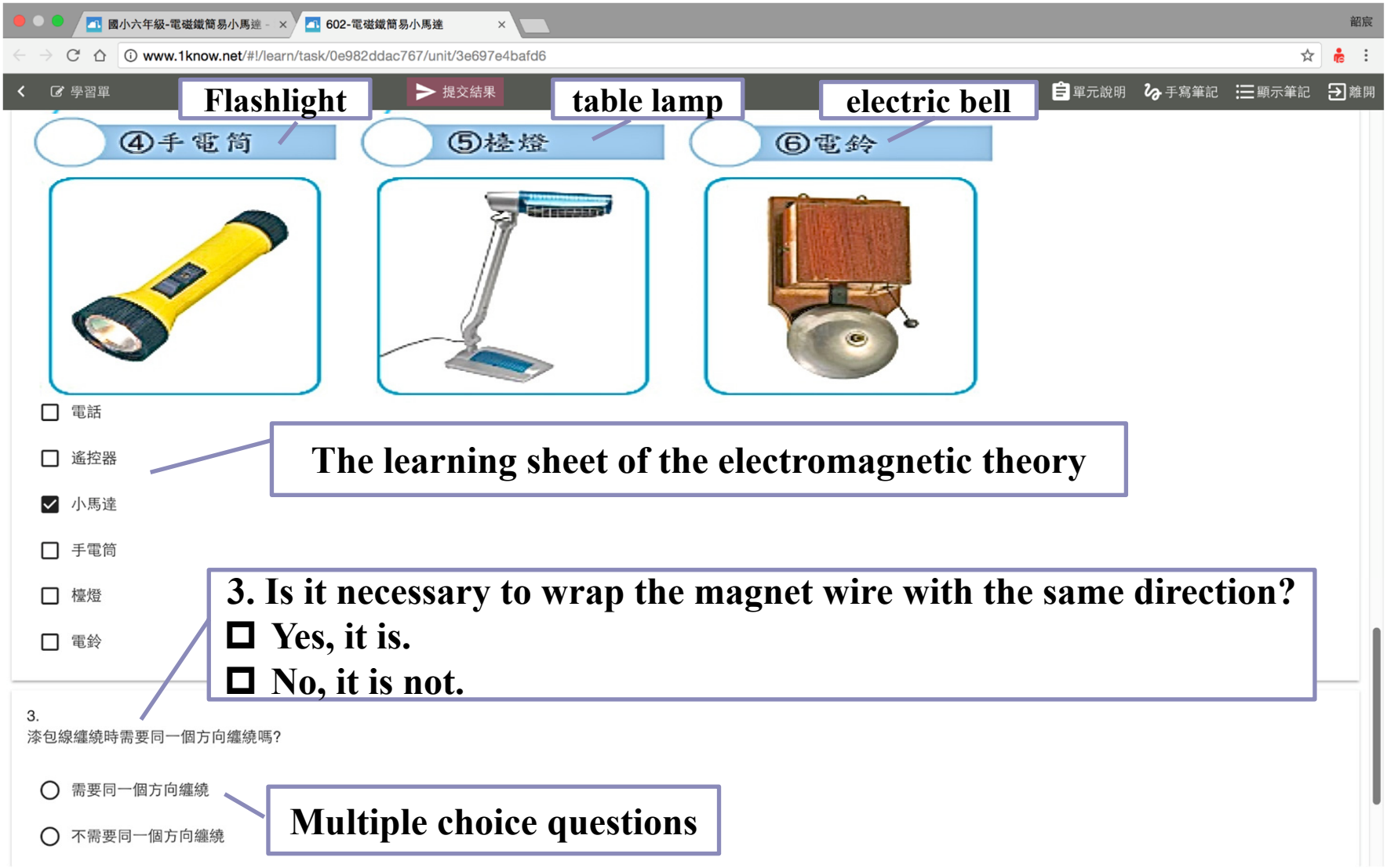
Impacts of an augmented reality-based flipped learning guiding approach on students' scientific project performance and perceptions

- Course unit: magnetic force
- **A combination of AR + flipped learning**
- In-class team-based learning activity: develop a motor
- Evaluating students' learning achievement, **critical thinking tendency, group self-efficacy**, motivation and cognitive load

Chang, S. C., & **Hwang*, G. J.** (2018). Impacts of an augmented reality-based flipped learning guiding approach on students' scientific project performance and perceptions. *Computers & Education, 125*, 226-239.

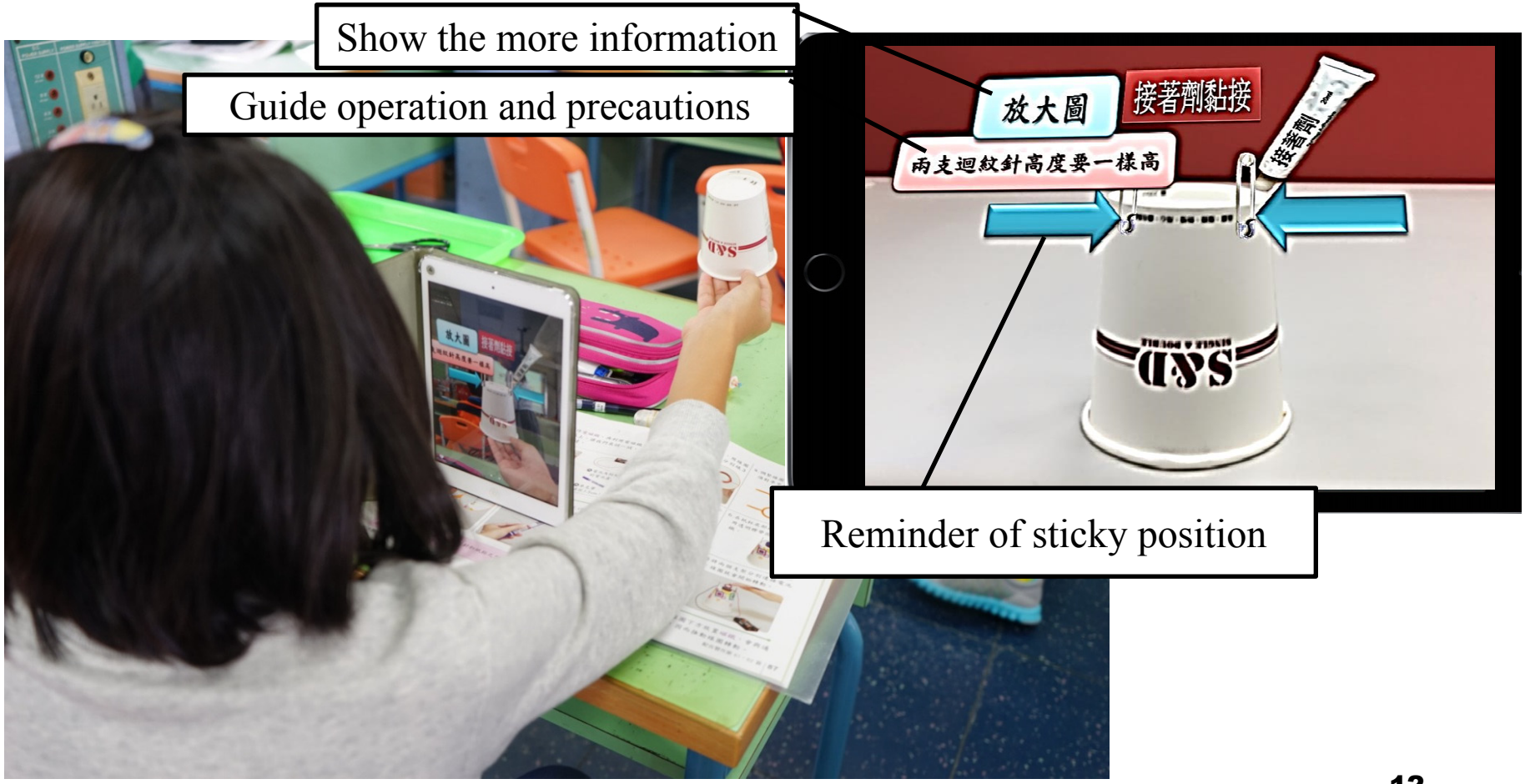
Before-class: watching instructional videos- electromagnetic theory and the process of developing a motor

Before-class: complete a learning sheet



In-class (control group): develop a motor following the instruction of a mobile learning system

In-class (experimental group): develop a motor following the instruction of an AR system




AR information showing the current flows of the real object
按下開關並輕推線圈，線圈就會開始轉動。

Results- learning motivation

	Group	N	Mean	SD	Adjusted Mean	SE	*F*
Post-test	Experimental Group	56	4.04	0.66	4.10	0.88	139.00***
	Control group	55	2.63	0.61	2.56	0.89	

***$p<.001$

Results- Critical thinking tendency

	Group	N	Mean	SD	Adjusted Mean	SE	*F*
Post-test	Experimental Group	56	4.07	0.75	4.13	0.10	95.66***
	Control group	55	2.65	0.71	2.59	0.11	

***$p<.001$

Results- Group self-efficacy

	Group	N	Mean	SD	Adjusted Mean	SE	*F*
Post-test	Experimental Group	56	4.12	0.71	4.17	0.84	57.75***
	Control group	55	3.30	0.57	2.24	0.85	

***$p<.001$

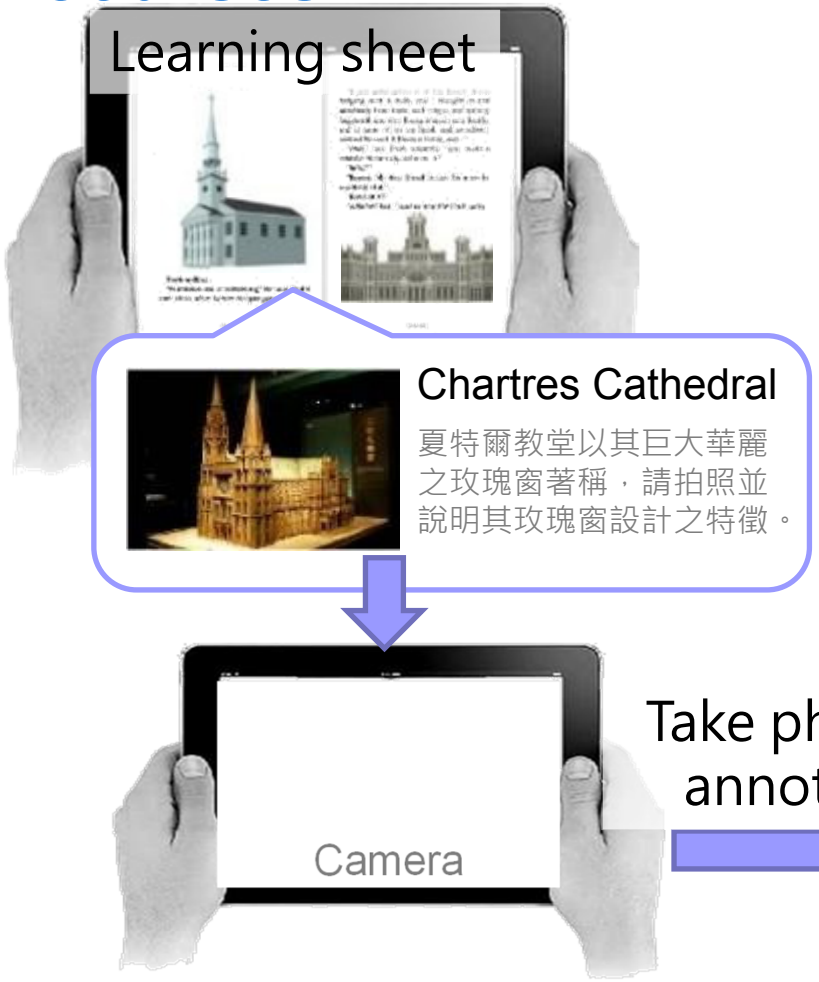
An Interactive Concept Map Approach to Supporting Mobile Learning Activities for Natural Science Courses

- proposing an **interactive concept map approach** for mobile learning
  - The students are asked to submit a concept map developed based on their observations in the field
  - The m-learning systems instantly provides hints or guidance to the students

Hwang, G. J., Wu, P. H., & Ke, H. R. (2011). An interactive concept map approach to supporting mobile learning activities for natural science courses. *Computers & Education, 57*(4), 2272-2280. (SSCI)

Provide instant comments on students' concept maps

A prompt-based annotation approach to conducting mobile learning activities for architecture design courses



Sung, H. Y., **Hwang*, G. J.**, Liu, S. Y., & Chiu, I. H. (2014). A prompt-based annotation approach to conducting mobile learning activities for architecture design courses. *Computers & Education, 76*, 80-90. (SSCI)

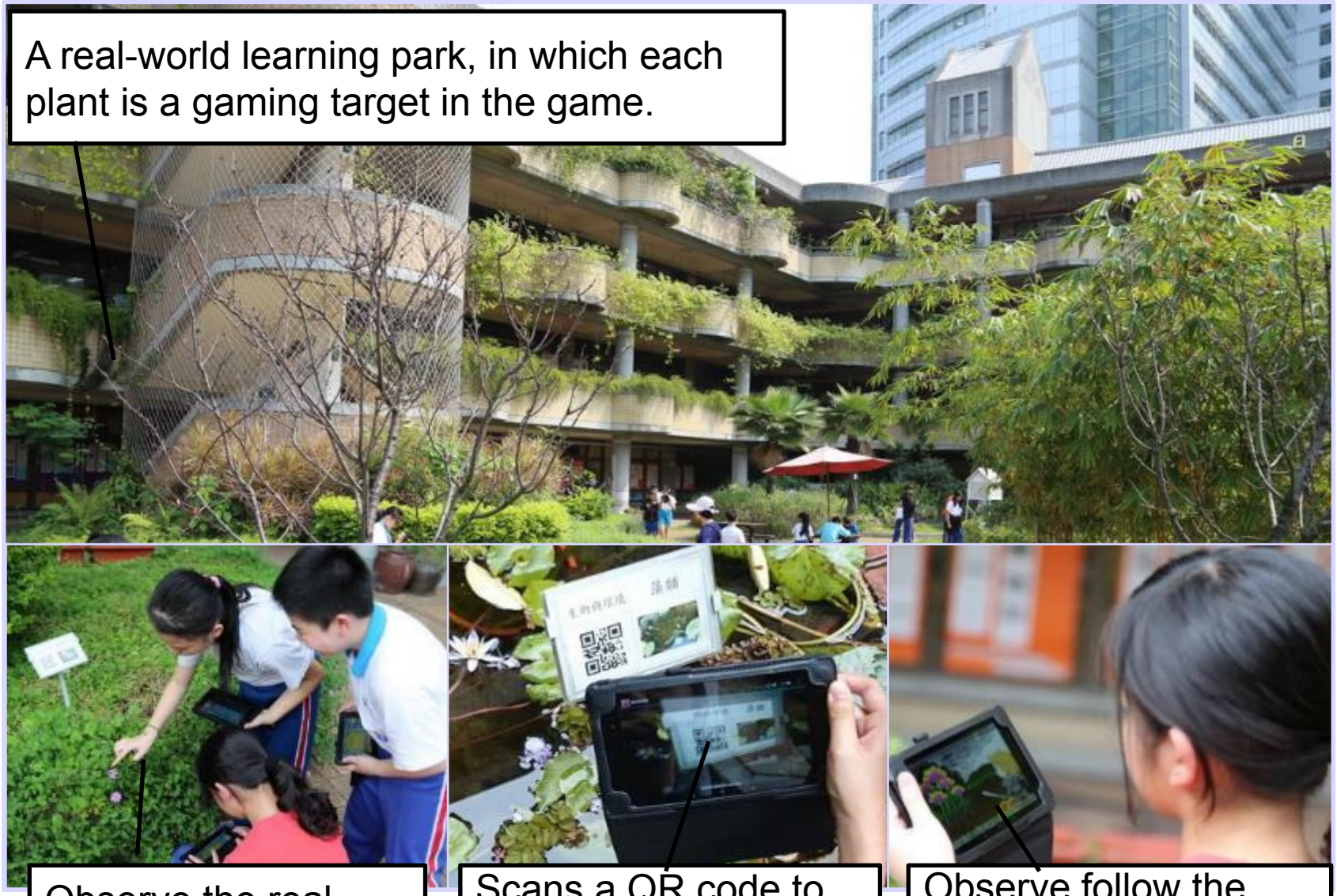

夏特大教堂

Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving

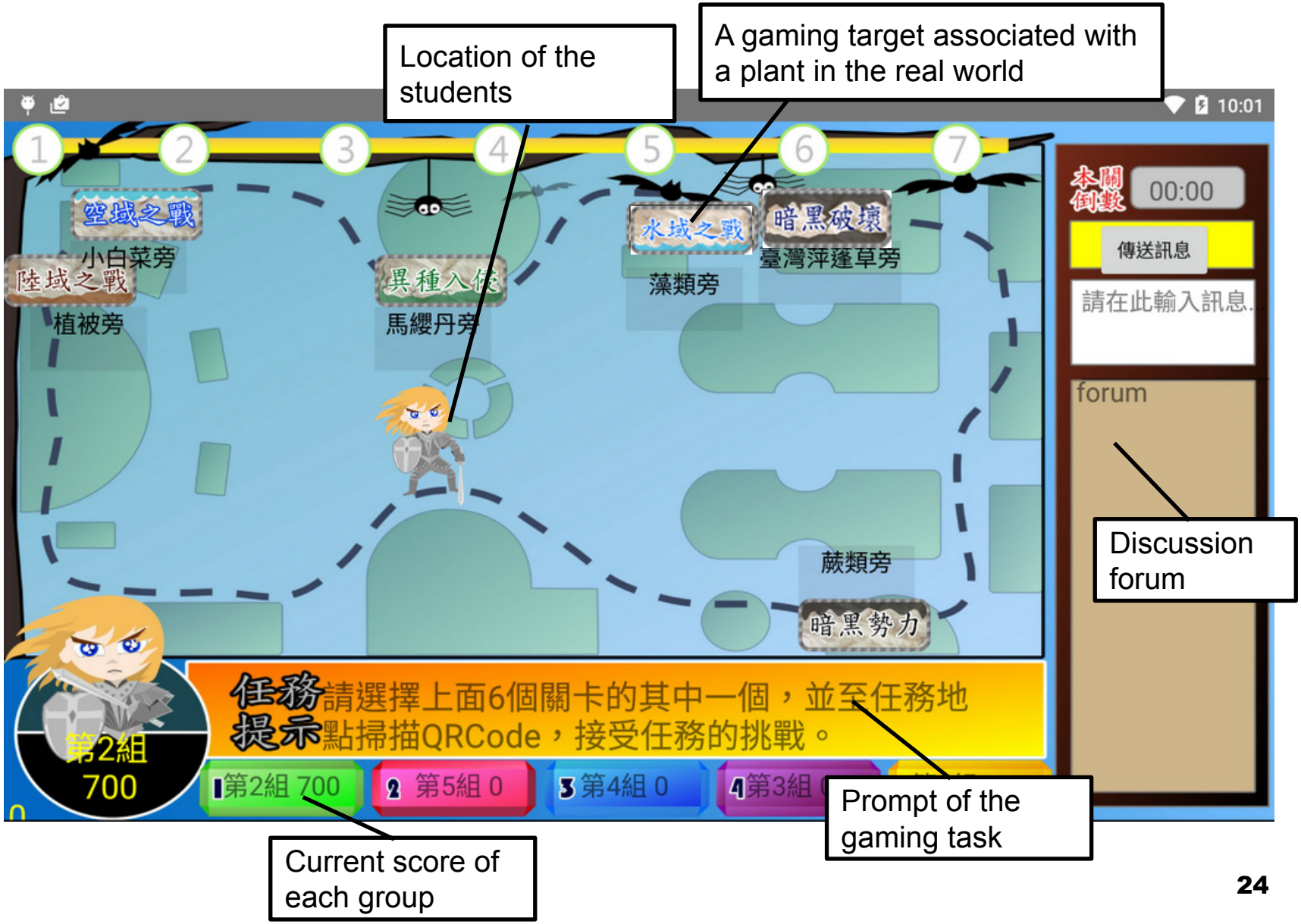
- Location: Campus of an elementary school
- Measuring students'
  - learning achievements
  - learning motivation
  - **behavioral patterns**
  - **tendency toward critical thinking and problem solving**

Hwang, G. J., & Chen, C. H. (2016). Influences of an inquiry-based ubiquitous gaming design on students' learning achievements, motivation, behavioral patterns, and tendency towards critical thinking and problem solving. *British Journal of Educational Technology,48*(4), 950-971. **(SSCI)**

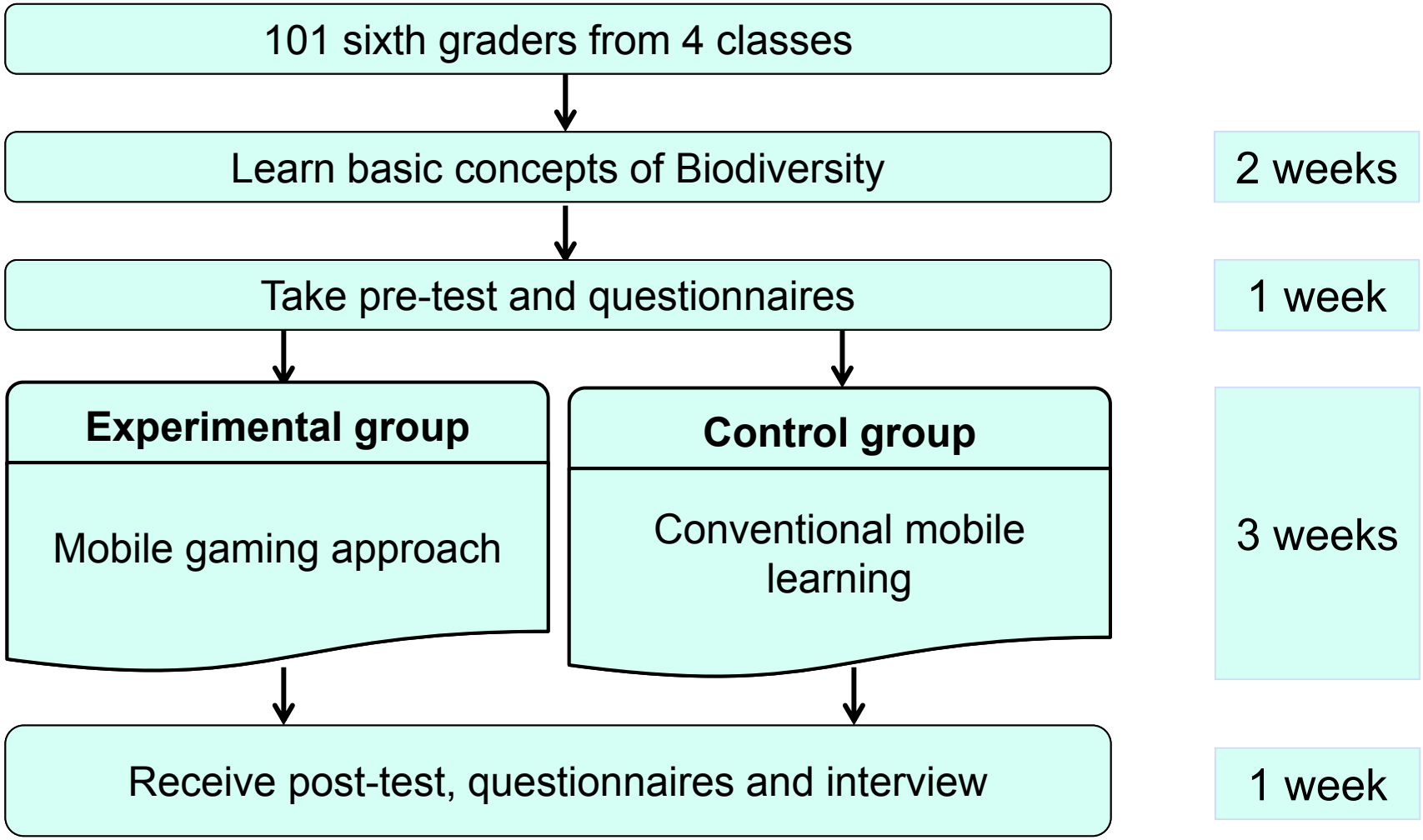
The real-world learning environment



The gaming interface



The Experiment Procedure



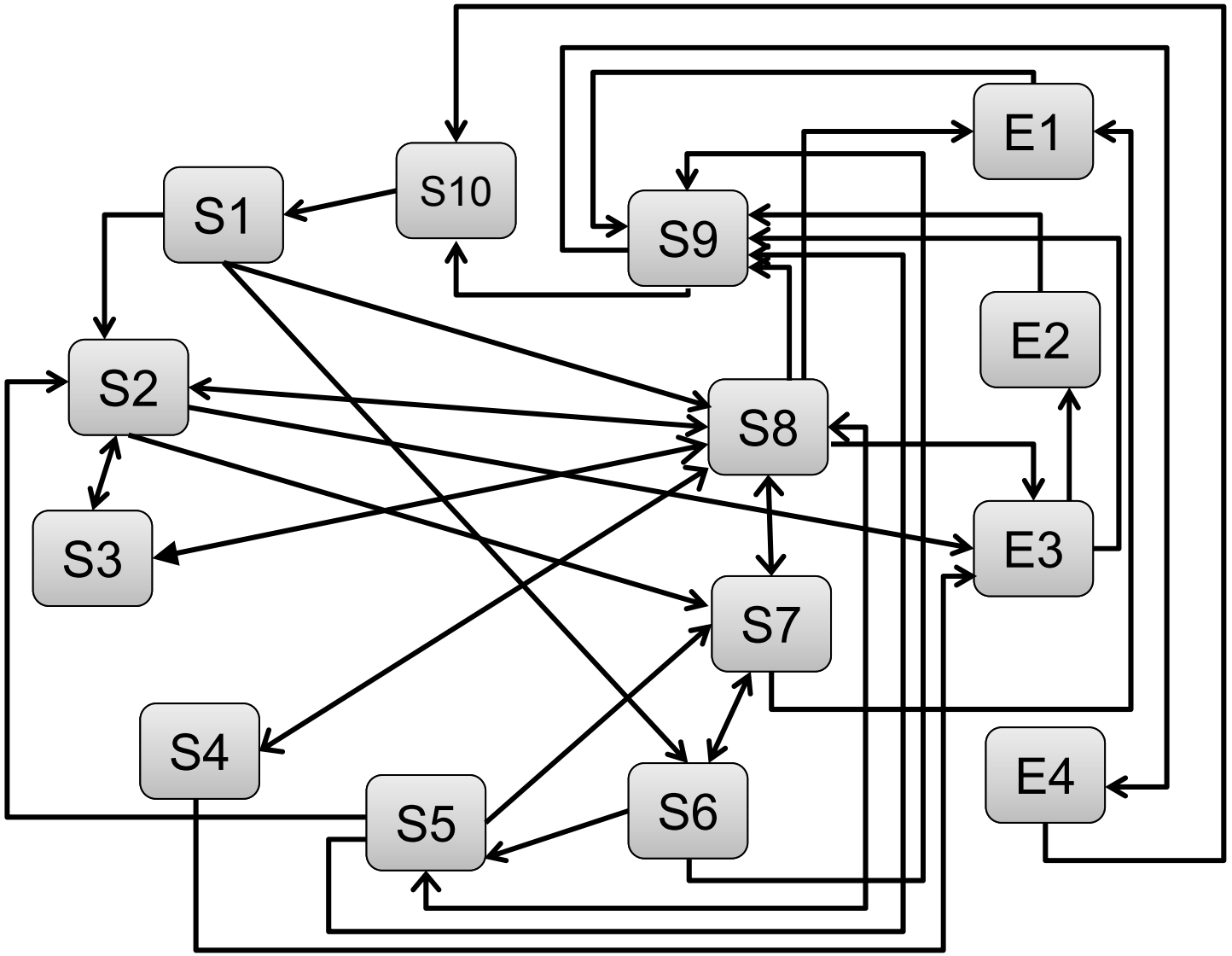
Code	Behavior	description	Example	Record
S1	Selection of a task	Scan a QR-Code and start a new gaming task.	Choose the stage of the “Hostile Water”.	Touch a “game stage” button
S2	Field observation	Observe the key characteristic of the creature or environment.	Please pay attention to the growth of algae and the color of the water.	Touch a blue shield
S3	Clue search	Obtain some key clues.	Please observe the circumstance of the territorial waters, including surface waters and deep waters.	Contact a sage
S4	Comparison	Observe a comparative creature or environment with counter characteristic.	Please scan the QR code next to the aquarium in the natural science classroom.	Touch a red shield
S5	Data search	Start a web search engine.	Look for the solutions to the problem on the Internet	Touch a crystal ball
S6	Reading supplementary materials	Provided with the relationship between the creature and environment.	Illustrates the relationship between Algal Blooms and Eutrophication	Read a treasury
S7	Review the task	Review the task of the stage.	Please explain the cause or effect of eutrophication	Contact an owl
S8	Pose a method	Submit an answer.	Reducing phosphates	Press the “submit” button
S9	Correctly recognize a creature / environment	Correctly answer a multiple-choice question of the basic	What is the color of the water with eutrophication?	Submit a right answer

Code	Behavior	Experimental group (n)	Mean	Control group (n)	Mean
S1	Selection of a task	350	7.00	357	7.00
S2	Field observation	155	3.10	40	0.78
S3	Clue search	66	1.32	45	0.88
S4	Comparison	95	1.90	30	0.59
S5	Data search	109	2.18	58	1.14
S6	Reading supplementary materials	140	2.80	184	3.61
S7	Review the task	85	1.70	1	0.02
S8	Pose a method	489	9.78	312	6.12
S9	Correctly recognizing a creature / environment	350	7.00	357	7.00
S10	Correctly comparing a creature / environment	350	7.00	357	7.00
E1	Lack of patience	10	0.20	26	0.51
E2	Trial and error	15	0.30	24	0.47
E3	Incorrectly identifying a creature / environment	57	1.14	80	1.57
E4	Incorrectly comparing a creature / environment	113	2.26	125	2.45
E5	Suspending the learning activity	0	0.00	0	0.00
	Total	2384	47.68	1996	39.14

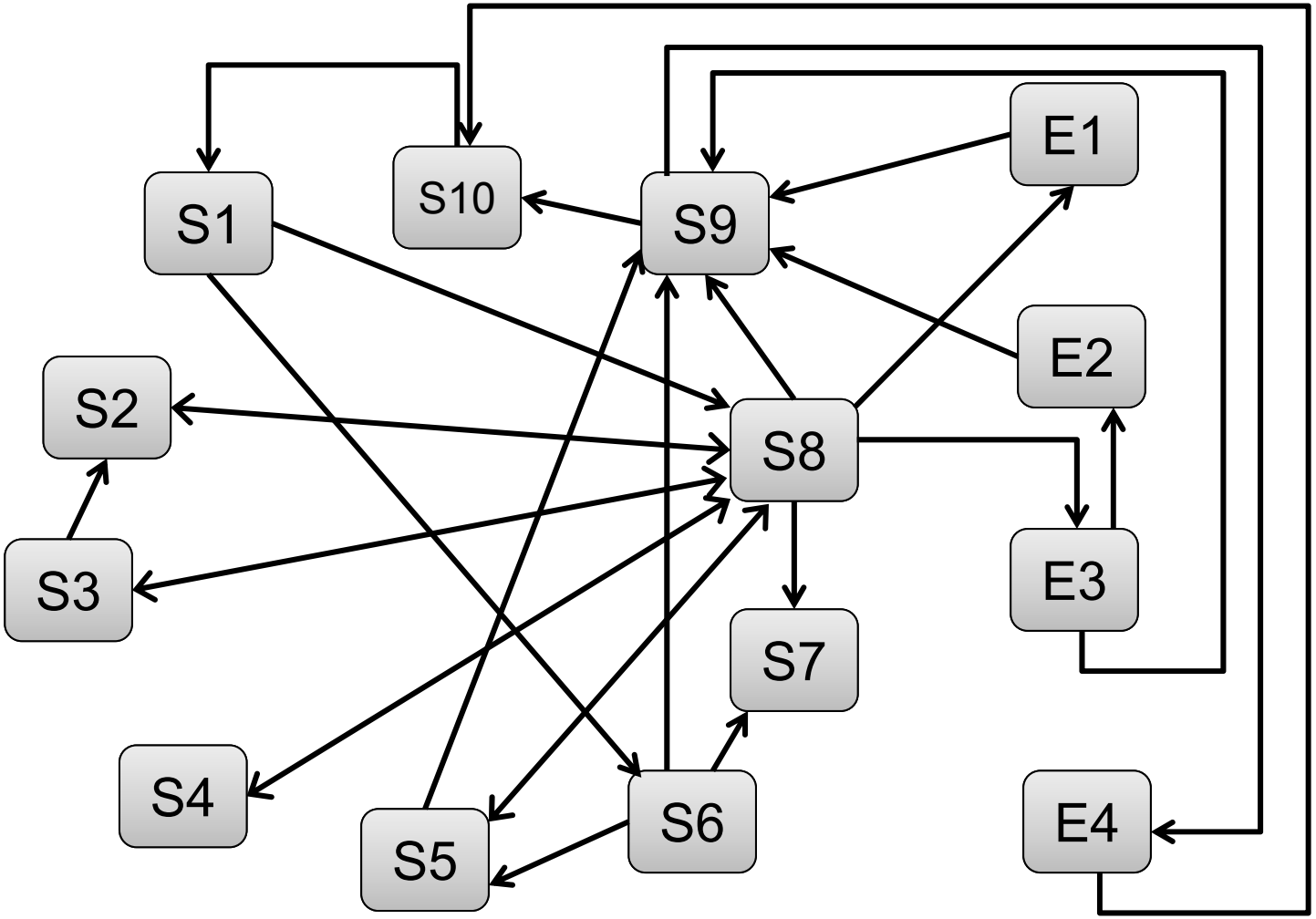
Variable	Group	N	Mean	S.D.	*t*	*d*
Field observation	Exp	50	3.10	2.88	5.34***	1.069
	Con	51	0.78	1.06		
Clue search	Exp	50	1.32	1.35	1.68	0.334
	Con	51	0.88	1.28		
Comparison	Exp	50	1.90	2.48	3.53**	0.704
	Con	51	0.59	0.88		
Data search	Exp	50	2.18	2.18	2.92**	0.582
	Con	51	1.14	1.28		
Reading supplementary materials	Exp	50	2.80	3.80	-1.17	-0.233
	Con	51	3.61	3.12		
Total	Exp	50	11.30	6.73	3.71***	0.739
	Con	51	7.00	4.74		

$^{**}p < 0.01$; $^{***}p < 0.001$

Experimental group' behavior transfer relationships

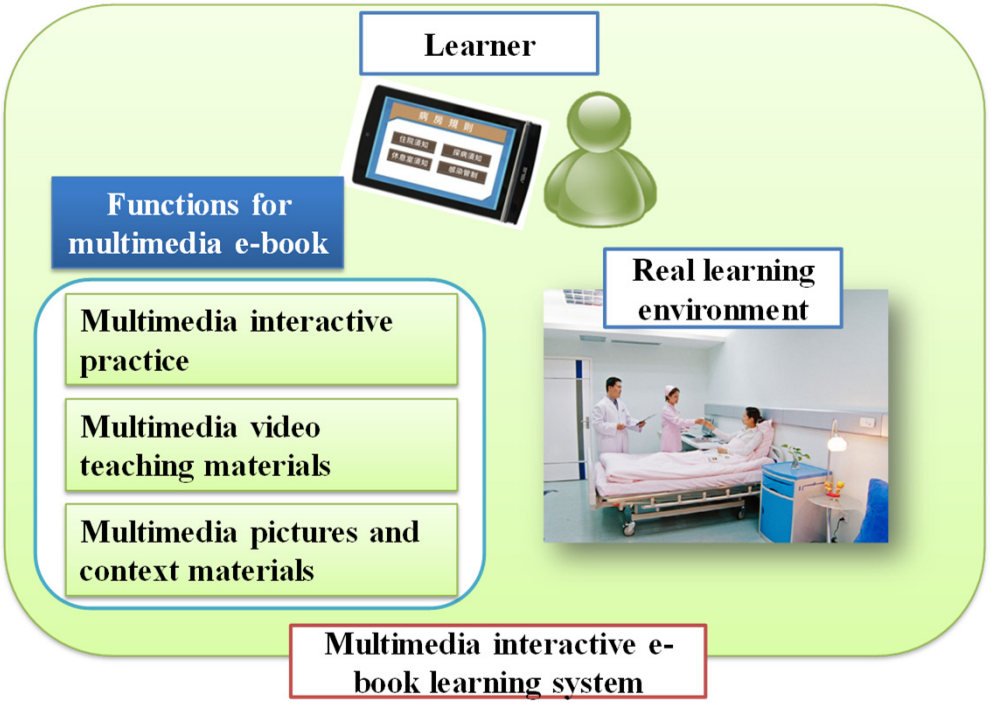


Control group' behavior transfer relationships



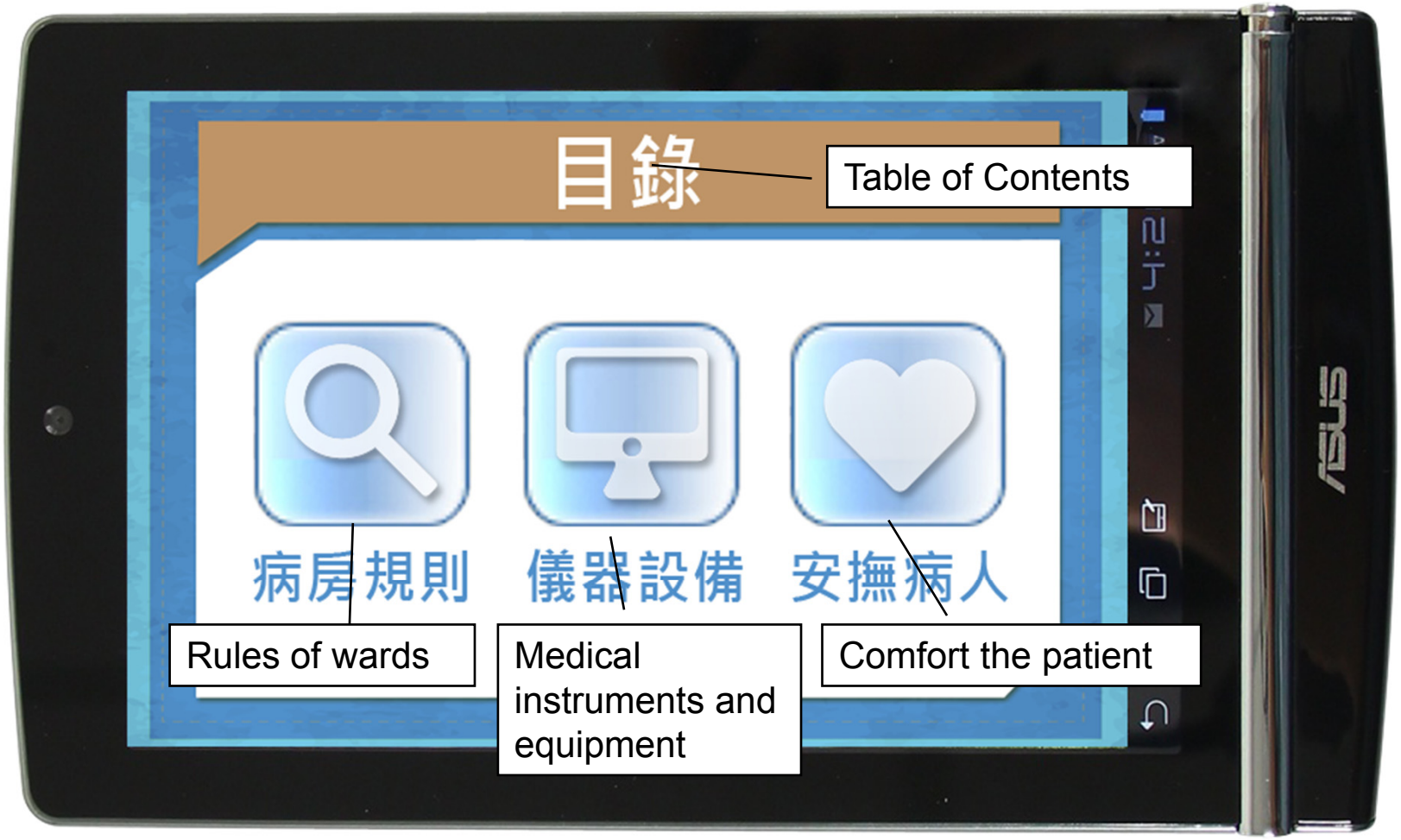
Effects of the use of interactive e-books by intensive care unit patients' family members: Anxiety, learning performances and perceptions

- seldom-considered subjects: **patients' family members**

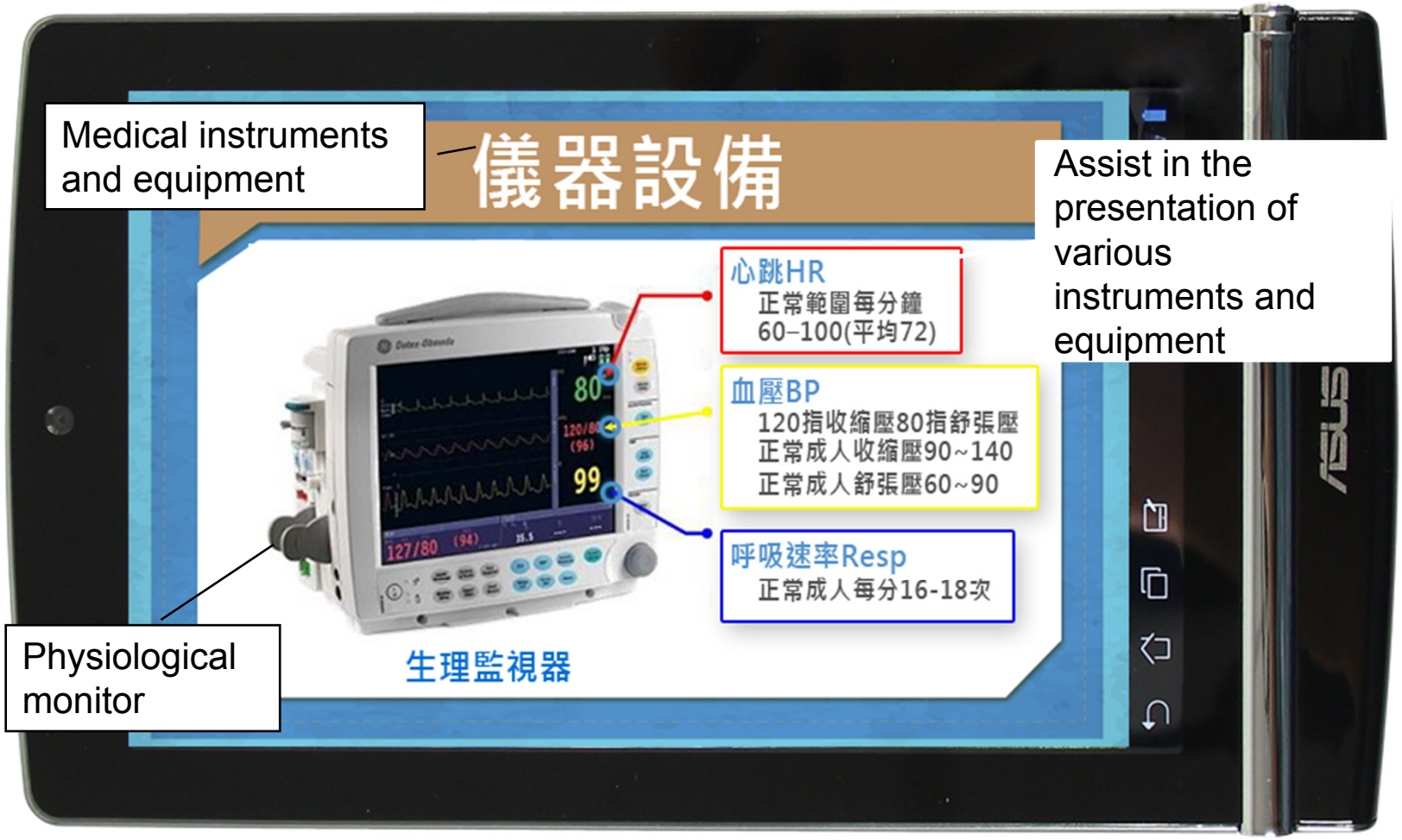


Lee, S. Y., Wang, T. J., **Hwang, G. J.**, Chang, S. C. (2018). Effects of the use of interactive e-books by intensive care unit patients' family members: anxiety, learning performances and perceptions. *British Journal of Ecuational Technology*. doi: 10.1111/bjet.12611 **(SSCI)**

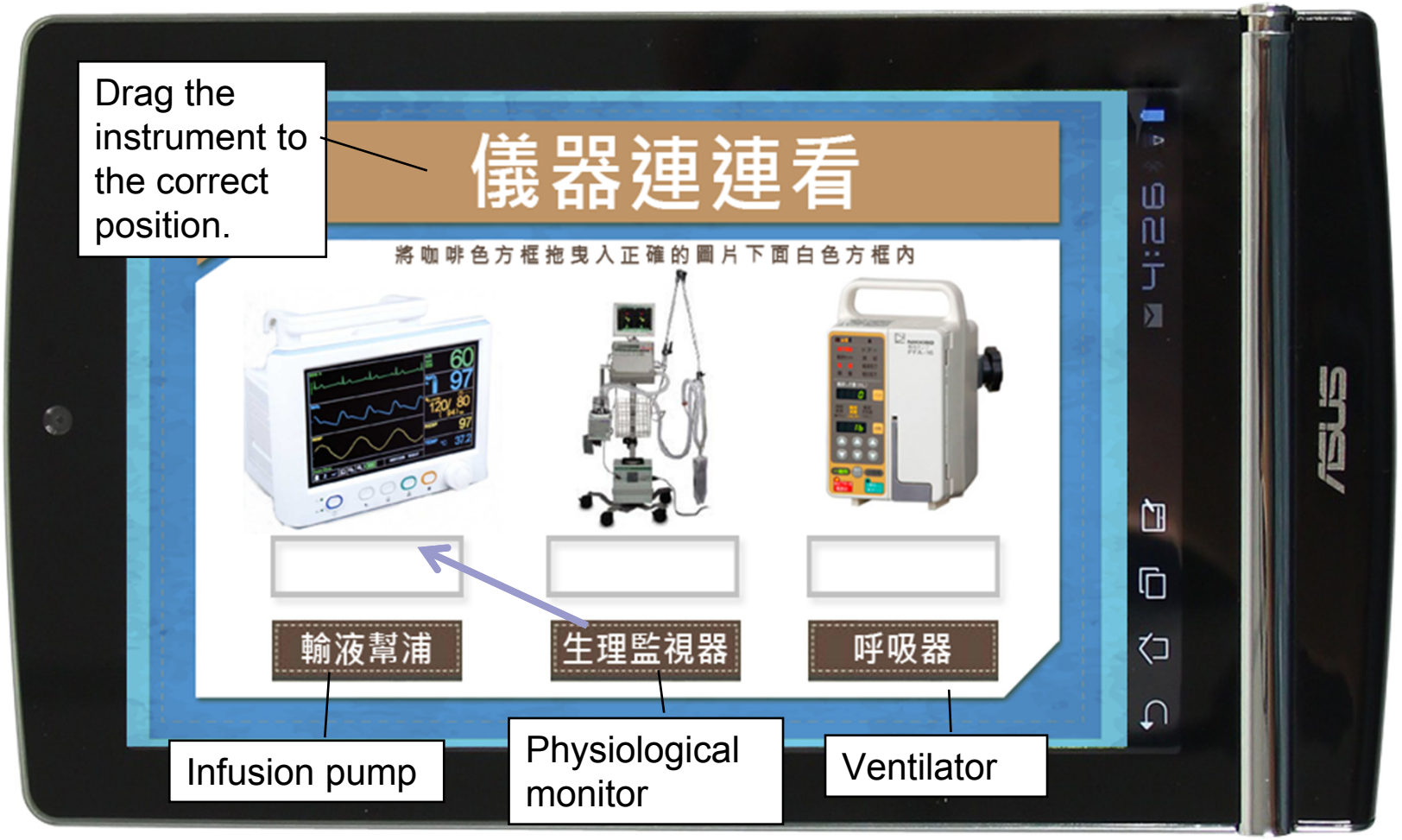
Content in the e-book



Medical instruments and equipment

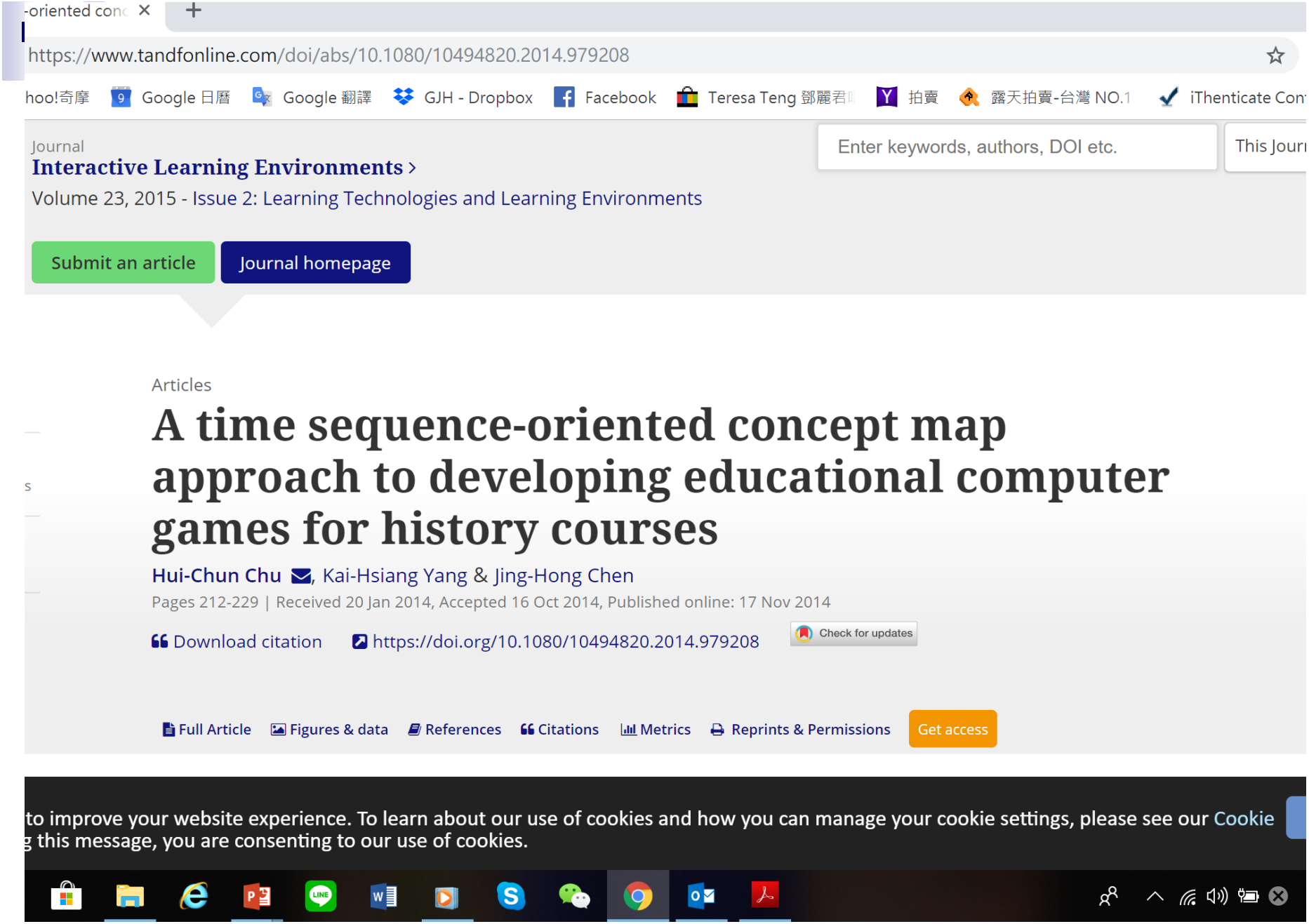


Small test- identify the equipment



Brainstorming

- Try to find 10 different ways of using concept maps in a class
  - Different purposes (e.g., summarize the learning content, barnstorming)
  - Different forms (e.g., fill-in-blank)
  - Different applications (e.g., Science vs historical course)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Volume 23, 2015 - Issue 2: Learning Technologies and Learning Environments
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A time sequence-oriented concept map approach to developing educational computer games for history courses
Hui-Chun Chu, Kai-Hsiang Yang & Jing-Hong Chen
Pages 212-229 | Received 20 Jan 2014, Accepted 16 Oct 2014, Published online: 17 Nov 2014
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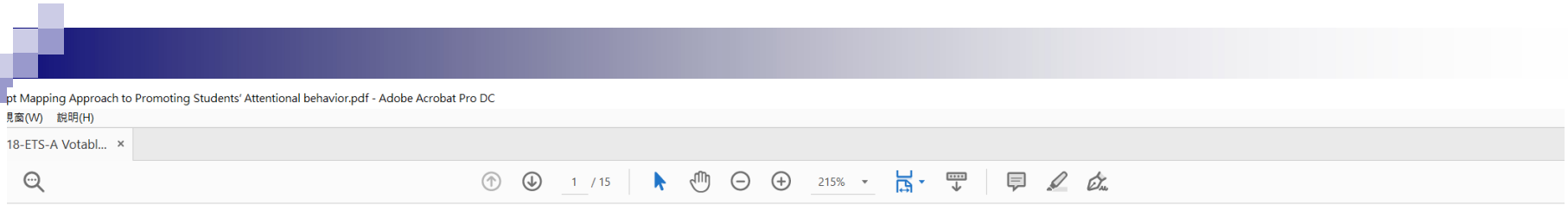

Sun, J. C.-Y., Hwang, G.-J., Lin, Y.-Y., Yu, S.-J., Pan, L.-C., & Chen, A. Y.-Z. (2018). A Votable Concept Mapping Approach to Promoting Students' Attentional Behavior: An Analysis of Sequential Behavioral Patterns and Brainwave Data. *Educational Technology & Society, 21* (2), 177–191.

A Votable Concept Mapping Approach to Promoting Students' Attentional Behavior: An Analysis of Sequential Behavioral Patterns and Brainwave Data

Jerry Chih-Yuan Sun[1*], Gwo-Jen Hwang[2], Yu-Yan Lin[1], Shih-Jou Yu[1], Liu-Cheng Pan[1] and Ariel Yu-Zhen Chen[1]

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ABSTRACT

This study explores the effects of integrated concept maps and classroom polling systems on students' learning performance, attentional behavior, and brainwaves associated with attention. Twenty-nine students from an Educational Research Methodology course were recruited as participants. For data collection, in-class quizzes, attentional behavior analysis, and a 20-minute structured interview were applied, and the attention-associated brainwaves of the participants were measured. In the first week, a group-polling method was introduced in class; in the second week, participants were asked to draw concept maps using pen and paper (PnP concept mapping); and in the third week, the polling system and concept maps were integrated (votable concept mapping) and applied. The results showed that the PnP concept mapping

Knowing more learning strategies via reading papers

Concept mapping, Game-based learning, Two-tier test, Problem posing, Aggressive prompting, WATA (Web-based Assessment and Test Analysis), WSQ (Watch, Summarize, question), Repertory grid, Collaborative learning, Project-based learning, Inquiry-based learning, WebQuest, Peer assessment, Self-regulated learning, Flipped learning, Problem-based learning, Video sharing, Digital storytelling, Competitions, Jigsaw II, Spreadsheet as Mindtool, Web issue-quest, Adaptive learning, Role-play strategy, active learning-promotion mechanism, collaborative issue-quest promotion mechanism, Creative thinking strategy

Peer-assessment

- Lai, C. L., & **Hwang*, G. J.** (2015). An **interactive peer-assessment criteria development** approach to improving students' **art design** performance using handheld devices. *Computers & Education, 85*, 149-159.
- Hsia, L. H., Huang, I., & **Hwang*, G. J.** (2016). Effects of different online peer-feedback approaches on students' performance skills, motivation and self-efficacy in a **dance course**. *Computers & Education, 96*, 55-71.
- Hsia, L. H., Huang, I., & **Hwang*, G. J.** (2016). A web-based peer-assessment approach to improving junior high school students' performance, self-efficacy and motivation in **performing arts courses**. *British Journal of Educational Technology, 47*(4), 618-632.

Knowing more research issues via reading papers

learning achievement, learning motivation, learning attitude, critical thinking, problem-solving, communication, collaboration, creative thinking, Metacognition, skills, self efficacy, learning anxiety, flow experience, self-regulation ability, learning satisfaction, cognitive load, technology acceptance, learning behavioral patterns, interactive patterns, questioning ability, self-directed learning, learning styles, cognitive styles, oral ability, writing ability, hearing ability, reading comprehension, art performing, approaches to learning science, scientific epistemic beliefs

How to measure?

Knowing more educational theories via reading papers

- Scaffolding Theory
- Cognitive apprenticeship
- Constructivism
- Situated learning
- Social constructivism
- Cognitive theory of multimedia learning

What are the connections between the theories, issues and strategies?

Check list of a research design

- **What are the innovations and contributions in this study?**
  - **Innovative technology, 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?
- **What are the educational theories supporting your strategies or findings?**

Gwo-Jen Hwang, Chair Professor

http://www.idlslab.net/

Professor Gwo-Jen Hwang is currently a Chair Professor at the Graduate Institute of Digital Learning and Education, National Taiwan University of Science and Technology. His academic expertise includes mobile and ubiquitous learning, game-based learning, and applications of artificial intelligence in education. He has presided over more than 100 projects and received numerous research awards, including 2007, 2010, and 2013 National Science Council Distinguished Research Awards, and the 2019 Ministry of Education National Excellent Teacher Award.

Professor Hwang has published more than 750 papers, including more than 400 journal articles, of which nearly 280 have been published in SSCI journals. He is currently on the review board of more than 40 SSCI/SCI/EI academic journals, as well as the Associate Editor of IEEE Transactions on Education (SCI), the Editor-in-Chief of the International Journal of Mobile Learning and Organisation, and Journal of Computers in Education.
Times World University Ranking announced the 10 most prolific and most cited researchers in 2016 (based on statistics from 2011 to 2015) and Professor Hwang is the world's top-ranked scholar in social sciences. https://www.timeshighereducation.com/news/ ten-most-prolific-and-most-cited-researchers

10 most prolific and most cited researchers in 2011-2015

https://www.timeshighereducation.com/news/ten-most-prolific-and-most-cited-researchers

Subject area	Name	Institution	Country	Research area	Publications	Citations per publication
Computer science	Peng Shi	Victoria University	Australia	Computational intelligence	250	31.9
Biochemistry, genetics and molecular biology	Cornelia van Duijn	Erasmus University Rotterdam	Netherlands	Genetic epidemiology	195	52.5
Business, management and accounting	Kee Hung Lai	Hong Kong Polytechnic University	Hong Kong	Logistics and shipping	50	25.1
Chemistry	Michael Grätzel	École Polytechnique Fédérale de Lausanne	Switzerland	Photonics and interfaces	275	66.6
Economics, econometrics and finance	Daron Acemoglu	Massachusetts Institute of Technology	United States	Political economy	52	22.9
Engineering	Frede Blaabjerg	Aalborg University	Denmark	Energy and electronics	448	14.5
Mathematics	Francisco Herrera	University of Granada	Spain	Soft computing and intelligence information systems	106	32.7
Neuroscience	Ronald Karl Petersen	Mayo Clinic, Rochester	United States	Cognitive impairment and dementia	121	58.7
Physics and astronomy	Arnulf Quadt	University of Göttingen	Germany	Hadron collider physics	599	42.9
Social sciences	Gwojen Hwang	National Taiwan University of Science and Technology (Taiwan Tech)	Taiwan	Education and learning	101	20.6

Thank you