To Explore the Effect of Age on Cognitive Load When Using Social Websites to Conduct Flipped Classrooms on Musical Instrument Performance Teaching - Taking Amateur Erhu Learners as an Example

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Abstract: Since the development of information technology, the teaching mode keeps innovating and flipped classrooms become popular. However, flipped classrooms need to preview the course videos on websites. It might affect the learners' cognitive load of different age levels during their learning process. Because the age range of amateur erhu learners is very wide, this research focus on amateur erhu learners. We use the teaching mode of flipped classrooms on websites and explore whether the age will affect the cognitive load. The result shows that the middle age learners got heavier cognitive load than the young and the old age learners.

Keywords: Age, flipped classroom, cognitive load, musical instrument performance teaching, social websites

1. Introduction

Erhu is a popular traditional string instrument in Taiwan. Learning erhu is difficult because the pitches of erhus must be controlled by the players themself. In the traditional amateur erhu teaching, teachers usually demonstrate erhu music in classrooms. Students learn the bowing and fingering in classrooms and then practice at home. But, Liou and Cai (2015) pointed out that traditional classrooms usually have poor performance because most students have no enough time for knowledge internalization. To improve this disadvantage, the concept of flipped classrooms comes out. Flipped classrooms were proposed by two chemistry teachers, Jon Bergmann and Aaron Sams in "Forest High School" located at Rocky Mountains (Bergmann & Sams, 2012). Flipped classrooms can just deepen the knowledge internalization through the preview before class and the interaction with teachers and classmates in classrooms. This improves the problem of knowledge internalization of traditional teaching.

However, flipped classrooms need to preview at home before class. It may be a burden for busy amateur erhu learners. Sometimes, it is difficult to understand how to play the musical instruments from demonstration videos. In addition, learners are asked to show their previewing results in classrooms. If the preview is not sufficient, it may cause a lot of pressures. Therefore, whether all ages of amateur erhu learners are well suitable to use flipped classrooms mode is worthy to explore. However, to conduct flipped classrooms need to upload the demonstration videos to the teaching websites to provide learners to preview. If learners need to re-apply usernames and passwords, it's not convenient for amateur erhu learners (Roblyer, McDaniel, Webb, Herman, & Witty, 2010). Therefore, to use a famous video website (e.g., YouTube) to provide learners to preview and a famous social website (e.g., Facebook) to provide a mutual exchange for students and interaction with the teachers can reduce the time to re-familiar with the teaching sites for learners.

Thus, taking amateur erhu learners as an example, this paper uses the flipped classroom mode to teach by social websites and investigate whether age will affect the learners' cognitive load. The results showed that, for the 34 valid samples, the cognitive load of the middle age learners is higher than that of the young learners and the old age learners.

2. Literature Review

2.1 The related researches and findings of flipped classrooms

Traditional classrooms are that teachers lecture the knowledge, raise questions and solve problems in classrooms. Then students conduct review at home after class. But knowledge is often not internalized in the process of traditional classrooms. This causes that the learning effective is poor or the progress is slow. Bergmann and Sams (2012) proposed the concept of "flipped classroom". The meaning of flipped classrooms is that the students watch the preview videos before class. Then students conduct raise questions and discussions by groups. Finally, teachers explain the key points and consolidate the learners' knowledge. This teaching style focuses on promoting the learners' abilities of autonomous learning, independent thinking and problem-solving. The comparisons of traditional classrooms and flipped classrooms are shown in Figure 1.
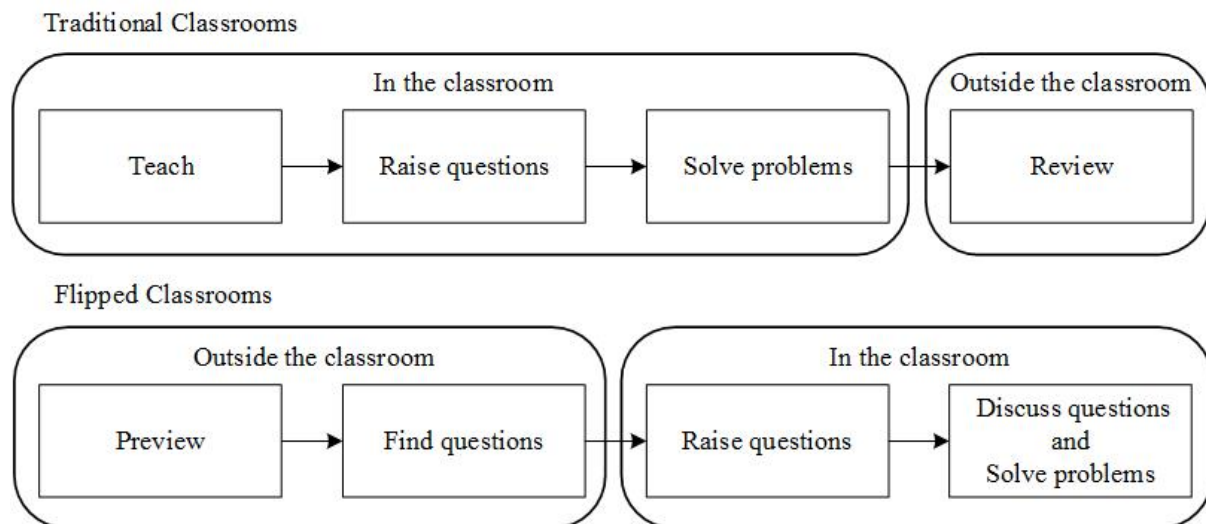

Figure 1. The comparisons of traditional classrooms and flipped classrooms.

Flipped classrooms subvert the structure of traditional classrooms. Flipped classrooms import information technologies into teaching perfectly. As long as flipped classrooms are understood and applied, it is believed that the teaching effectiveness will be better (Wang, Shi, & Ma, 2015).

2.2 The Applications of Social Websites in Teaching

Roblyer et al. (2010) pointed out that the current students prefer to use social websites (e.g., Facebook) to conduct online learning exchanges and discussions. In addition to sharing the stories, photos, videos and interests, Facebook can establish communities to let their friends join. After these features are applied to teaching, the results showed that the students not only have excellent performance in the communication of learning and interaction, but also their professional knowledge is increased effectively (Pérez, Araiza, & Doerfer, 2013).

2.3 Cognitive Load Theory

Sweller (1988) proposed the concept of cognitive load theory. The cognitive load theory contains two parts: mental load and mental effort (Paas, 1992). The meaning of mental load is whether the students

feel difficulty or frustration when learning the content of activities (Paas & van Merriënboer, 1994). The meaning of mental effort is whether the students feel difficulty to understand the presentation of the materials and the process of learning (Pass, Tuovinen, Tabbers, & van Gerven, 2003).

Using the above theory, we can understand the burden of students in the process of learning and improve the teaching method to reduce the burden on students. As a result, cognitive load has become one of research areas of E-learning to understand whether students can learn from different ways and whether they will produce the burden of learning in different ways (Chang & Wu, 2011; Chen & Chen, 2012; Hwang, Yang, & Wang, 2013; Hwang, Kuo, Chen, & Ho, 2014). In the past, there are few researches about exploring the impact of cognitive load in flipped classrooms on musical instrument performance teaching. Therefore, this paper is to explore the effect of age on cognitive load when using social websites to conduct flipped classrooms on musical instrument performance teaching and provide different suggestions to teachers.

3. Research Method

3.1 Research Design

This study first conducts literature review and the design of the cognitive load questionnaire which then is inputted into the Google online questionnaire system (Google form). Then we invited an amateur erhu teacher of a music classroom in the central region of Taiwan to record the preview videos before class and uploaded the videos to video websites (YouTube) to provide students to preview. The amateur erhu teacher has taught erhu over 30 years. Also, we used the famous social websites (Facebook) to establish the class learning community to provide teachers and students online communication. Learners then watched the preview erhu videos before class, and conducted asking questions, discussions and showed their previewing results in classrooms. After the course, we invited learners to fill in the Google online questionnaire of cognitive load. Then we used the SPSS19 software to conduct the reliability analysis of the questionnaire and ANOVA analysis to explore the impact of cognitive load for different age levels of learners. Finally, the results of the analysis are verified by the feedback of the open questions. Research process is shown in Figure 2.
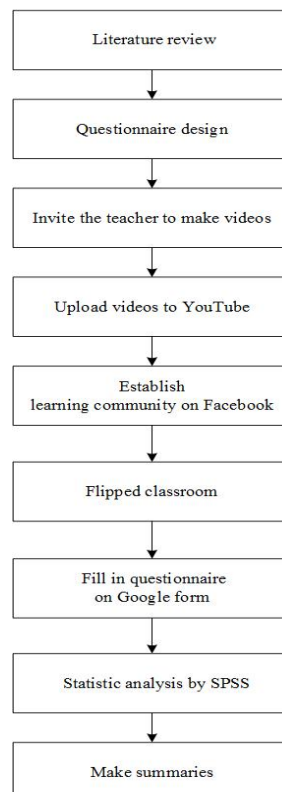

Figure 2. Research process.

3.2 Experimental Flow

This study divided the amateur erhu learners into three groups: young people, middle age people and old age people. The experimental duration was divided into four weeks of erhu flipped classroom teaching and one week of questionnaires at the end. The experimental flow is shown in Figure 3.
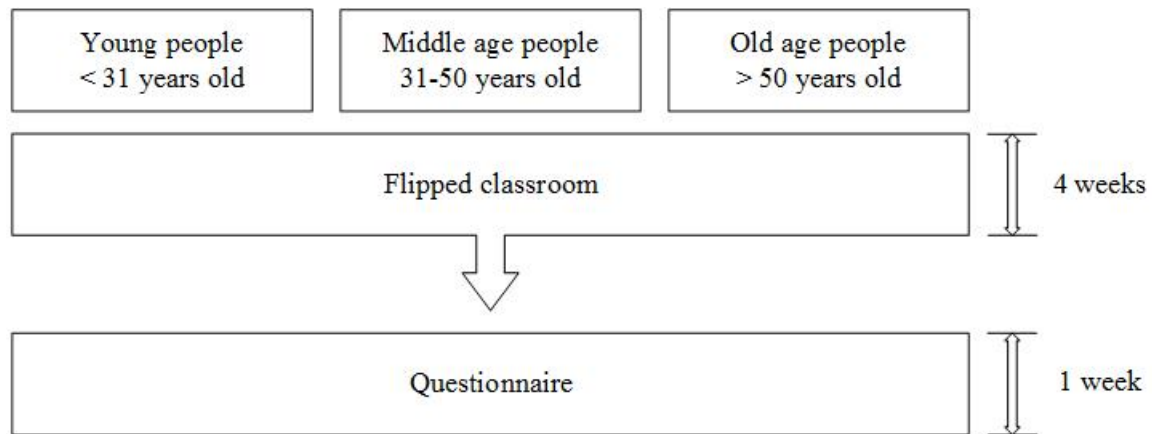

Figure 3. Experiment flow.

3.3 Experimental Participants

The participants of this study are 48 amateur erhu learners of a music classroom in the central region of Taiwan. There are only 34 valid samples who participate throughout. They include 7 young learners (less than 31 years old), 16 middle age learners (31 to 50 years old) and 11 old age learners (great than 50 years old).

3.4 Experimental Tools

The research tools of this study include pre-recorded videos before class, social websites, a cognitive load questionnaire and the SPSS statistical analysis software. Firstly, the teacher pre-recorded about 500 erhu teaching videos and uploaded the videos to YouTube video website. Then the learners can freely conduct the preview of the videos before class and discover the problem from the preview. The instructional video channel is shown in Figure 4.
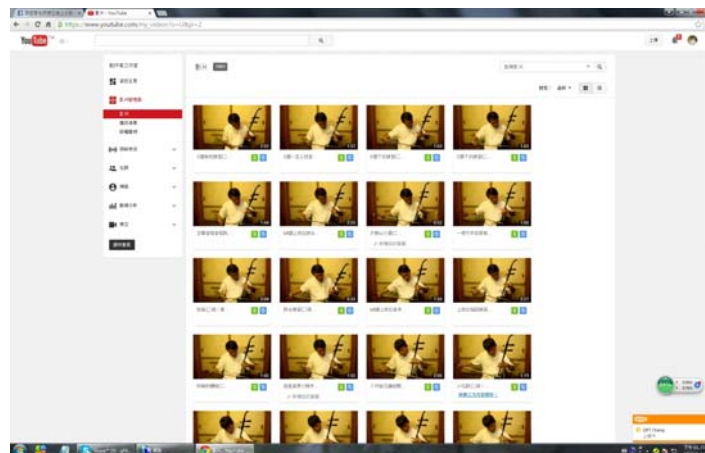

Figure 4. Instructional video channel.

Learners can ask questions and participate discusses in the learning community of social websites (Facebook) which is set up by teachers. Each class has the specific group in social websites as shown in Figure 5.

Figure 5. Social websites.

The cognitive load questionnaire mainly referred to the paper of (Hwang, Yang, & Wang, 2013). The questions of the questionnaire were divided into two categories: mental load (5 questions) and mental effort (2 questions), as shown in Table 1. The questionnaire was based on a 7-point Likert scale. After the reliability analysis, the Cronbach's Alpha values were all greater than 0.7. So, the effect of this questionnaire is well as shown in Table 2. In order to further understand the views of the learners, we also designed two open questions which are to let the learners describe the advantages and disadvantages of the teaching method.

Table 1: Questionnaire of mental load and mental effort.

Mental load
1. The music of erhu lessons is difficult to me.
2. I must spend a lot of effort and practice in order to learn the music well for the erhu lessons. It was so tired to practice the music of erhu lessons.
3. It was so tired to practice the music of erhu lessons.
4. It was so frustrated to practice the music of erhu lessons.
5. I don't have enough time to practice the music of erhu lessons.

Mental effort
1. The learning style of erhu lessons makes me have a lot of stress.
2. The learning style of erhu lessons makes me need to devote a lot of efforts in order to complete.

Table 2: Cronbach's α of mental load and mental effort.

	Cronbach's α
mental load	.761
mental effort	.771

4. Results and Discussions

In order to understand the cognitive load of learners, we conduct the cognitive load questionnaire investigation. The questions of the questionnaire include two parts: mental load and mental effort. Then, the questionnaire results are analyzed by ANOVA of SPSS. The results showed that the cognitive load of the middle age people is significantly higher than those of the young people and the old age people as shown in Table 3.

Table 3: Analysis of ANOVA of the cognitive load for young people, middle age people and old age people.

Age	N	Mean	SD	F	
(a) <31	7	3.40	1.04	3.99*	(b)>(a) (b)>(c)
(b) 31-50	16	4.68	1.01		
(c) >50	11	3.78	1.29		

*$p<.05$

In order to further confirm which part of the mental load or the mental effort is the main impact on cognitive load, this study continues to conduct ANOVA analysis on the two parts respectively. The results showed that there was no significant difference in mental load as shown in Table 4 while their mental effort was significantly different as shown in Table 5.

Table 4: Analysis of ANOVA of the mental load for young people, middle age people and old age people.

Age	N	Mean	SD	F
(a) <31	7	3.37	.96	3.23
(b) 31-50	16	4.51	.94	
(c) >50	11	3.93	1.17	

Table 5: Analysis of ANOVA of the mental effort for young people, middle age people and old age people.

Age	N	Mean	SD	F	
(a) <31	7	3.43	1.24	3.80*	(b)>(a) (b)>(c)
(b) 31-50	16	4.84	1.27		
(c) >50	11	3.64	1.57		

*$p<.05$

In order to explore why the mental effort of the 16 middle age learners is higher than those of the young learners and the old age learners, we analyzed the feedback of the open questions. The

reasons are summarized as follows. For the 16 middle age learners, five learners (S11, S13, S14, S16, S20) did not understand the content of the videos somewhat in the process of autonomously previewing videos and can't judge whether their action of playing erhu is correct or not (A1). Three learners (S10, S12, S18) felt that the need to demonstrate in the classroom will be nervous (A2). Three learners (S9, S19, S21) thought that they must spend time before class to preview the videos in order to avoid to have a great lagged progress (A3). Two learners (S17, S23) thought that, to preview the videos and to play in the classroom, learners felt no real sense of teaching (A4). Two learners (S8, S15) thought that, to use flipped classroom teaching, it needed to use digital learning devices so that it is not convenient (A5). The feedback of open questions is shown in Table 6. The above reasons are the pressures due to the curriculum teaching mode. They are not the pressures due to the difficulty of the course itself. So, all the reasons belong to mental effort.

Table 6: The reasons of high mental effort of middle age learners.

Feedback of the open questions	Learners
A1: Not understand the content of the videos somewhat and whether the practice action is correct or not.	S11, S13, S14, S16, S20
A2: The need to demonstrate in the classroom will be nervous.	S10, S12, S18
A3: Time consuming.	S9, S19, S21
A4: To feel no real sense of teaching.	S17, S23
A5: Using the digital learning devices is not convenient.	S8, S15

5. Conclusions and Suggestions

This study recorded and uploaded teaching videos by the teacher. Then the teacher conducted flipped classroom teaching to let learners experience a new and different learning process. Finally, the questionnaire investigation of cognitive load was conducted. The results of this study showed that the middle age learners in using the flipped classroom teaching have a higher mental load than those of the young learners and the old age learners.

From the feedback of the open questions, the reasons are as follows. Most of the 16 middle age learners thought that this teaching method needed to spend time to preview at home. Although this method improved the disadvantage of the speed of knowledge internalization for every learners are different, but the cognitive load was increased. In addition, in the process of preview, if the contents of the videos did not be understood, the mistakes can't be immediately corrected. Also, in the classroom, it needed to play a demonstration so that the pressure was increased. This resulted in reducing the learning willingness. Regarding to the young learners and the old age learners, their pressures were significant lower than the middle age learners. The reasons may be that, in the flipped classroom, learners can repeatedly preview the videos and practice. It can increase the effect of knowledge internalization. For the middle age learners, because of working pressure, they were not willing to spend time to preview videos. Thereby, the pressure was created. For the young learners and the old age learners, they are students and the elders. They can effectively use the time after school and at home. They can arrange time appropriately to conduct the action of preview. The specific recommendations of this study are as follows:

● Young learners: This group of learners is the most suitable group for the use of flipped classroom mode of teaching. Because their ability of information and learning capacity could be better, they can make the best use of sparse time coolly to conduct video preview and erhu practice. Also, they can ask questions positively to specifically increase learning effectiveness and conduct knowledge internalization.

- Middle age learners: The learning cognitive load of this group is highest. The reason may be that they are going through the most important part of life and need to be worry about work and family. So, it is suggested that the progress of the flipped classroom teaching can be slightly slowed down to avoid excessive mental effort and learning pressure.
- Old age learners: This group of learners is also suitable for the use of the flipped classroom mode. They may be retirees and have more time to learn but their learning ability is not so strong than the young learners and the middle age learners. Therefore, it is suggested more previewing and practicing can deepen their impression. In addition, they can enjoy themselves by erhu so that they can memorize easily.

In the future, we will design flipped classroom activities of different levels to help learners more easily reach their goals. In addition, the relationship between classroom activities and learners will be analyzed. It is expected that deeper findings will be discovered.

Acknowledgements

References

Bergmann, J. & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day*. USA: International Society for Technology in Education (ISTE).

Chang, P. Y. & Wu, H. M. (2011). The effect of different types of music on math problem solving and cognitive load. *Instructional Technology & Media, 95*, 17-35.

Chen, Y. T. & Chen, L. F. (2012). The design and evaluation of a thematic interactive. *Journal of Tainan University of Technology, 31*, 247-259.

Hwang, G. J., Kuo, F. R., Chen, N. S., & Ho, H. J. (2014). Effects of an integrated concept mapping and web-based problem-solving approach on students' learning achievements, perceptions and cognitive loads. *Computers & Education, 71*, 77-86.

Hwang, G. J., Yang, L. H., & Wang, S. Y. (2013). A concept map-embedded educational computer game for improving students' learning performance in natural science courses. *Computers & Education, 69*, 121-130.

Liou, C. & Cai, Y. M. (2015). *The research of programming teaching design based on flipped classroom model*. The 19th Global Chinese on Computers in Education (GCCCE2015), Taipei, Taiwan.

Paas, F. (1992). Training strategies for attaining transfer of problem-solving skill in statistics: A cognitive-load approach. *Journal of Educational Psychology, 84*(4), 429-434.

Paas, F. G. W., & van Merriënboer, J. J. G. (1994). Instructional control of cognitive load in the training of complex cognitive tasks. *Educational Psychology Review, 6*, 51–71.

Pass, F., Tuovinen, J. E., Tabbers, H., & van Gerven, P. W. M. (2003). Cognitive load measurement as a means to advance cognitive load theory. *Educational Psychologist, 38*(1), 63–71.

Pérez, T., Araiza, M. D. J., & Doerfer, C. (2013). Using facebook for learning: A case study on the perception of students in higher education. *Procedia-Social and Behavioral Sciences, 106*, 3259-3267.

Roblyer, M., McDaniel, M., Webb, M., Herman, J., & Witty, J. V. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. T*he Internet and Higher Education, 13*(3), 134-140.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285.

Wang, C., Shi, Y. X., & Ma, C. (2015). *Flipped classroom teaching research based on learning science*. The 19th Global Chinese on Computers in Education (GCCCE2015), Taipei, Taiwan.

The Role of Social Presence in a Flipped Classroom to Facilitate Oral Skills of Language Learners

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Abstract: With the invention of new technologies, issues and studies concerning how the emerging technologies can be applied into educational settings to facilitate language teaching and learning have gained its prominence. While a plethora of studies have supported the application of technologies to language education, there has been little research into the effects of mobile-assisted language learning and flipped learning on EFL learners' oral proficiency. In view of this, the current study attempted to examine the impact of an online learning community in a flipped classroom, specifically via mobile platforms, on EFL learners' oral proficiency and their perceptions of the social as well as interpersonal communication in a flipped instruction. The subjects of this empirical study were 50 English-majored sophomores enrolled in two required oral training classes at a four-year comprehensive university in central Taiwan. Dual sources of data collection were used to analyze quantitative data, including pre- and post-tests on oral reading and comprehension questions, and a "Community of Inquiry" (CoI) questionnaire. The results revealed that the online learning community in a flipped instruction created a learning setting that not only supported social and interpersonal communication and collaboration but also significantly enhanced the participants' oral proficiency, making them more competent and motivated in highly interactive learning activities, such as online or in-class interaction, collaboration, and discussion.

Keywords: flipped learning, social presence, online learning community, oral proficiency

1. Introduction

With regard to language teaching and learning, English has become one of the primary languages in many fields, including academic discourse, business, technology, and international relations (Sun, Huang, & Liu, 2011; Wu, Sung, Huang, Yang, & Yang, 2011). While traditional EFL instruction has focused on vocabulary, grammar, and sentence structure, the mastery of oral ability holds the key to successful interaction in an international society, as language learning is all about learning to communicate and interact. However, the significance of speaking is not reflected at most of the instances in EFL settings, as reading and writing are highly emphasized than speaking and listening (Cheon, 2003; Tsou, 2005) and limited opportunities to speak English in non-English-speaking countries (such as Taiwan, South Korea, and Japan) remain prevalent.

Nevertheless, with technological advances that contribute to education transformation (Bishop & Verleger, 2013), technologies have become much more available and integrated into the field of language teaching and learning, with their distinctive features such as mobility, reachability, personalization, spontaneity, and ubiquity. Consequently, technology-enhanced language learning (TELL) and mobile-assisted language learning (MALL) has increasingly been the mainstream in recent years, as documented in Kiernan & Aizawa (2004). One of the alternative approaches that integrates technology into language learning and that contributes to ample opportunities for students to learn is the flipped learning (Hung, 2015; McLaughlin, Roth, Glatt, Gharkholonarehe, Davidson, Griffin, Esserman, & Mumper, 2014), where technologies (such as mobile devices) are employed to make efficient use of class time and students are given more opportunities to participate in meaningful engaging activities in an learning community, thus enhancing the learning outcomes.

In an online learning community, a learner constructs knowledge gradually as the result of interaction with the environment and with both internal and external influences (Zhang &Kou, 2012), meaning that learners develop strong relationships with others in the online setting (Murdock & Williams, 2011), where "active interaction is not listening and mirroring the correct realities, but rather participating in and interacting with the learning situation and environment in order to create a personal view of the world" (Janassen, Davidson, Collins, Campbell, & Haag, 1995, p. 20).

The flipped instruction shifts from teacher-centered lectures to student-centered learning. Instructors devote class time to creating engaging learning environments and students develop solutions via interaction with their peers, echoing the previous studies that students construct meaning and confirm knowledge in the presence of peers during online student discussions (Akyol & Garrison, 2011a, b). Online learning communities are successful and effective when "participants work in groups to solve authentic problems; participants have shared learning goals; knowledge is emergent and experts in the group are facilitators; group members operate at varying levels of mastery; there is a commitment on the part of group members to participation in the community" (Cowan, 2012, p. 12). As the educational field gradually moves toward the constructivist approach, student-centered learning, and technology-integrated pedagogy, traditional lecture-based instruction has been criticized for its sheer ignorance of leaners' active participation and its unidirectional installment of knowledge to learners.

However, there has been little investigation into English oral proficiency via MALL in an EFL setting. In light of the widespread social and educational use, what research evidences are there to indicate whether the integration of mobile technology into flipped learning can enhance students' oral proficiency? Furthermore, most online learning theories focus on the examination of structural issues rather than the probe into teaching and learning (Garrison, 2000), let alone an in-depth investigation into how social and interpersonal communication affected learning outcomes. To optimize the benefits and affordances of mobile technology and flipped learning, the current study aimed to examine the effects of an online learning community via LINE for flipped learning in an EFL oral training class.

2. Methods

2.1 Participants

The participants included 50 sophomore English-majors in two required English Oral Training classes at a four-year university in central Taiwan, mostly female and between the ages of 20 and 21. The participants had studied English for around 8 years through high school and their English proficiency was considered to be at the upper-intermediate level.

2.2 Data collection and analysis

Dual sources of data collection were employed to examine the participants' oral proficiency as the result of the online learning community and perceptions of the flipped learning experience, including (1) pre- and post-tests of oral reading and comprehension questions, and (2) Community of Inquiry survey. Figure 1 shows the issues and instruments involved in the current study, and Figure 2 displays the entire instructional and data collection process.

The pre-tests and the post-tests, respectively for the traditional instruction and the flipped learning instruction, were identical in content and the participants were asked to respond orally to paragraph reading and comprehension questions. The means of the pre- and post-tests were calculated to compare the instructional differences (i.e., flipped versus traditional). To assure higher inter-rater reliability, the current researchers adopted the *IELTS Assessment Criteria: Speaking* to evaluate against the participants' oral performance, focusing on (1) fluency and coherence, (2) lexical resource, (3) grammatical range and accuracy, and (4) pronunciation. Furthermore, a Paired-Samples *t*-Test was employed to investigate the participants' oral learning outcomes in two different instructions.

To compare the differences in social and interpersonal communication between the flipped learning and past lecture-based learning experiences, the social presence in the Community of Inquiry

survey (Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson, & Swan, 2008) in the form of a 5-point Likert scale was employed.
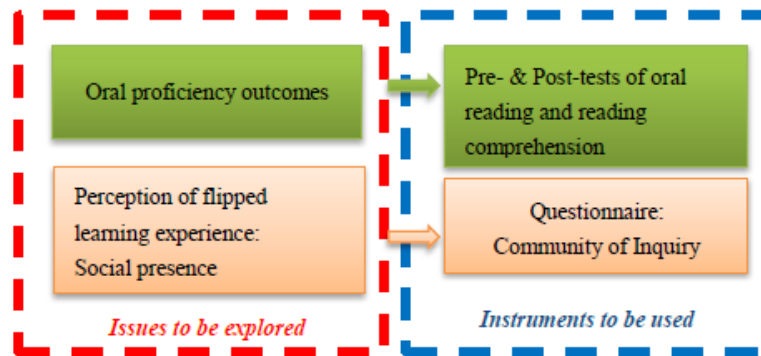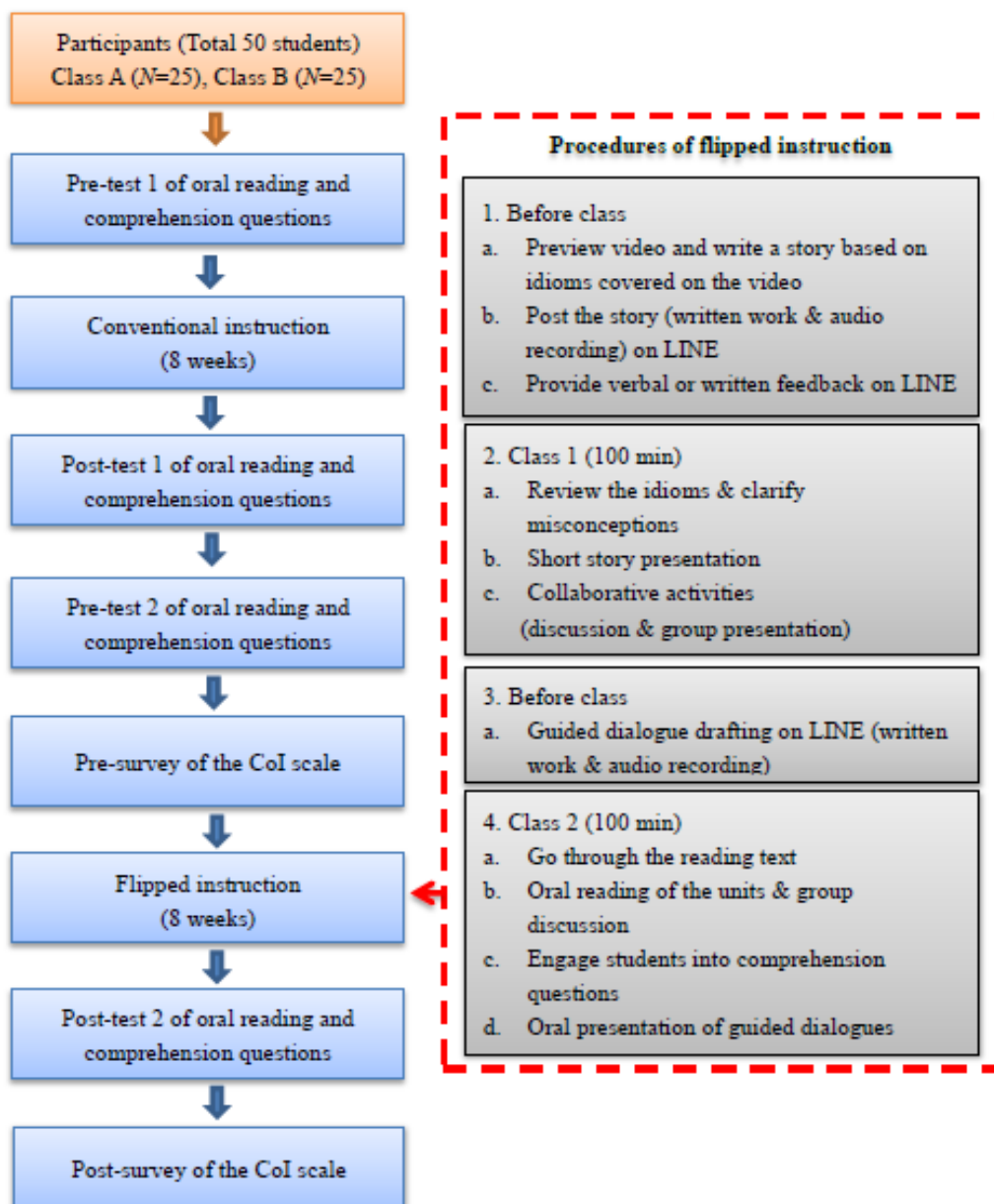

Figure 1. Issues and instruments involved in the current study.

Figure 2. Procedures of the current study.