Using ePUB3 eBook-based SNS to Enhance Students' Learning Effects in Flipped Classes

Tina Pingting Tsai[1], Jyhjong Lin[2], Chingsheng Hsu[2]

[1] Center for General Education, National Taipei University of Education, Taiwan
[2] Department of Information Management, Ming Chuan University, Taiwan
tinatsai85@gmail.com, jlin@mail.mcu.edu.tw, cshsu@mail.mcu.edu.tw

Abstract

In flipped learning, students take self-conducted activities before and in their classes. Taking advantage of flipped learning, we presented an ePUB3 eBook-based method in our earlier study that provided students with flipped learning activities centering the curricular contents in ePUB3 eBooks. However, an important issue in its success is the effectiveness of the class discussions because discussions can activate students' learning from their interactions and the articulation and reflection of learning contents in their own words. In this paper, we introduce an ePUB3 eBook-based SNS platform that takes advantage of the robust features from ePUB3 eBook and Social Network Software (SNS) to provide students with an active and effective way for their class discussions. Then, we explore the adoption of such an SNS platform in our earlier ePUB3 eBook-based flipped learning method to enhance the effectiveness of students' discussions. The adopted method is then applied to an academic "Reading & Writing" class where a quasi-experimental study on the comparative analysis of experimental and controlled *groups* is conduced to verify its validity.

Keywords: ePUB3 eBook-based SNS platform, ePUB3 eBook-based flipped learning, Discussion effectiveness, "Reading & Writing" class, Quasi-experimental study

1 Introduction

In education, flipped learning [1-5] is an execution method of blended learning [6-7] that reverses the role of classrooms as student-centric such that students take self-conducted activities before and in their classes. That is, students preview learning contents at their own pace before the classes and then take self-conducted activities in the classes. If necessary, the teacher may give supplemental helps/instructions before or in the classes. To take advantage of such an innovative flipped learning, we presented in our previous work an ePUB3 eBook-based method [8-9] that provided students with flipped learning activities centering the curricular contents in ePUB3 eBooks [10-12]. Therefore, it encouraged students to preview the learning contents in these ePUB3 eBooks before their classes and then imposed group discussions in the classes for enhancing their learning effects [13-15]. However, as one may conceive, an important issue in its success is the effectiveness of the group discussions because discussions can activate students' learning from their interactions and the articulation and reflection of the learning contents in their own words.

Therefore, for this need, many efforts have been made to support various ways of discussion for promoting the effectiveness of the class discussions. For example, based on social networking [16-17], Social Network Software (SNS) [18-19] has been used in classes to support students' learning through the collaborative way of self-conducted, motivated, sustained, disciplined, and dialogued discussions. As discussed in [20], SNS can assist students in developing their critical way of thinking, skill of problem solving, and participation of collaborative work. In addition, based on Web 2.0 techniques [21-22], ePUB3 eBooks have been issued in recent years [10-12] to support the structured and encoded representation of Web contents where dynamic modalities such as interactive and communicative media can be embedded. Therefore, ePUB3 eBooks and their embedded modalities have been used in education for delivering curricular contents and assisting learning activities to promote students' learning effects.

After recognizing the advantage of the above two artifacts, we present in this paper an ePUB3 eBook-based SNS platform that takes advantage of the robust features from ePUB3 eBook and SNS to provide students with an active and effective way for their class discussions. Then, we explore the adoption of such an SNS platform in our earlier ePUB3 eBook-based flipped learning method to enhance the effectiveness of students' discussions. Afterwards, for illustrating its usefulness, the adopted method is applied to a 'Reading

& Writing' class in a local university where a quasi-experimental study on the comparative analysis of experimental and controlled *groups* is conduced to verify its validity.

This paper is organized as follows. Section 2 presents our discussions about the ePUB3 eBook-based SNS platform. In Section 3, such an SNS platform is adopted in our ePUB3 eBook-based flipped learning method. The adopted method is then applied in Section 4 to a 'Reading & Writing' class in a local university and quasi- experimental discussions are presented for verifying its validity. Finally, Section 5 has the conclusion.

2 The ePUB3 eBook-based SNS Platform

In this section, we introduce the ePUB3 eBook-based SNS platform and how its features are incoported from both of ePUB3 eBook and SNS.

2.1 Features of ePUB3 eBook

As presented in [10-12], ePUB3 eBook is issued in recent years by using the ePUB3 techniques [11] as a distribution and interchange format standard for digital publications and documents. Since ePUB3 is based on the Web 2.0 techniques [21-22], its constructed eBook can thus support the structured and encoded representation of Web contents where dynamic modalities such as interactive and communicative media can be embedded. In general, it has the following features for providing the publication and document services:

(1) It defines a means of representing, packaging, and encoding structured and semantically enhanced Web contents - including HTML5, CSS, JavaScript, SVG, images, and other resources - for distributions in a single-file format. As such, ePUB3 eBook has been widely used as a standardized format for digital publications and documents, and its significant features increase the format capabilities to support a wider range of publication requirements, including complex layouts, rich media, interactivities, and global typographies.

(2) In particular, by using the dynamic features in Web 2.0, many functions can be embedded in ePUB3 eBook such as those modalities in its textual contents: *video, referential link, guided reading, automatic repetition, exercise, test,* and *questionnaire*. Therefore, as shown in Figure 1, this makes ePUB3 eBook be able to keep contents vivid and interactive for motivating students' interests and mindfulness. Further, as shown in Figure 2, by taking advantage of the interactive features in Web 2.0, communicative anchors can be associated with ePUB3 eBook to provide the teacher and students with desired communicative functions. As one may conceive, this makes ePUB3 eBook be able to support the communications among these teacher and students for satisfying their teaching or discussive needs.

Figure 1. ePUB3 eBook with embedded modalities (a video and question exercises)
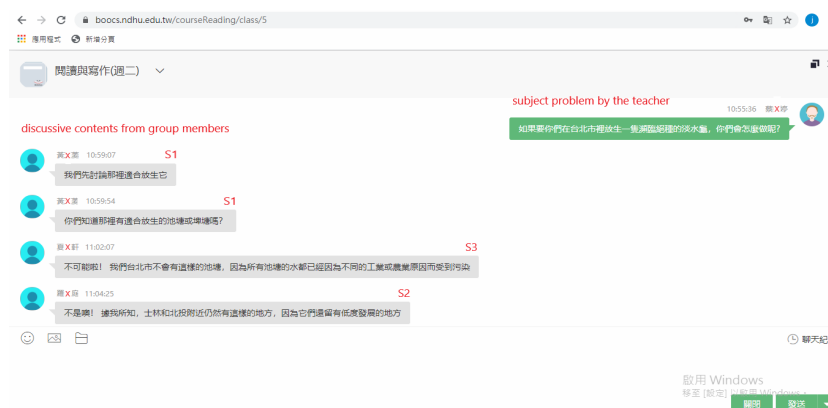

Figure 2. Communicative functions among the teacher and students

2.2 Features of SNS

As introduced in [18-19], SNS takes also advantage of the interactive features in Web 2.0 to provide its users with communicative services to share information, spread experience, aware contact, and gamify context. It helps users to maintain and strength their social ties with other members that in turn increase their intention to continue participating in the community. In general, it has the following features to provide the communicative services:

(1) Its users represent the individuals using the software. Users can form relationships among each other, which can be either one-sided or mutual and may need to be accepted by the other parties. For creating new relationships, facilities may be enabled that help users to find other parties. In forming relationships, the software may provide advanced grouping mechanisms to support various types of group that may be private or public.

(2) In a relationship, it often means that users can subscribe contents provided by the other members. Further, these contents can be directly created by the subscribed users or be indirectly derived by the software based on these users' activities or relevant events. A common case for using such contents is to make collaborations. In this case, these contents can be delivered in the form of messages, annotations, or comments toward the collaborative members along with possible notifications to notify these members. As results, these members can make discussions or give rates about these contents. In particular, depending on its purposes, giving rates can range from easy actions (e.g., give a "like" note) to sophisticated efforts (e.g., give a "review" feedback).

(3) When specific conditions are satisfied, the software can emit responsive events to trigger desired actions. Such actions may result in the creation and delivery of desired contents on behalf of interested parties (e.g., concern such conditions) and then the discussions or rates of these contents by these parties (e.g., make discussions about such conditions) or the changes of these parties' status (e.g., take actions to deal with such conditions).

2.3 Features of ePUB3 eBook-based SNS Platform

After exploring the sound features of the above ePUB3 eBook and SNS mechaisms, we then incorporate these features as an integrated scheme to provide students with an active and effective learning way for their class participations and discussions. Therefore, such an integrated ePUB3 eBook-based SNS scheme would have the following features:

(1) It provides students in an integrative manner with ePUB3 eBooks for learning knowledge about class subjects and communicative services for participating in class discussions. As dynamic and interactive functions can be embedded, these eBooks keep contents vivid and interactive for motivating students' interests and mindfulness. Furthermore, these communicative services support students' one-sided or mutual discussions in various types of private or public group. The teacher can create or assign groups amongst students for class discussions according to his/her instructional needs.

(2) Since communicative anchors can be associated with ePUB3 eBooks for providing communicative services, students can make necessary discussions while reading the eBooks for clarifying or judging their learning issues. In contrast, as dynamic and interactive functions can be embedded in the eBooks, students can bring in information from the eBooks or embedded modalities such as *video* and *referential link* while making discussions for developing their skills of critical thinking and problem solving from the discussions.

(3) In the discussions, interactive contents can be provided to or subscribed from group members in the form of messages, annotations, or comments. If necessary, the teacher can join in or intervene with the discussions to address his/her concerned conditions from group members' actions (e.g., have few interactions, serious arguments, or inadequate messages among group members). Such interventions may result in the creation and delivery of specific contents on behalf of these members (e.g., give reminding messages to acknowledge the concerned conditions) and then the responses from these members (e.g., take responsive actions to alleviate the concerned conditions).

To address these features, an ePUB3 eBook-based SNS platform based on the work in [23] is developed as shown in Figure 3 with the following characteristics:

(1) The platform extends the work in [23] by using the Web 2.0-based ePUB3 techniques to provide sufficient functions for addressing the above mentioned features. As shown in Figure 4, both of ePUB3 eBooks and SNS services can be provided in an integrated environment. This makes the teacher and students easy to join in the discussions while reading the eBooks or versa.

(2) For helping the teacher to address his/her concerned conditions about students' actions in their discussions, the big data analytics mechanism in [23] is extended by tracking and analyzig their accesses on the ePUB3 eBooks and SNS services (e.g., the actions taken on the eBooks or embedded modalities or associated communicative anchors). Therefore, the mechanism includes such necessary modules as PouchDB. CouchDB (to store these accesses), ETL (to screen these accesses), Elasticsearch.Analytics (to analyze these accesses), and Façade (to display analyzed information). For more detail about these modules, the reader is referred to [23].
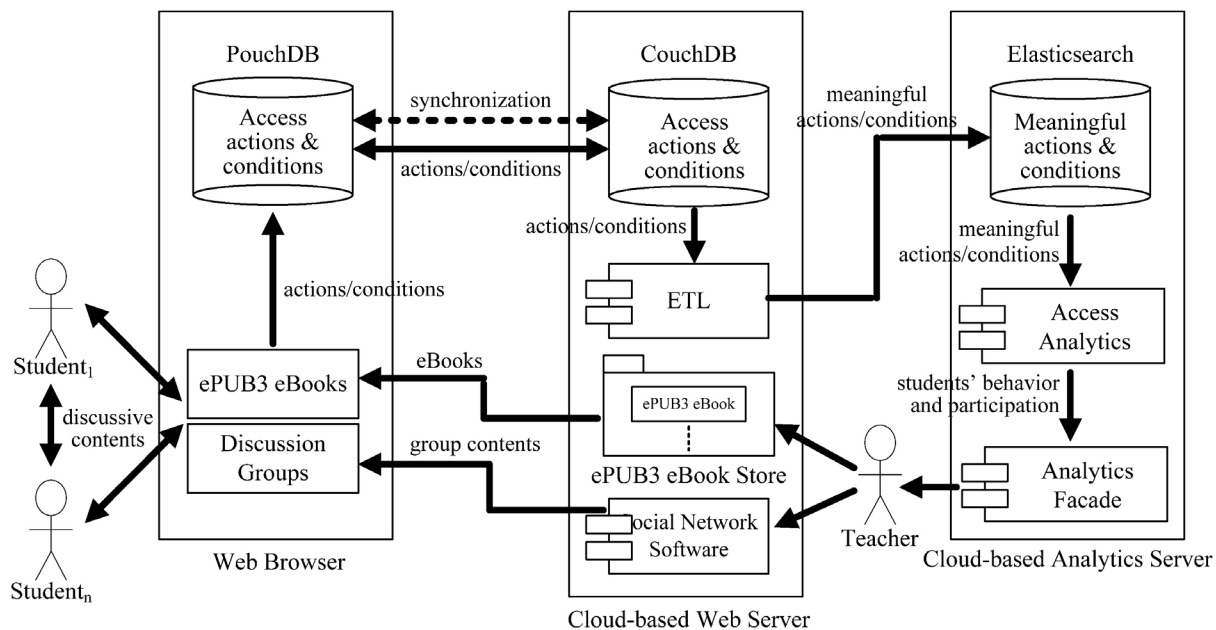
Figure 3. The ePUB3 eBook-based SNS platform

Figure 4. The integrated platform with eBook (embedded *video*) and SNS services

3 Using the Platform in Flipped Classes

In this section, we adopt the above ePUB3 eBook-based SNS platform in our eariler ePUB3 eBook-based flipped learning method [8-9]. The resultant ePUB3 eBook -based SNS flipped learning method for the teaching of a class thus has the following class design steps:

(1) Identify learning objectives - This step focuses on the pedagogical purposes of the class such as what knowledge students acquire and what capabilities they possess. In general, these objectives can be identifed by ① referencing the expected achievement of the class that is usually approved by the institute; for instance, a "Reading & Writing" class is often designed in an universiy for enhancing students' capabilities of reading comprehension and applied writing; and ② considering students' characteristics to ensure or adjust the above identified objectives; these characteristics may include: ① their attributes such as academic abilities and interests; and ② their prior competencies such as experiences of applied writing.

(1) Determine learning activities - This step addresses the necessary activities to complete the class. For instance, the "Reading & Writing" class that uses the ePUB3 eBook-based SNS platform may have the following learning activities:

① A preview of the class ePUB3 eBook on the ePUB3 eBook-based SNS platform before the class. This will be taken by all students prior to the class for establishing their preparative knowledge about the class learning contents.

② A pre-class test at the beginning of the class. This is also taken by all students for verifying their preparative knowledge about the learning contents.

③ The group discussions using the ePUB3 eBook-based SNS platform to solve the subject problem designated by the teacher. The discussions are taken by all grouped students through the ePUB3 eBook-based SNS platform. In general, after grouping by the teacher, the discussions in each group follow an interactive approach that takes advantage of the well-known inquiry-based discussion [24-26] and quality talk [27-28] for providing group members with an effective interactive way in making their discussions:

(A) The discussions begin from the development of group members' cognition and thinking experience through the practice of a series of interactive questions/responses to share ideas, inquire hypotheses, and provide evidences. As presented in [29], there are seven types of question to practice: (Q1) authentic one AQ to require thinking about the learning contents, (Q2) uptake one UQ to ask about something that was said earlier, (Q3) speculation one SQ to require considering alternatives, (Q4) high-level thinking one HLQ to build on ideas and generate new information, (Q5) affective one AfQ to connect someone's experience with the learning contents, (Q6) connection one CQ to connect materials within the learning contents, and (Q7) test one TQ to presuppose answers in the learning contents. Correspondingly, there are three types of response to practice: (R1) elaborated explanation EE to give a claim and supportive evidences, (R2) exploratory talk ET to give a challenge and reasons, and (R3) cumulative talk CT to build positively on what others have said.

(B) After the practice, group members need to identify main issues relevant to the subject problem designated by the teacher. In doing so, they may need to bring in more info from various resources such as media (e.g., social media), materials (e.g., referential data), and experts (e.g., relevant faculty).

(C) Then, in formal discussions, group members have a series of interactive moves between the practiced seven types of questions and three types of responses for inferring and verifying the conclusions about solving the problem in light of the identified relevant issues.

(D) Finally, at the end of the formal discussions, group members summarize and conclude their discussions in light of the consensus through their interactions using questions and responses for inferring, verifying, and consenting the conclusions.

④ A sharing of conclusions with the peers of other groups to help them enhance their cognition and thinking abilities through recognizing the value and dis/advantage of the conclusions from other groups. In addition, the teacher also gives comments and suggestions about their conclusions for assisting their self-assessments and reflections of the learning in this class.

⑤ A post-class test at the end of the class. This is taken by all students for verifying their learning effects from the class.

(3) Prepare the ePUB3 eBook and SNS – This step focuses on the preparation of the ePUB3 eBook and SNS for supporting the actions of those learning activities determined above. In general, as shown in Figure 4, this can be achieved by activating the ePUB3 eBook- based SNS platform where (1) the ePUB3 eBook is accessible to provide desird curricular contents about class subjects; supportive functions such as *pictures*, *videos*, and *referential links* can be embedded in these contents to enhance students' interests and mindfulness; and (2) the SNS provides communicative services in discussions for enhancing students' learning effects.

Instruct the class - This step addresses the actual instruction of the class. In general, the instruction is taken in the arranged class time and follows the learning activities determined above where desired curricular contents in the eBook are delivered and communicative services in the SNS are provided for completing the class.

4 Practical Application

In this section, we apply our adopted method to a 'Reading & Writing' class in a university in Taiwan. The purpose of this class is to enhance students' reading and writing abilities by their reading curricular contents in an ePUB3 eBook and discussing the subject problem through the ePUB3 eBook-based SNS platform. Their learning effects are compared between an experimental *group* and a control *group*.

4.1 Instructional Design

In our study, the experimental *group* uses our adopted method (i.e., using the ePUB3 eBook and SNS services through the platform) and the control *group* instead uses our earlier ePUB3 eBook-based flipped learning method (i.e., using only the ePUB3 eBook via the platform). Table 1 shows the learning activities of the two *groups* in the class. In particular, as shown in the two *groups*, an ePUB3 eBook entitled "Free Captive Animals" is used to deliver the curricular contents for students' reading and discussions. Figure 1 illustrates the ePUB3 eBook where a video and some exercises are embedded for increasing the effects of students' self-review and group- discussion.

Table 1. The learning activities of the two groups in a "Free Captive Animals" class

activities	experimental *group*	control *group*
A 7-day preview of the used "Free Captive Animals" ePUB3 eBook before the class	using the ePUB3 eBook-and SNS services through the ePUB3 eBook- based SNS platform	using the ePUB3 eBook through the ePUB3 eBook-based SNS platform
A 5-min pre-class test at the beginning of the class	10 multiple-choice questions for verifying students' preparative knowledge about the previewed contents	the same as experimental *group*
The 50-min group discussions for solving the subject problem designated by the teacher	using the ePUB3 eBook in below SNS services-applied activities	using the ePUB3 eBook in below face-to-face activities
	20-min practice of a series of seven types of questions and three types of responses	
	5-min identify main issues relevant to the problem	
	20-min interactive moves between the practiced seven types of questions and three types of responses for solving the problem in light of the identified relevant issues	the same as experimental *group*
	5-min conclude the discussions in light of convergent consensus	
A 20-min sharing of conclusions with other groups	using SNS services to share conclusions across groups and comments by the teacher	using face-to-face to share conclusions across groups and comments by the teacher
A 15-min post-class test at the end of the class	one applied writing question : "*describe the bad results caused by improper freeing based on your experiences or the stories you have ever heard*"	the same as experimental *group*

In addition, students in the two *groups* begin their discussions from the 20-min practice of a series of seven types of questions and three types of responses. Afterwards, they use 5 minutes to identify main issues relevant to the problem being solved. Then, they carry on a 20-min series of interactive moves between the practiced seven types of questions and three types of responses for solving the problem in light of the identified relevant issues. Finally, they have 5 minutes to conclude their discussions in light of their convergent consensus.

It is also noted that the ePUB3 eBook-based SNS platform is used in the two *groups* where the experimental *group* uses both of the ePUB3 eBook and SNS services in an integrated manner for students' reading and discussing and the control *group* uses only the ePUB3 eBook for students' reading. Figure 2 illustrates the platform in light of the teacher with part of the interactive contents from a group of students in the experimental *group*. Then, Figure 4 shows the integrated platform in light of the teacher for assisting students to bring in information from the eBook and its embedded *video* while making discussions for solving the problem designated by the teacher.

However, for validating our study, it should be noticed that both of these two *groups* use the same ePUB3 eBook in the class, the same interactive approach for their discussions, the same 10 multiple-choice questions for the pre-test to verify their preparative knowledge, and the same applied writing question for the post-test to verify their learning effects from this class.

4.2 Data from Practical Instruction

According to the class schedule at the Fall semester in 2019, a 25-student class for the experimental *group* was held on 10/08/2019, while a 21-student class for the control *group* was done on 10/11/2019. The following illustrates part of the discussions from a group of students S1-S3 in the experimental *group*:

(1) The discussions began from their practicing interactive questions/responses about a subject issue designated by the teacher : 「*is it good to free a captive animal no matter it is endangered or not?*」 As results, these students had a series of interactions between questions and responses for solving this issue: ① S1: do you support to free a captive animal no matter it is endangered or not? (AQ question), ② S2: I support to free an endangered animal because it is about to be extinct (EE response), ③ S3: no! according to a report from the World Animal Protection, it is not good to free an endangered animal because its survival is hard to ensure in the freed environment (ET response), (4) S2: ooh! how is this report written? (UQ question).

(2) After the practice, the teacher designated a subject problem for these students to make discussions : 「*what do you do if you are asked to free an endangered freshwater tortoise in Taipei city?*」

(3) The discussions continued then by these students to identify the main issues relevant to the problem: ① where is suitable to free it, ② how to ensure it lives good in the freed environment, ③ what to do if it is found not good living in the freed environment.

(4) In their discussions, these students had a series of interactive moves for solving the first issue (as shown in Figure 3 for their original Chinese version): ① S1: do you know if there is a pond or reservoir that is suitable to free it? (AQ question), ② S3: not possible! there is no such a pond in Taipei city since the water in all ponds has been contaminated by different industrial or agricultural reasons (ET response), ③ S2: not really! as I know, there are still such places near the Shilin and Beitou districts because they still have low-developed areas (ET response), ④ S1: good! do you know where they are and how to clarify their water quality? (UQ question).

(5) At the end of their discussions, these students had the conclusion about the first issue: there are still some irrigation ponds around the Shilin and Beitou districts that have sufficiently fresh water for the living of a freshwater tortoise. This can be verified by referring to the report of water quality about irrigation areas published by their managerial Chising irrigation association.

4.3 Verification of Learning Effects

After practical class instructions, the scores of pre-test and post-test were collected from each *group* to verify students' learning effects. In our study, we used one-way analysis of covariance (one-way ANCOVA) to control the effects of pre-test scores on post-test ones where the covariate X represented pre-test scores, the categorical independent variable G (called a treatment) represented *group* types (experimental and control *groups*), and the dependent variable Y represented post-test scores. The data were analyzed by a 'PASW Statistics 18' tool [30] to summarize the homogeneity test of regression slopes. As shown in Table 2, the p-value of the interaction term $G \times X$ shows that the regression slopes are not significantly different since its value 0.329 is greater than 0.05. Therefore, one-way ANCOVA can be performed. Table 3 is the summary table of the conducted one-way ANCOVA. Since its F statistic is 5.299 and p-value is 0.026, the experimental treatment effect is thus significant at the 0.05 level of significance. In addition, the adjusted mean score of the experimental *group* is 85.913, while that of the control *group* is 79.152. Therefore, the learning effect of the experimental *group* is significantly better than that of the control *group* at the 0.05 level of significance.

Table 2. Summary of the homogeneity test of regression slopes

Source	Type III SS	df	MS	F	Sig.
Corrected Model	856.277a	3	285.426	2.905	.046
Intercept	11097.012	1	11097.012	112.951	.000
G	179.147	1	179.147	1.823	.184
X	209.069	1	209.069	2.128	.152
G × X	95.853	1	95.853	.976	.329
Error	4126.332	42	98.246		
Total	320550.000	46			
Corrected Total	4982.609	45			

Table 3. Summary of the one-way ANCOVA

Group	n	Adjusted Mean	Source	F	Sig.	Partial Eta Squared
Experimental	25	85.913	G	5.299*	.026	.110
Control	21	79.152				

*p < .05. **p < .01.

4.4 Qualitative Analysis of Group Discussions

In addition to verifying students' learning effects, we also figure out students' concerned topics, concepts, and viewpoints in their discussions. The 'TF-IDF' and 'TextRank' schemes provided by the 'Jieba' Chinese word segmentation program module [31] is used to extract the keywords in their discussions. Each generated keyword is accompanied by a corresponding weight to indicate its importance in discussions. In addition, a vocabulary method is also used to retrieve the positive and negative emotional words to obtain a deep understanding of students' emotional responses. Table 4 is the analysis result of the discussions by the experimental *group* where keywords are ranked in a descending order of their weights. It can be seen from the TF-IDF and TextRank in Table 4 that what students concern such as 'free a captive animal', 'pond', and 'survive' are related to the subjects designated by the teacher. The emotional words also reflect their opinions about freeing a captive animal.

5 Conclusion

In this paper, we discuss an important issue about the success of flipped learning: the effectiveness of students' class discussions. In particular, as the ePUB3 eBook-based SNS platform incorporates the robust features from ePUB3 eBook and SNS to provide students with an active and effective way for their class

Table 4. Analysis of the discussions by the experimental *group*

TF-IDF		TextRank		Emotion Words	
Keywords	Weights	Keywords	Weights	Positive	Negative
放生 (free a captive animal)	1.6428	池塘 (pond)	1.0000	支持 (support)	不行 (cannot)
池塘 (pond)	1.3839	士林 (Shilin Dist.)	0.9809	贊成 (agree)	不好 (not good)
士林 (Shilin Dist.)	0.8406	放生 (free a captive animal)	0.5621	適合 (suitable for)	污染 (pollution)
灌溉 (irrigation)	0.3789	世界 (world)	0.4272	開發 (develop)	
生存 (survive)	0.2419	污染 (pollution)	0.4272	管理 (manage)	
公告 (announcement)	0.1929	生存 (survive)	0.4272	太好了 (very good)	
台北市 (Taipei City)	0.1698	原因 (reason)	0.4242		
保有 (retain)	0.1567	淡水 (fresh water)	0.4242		
地方 (area)	0.1549	公告 (announcement)	0.3969		
淡水 (fresh water)	0.1305	灌溉 (irrigation)	0.3392		
污染 (pollution)	0.1269	管理 (manage)	0.3271		
支持 (support)	0.0891	地方 (area)	0.1898		

discussions, we thus focus on the adoption of such a platform in our ePUB3 eBook- based flipped learning method to enhance the effectiveness of students' discussions. Therefore, a flipped class using our adopted method that has group discussions through the ePUB3 eBook-based SNS platform has the following learning activities:

1. Students preview the ePUB3 eBook in the platform before the class for establishing their preparative knowledge about the learning contents in this class.

2. Students take a pre-class test at the beginning of this class for verifying their preparative knowledge about the learning contents.

3. Students make group discussions using the platform for solving the subject problem designated by the teacher. In general, after grouping by the teacher, the practices and formal discussions in each group follow an interactive approach that takes advantage of the inquiry-based discussion and quality talk for providing group members with an effective interactive way in making their discussions.

4. Students share their conclusions with the peers of other groups to enhance their cognition and thinking abilities through recognizing the value and dis/advantage of the conclusions from other groups.

For illustration, our adopted flipped learning method was applied to a 'Reading & Writing' class in a university in Taiwan. Its effectiveness was verified by a comparison between an experimental *group* that used our adopted method and a control *group* that used our earlier ePUB3 eBook-based flipped learning method. After practical class instructions at the Fall semester in 2019, the scores from these two *groups* were collected for conducting an one- way ANCOVA. As the results indicates, there was a significant difference between the two *groups* and the increase in the mean score in the experimental *group* showed an enhanced development of students' reading and writing abilities through the ePUB3 eBook-based SNS platform in the flipped class.

In our future work, we will continue to explore the application of our adopted method on more discussions in various classes. Since our method is applied herein only to an academic 'Reading & Writing' class, its application to more classes in different academic disciplines and institutes will be conducted in our future studies. Further, in addition to our ePUB3 eBook-based flipped learning method, we will also try to adopt the ePUB3 eBook-based SNS platform in other execution methods of blended learning. As presented in [6-7], there are many other execution methods on blended learning such as face-to- face driver, rotation, online lab, flex, and online driver methods. The validities of adopting the ePUB3 eBook-based SNS platform in these methods will also be respectively discussed.

Acknowledgements

References

[1] J. Bergmann, A. Sams, *Flip Your Classroom: Reach Every Student in Every Class Every Day*, International Society for Technology in Education, July 2012.

[2] G. J. Hwang, M. R. Chen, H. Y. Sung, M. H. Lin, Effects of Integrating A Concept Mapping-based Summarization Strategy into Flipped Learning on Students' Reading Performances and Perceptions in Chinese Courses, *British Journal of Educational Technology*, Vol. 50, No. 5, pp. 2703-2719, September, 2019.

[3] J. Lee, H. Choi, Rethinking the Flipped Learning Pre-class: Its Influence on the Success of Flipped Learning and Related Factors, *British Journal of Educational Technology*, Vol. 50, No. 2, pp. 934-945, March, 2019.

[4] C. J. Lin, G. J. Hwang, Q. K. Fu, J. F. Chen, A Flipped

Contextual Game-based Learning Approach to Enhancing EFL Students' English Business Writing Performance and Reflective Behaviors, *Educational Technology & Society*, Vol. 21, No. 3, pp. 117-131, July, 2018.

[5] Z. Zainuddin, Students' Learning Performance and Perceived Motivation in Gamified Flipped-Class Instruction, *Computers & Education*, Vol. 126, pp. 75-88, November, 2018.

[6] C. Bonk, C. Graham, *The Handbook of Blended Learning*, Wiley, 2006.

[7] C. Bonk, C. Graham, *Handbook of Blended Learning: Global Perspectives*, Pfeiffer Publishing, 2005.

[8] P. T. Tsai, C. S. Hsu, J. J. Lin, An Application of ePUB3 eBooks to the Design and Teaching of Flipped "Applied Writing" Courses: An Example of "Abstract Writing", *Journal of Educational Media & Library Sciences*, Vol. 56, No. 1, pp. 69-105, March, 2019.

[9] P. T. Tsai, J. J. Lin, L. C. Lin, A Flip Blended Learning Approach for ePUB3 eBook-based Course Design and Implementation, *Eurasia Journal of Mathematics, Science and Technology Education*, Vol. 14, No. 1, pp. 123-144, January, 2018.

[10] L. C. Lin, P. T. Tsai, J. J. Lin, J. R. Li, Some Useful ePUB3-based Contents Delivery Functions, *5th International Conference on Information and Education Technology*, Tokyo, Japan, January, 2017, pp. 49-52.

[11] ePUB3 Overview, http://www.idpf.org/epub/30/spec, October, 2011.

[12] ISO/IEC TS 30135, ePUB3 Overview, https://www.iso.org/standard/53255.html, July, 2020.

[13] A. Soter, The Use of Discussion as a Pedagogical Tool in the University Context, in: J. Donnermeyer (Ed.), Talking about Teaching: *Essays by Members of The Ohio State University Academy of Teaching*, Columbus, Ohio, 2007, pp. 30-43.

[14] A. Soter, I. Wilkinson, P. Murphy, L. Rudge, K. Reninger, M. Edwards, What the Discourse Tells Us: Talk and Indicators of High-level Comprehension, *International Journal of Educational Research*, Vol. 47, No. 6, pp. 372-391, 2008.

[15] P. Murphy, I. Wilkinson, A. Soter, Instruction Based on Discussion. in: R. E. Mayer, P. A. Alexander (Eds.), *Handbook of Research on Learning and Instruction*, Routledge, 2011.

[16] G. Barnett, *Encyclopedia of Social Networks*, Sage, 2011.

[17] C. Kadushin, *Understanding Social Networks: Theories, Concepts, and Findings*, Oxford University Press, 2012.

[18] S. C. Cheng, C. K. Chen, Application in Social Network English Learning Based on Virtual Cloud Technology Combined with Essential Articles Classification, *Journal of Internet Technology*, Vol. 13, No. 6, pp. 989-996, November, 2012.

[19] L. Singer, K. Schneider, Influencing the Adoption of Software Engineering Methods Using Social Software, *34th International Conference on Software Engineering (ICSE 2012)*, Zurich, Switzerland, June 2012, pp. 1325-1328.

[20] S. Pérez-Soler, E. Guerra, J. de Lara, Collaborative Modeling and Group Decision Making Using Chatbots in Social Networks, *IEEE Software*, Vol. 35, No. 6, pp. 48-54, November/December, 2018.

[21] G. Baxter, T. Connolly, M. Stansfield, N. Tsvetkova, B. Stoimenova, Introducing Web 2.0 in Education: A Structured Approach Adopting a Web 2.0 Implementation Framework, *7th International Conference on Next Generation Web Services Practices*, Salamanca, Spain, October 2011, pp. 499-504.

[22] G. Blank, B. Reisdorf, The Participatory Web, *Information, Communication & Society*, Vol. 15, No. 4, pp. 537-554, 2012.

[23] P. T. Tsai, J. J. Lin, J. L. Hou, Y. S. Chen, C. S. Hsu, Preview Analytics of ePUB3 eBook-based Flipped Classes Using a Big Data Approach, *Journal of Internet Technology*, Vol. 20, No. 7, pp. 2129-2140, December, 2019.

[24] F. Abd-El-Khalick, F. BouJaoude, R. Duschl, N. Lederman, R. Mamlok- Naaman, A. Hofstein, M. Niaz, D. Treagust, H. Tuan, Inquiry in Science Education: International Perspectives, *Science Education*, Vol. 88, No. 3, pp. 397-419, May, 2004.

[25] T. Bell, D. Urhahne, S. Schanze, R. Ploetzner, Collaborative Inquiry Learning: Models, Tools, and Challenges, *International Journal of Science Education*, Vol. 32, No. 3, pp. 349-377, June, 2009.

[26] J. Chisholm, A. Godley, Learning about Language through Inquiry-based Discussion, *Journal of Literacy Research*, Vol. 43, No. 4, pp. 430-468, December, 2011.

[27] P. Murphy, J. Greene, C. Firetto, B. Hendrick, M. Li, C. Montalbano, L. Wei, Quality Talk: Developing Students' Discourse to Promote High-level Comprehension, *American Educational Research Journal*, Vol. 55, No. 5, pp. 1113-1160, October, 2018.

[28] I. Wilkinson, A. Soter, P. Murphy, Developing a Model of Quality Talk about Literary Text, in: M. G. McKeown, L. Kucan (Eds.), *Bringing Reading Research to Life*, Guilford Press, 2010, pp. 142-169.

[29] H. L. Hsu, H. J. Chen, W. T. Lin, Quality Discussion and High-Level Comprehension: An Analysis of Taiwanese College Students, *Journal of Educational Media & Library Sciences*, Vol. 56, No. 1, pp. 107-130, March, 2019.

[30] PASW Statistics 18, http://www.spss.com.hk/statistics/, July 2020.

[31] Jieba, https://github.com/fxsjy/jieba, July 2020.

Biographies

Tina Pingting Tsai is an associate professor of the Center for General Education at National Taipei University of Education in Taiwan. She received her Ph.D. degree in 2010 from the Chinese Literature Department at National Central University, Taiwan. Her research interests include Chinese Education, e-Learning, Chinese Literature, and Marketing Planning.

Jyhjong Lin is a full professor of the Information Management Department at Ming Chuan University in Taiwan. He received his Ph.D. degree in 1995 from the Computer Science Engineering Department at University of Texas at Arlington in USA. His research interests include Software Engineering, System Architecture and Development, and e-Learning.

Chingsheng Hsu got his Ph.D. degree from the Information Management Institute, National Central University, Taiwan, in 2005. Currently, he is an associate professor of the Information Management Department, Ming Chuan University. His research interests include Block Chain Technology, Data Mining and Big Data, Digital Watermarking and Information Hiding, and e-Learning.