Exploring the Effects of Online Academic Help-Seeking and Flipped Learning on Improving Students' Learning

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ABSTRACT

This study explored the effects of online academic help-seeking (OAHS) and flipped learning (FL) on students' development of involvement, self-efficacy, and self-directed learning. A quasi-experiment was conducted to investigate whether students' involvement, self-efficacy, and self-directed learning increases over time with intervention by OAHS, FL, and their combination. Three classes of first-year university students in a one-semester course were chosen for this empirical research. The 102 students were divided into three groups. The first group (G1, which received online OAHS and FL), and the second group (G2, which received online FL only), were the experimental groups. The last group (G3), which received the traditional teaching method in a blended course, served as the control group. The results indicate that G1 students' involvement, self-efficacy, and self-directed learning all improved under the condition of simultaneously applying OAHS and FL. In addition, this study also reveals that the application of FL alone could be helpful in G2 students' development of their involvement, self-efficacy, and self-directed learning. However, G3 students, who learned with traditional teaching method in a blended learning environment, did not have better development in their involvement, self-efficacy, and self-directed learning. Finally, the authors further discuss the implications for teachers, scholars, and schools engaged in online education.

Keywords

Online academic help-seeking, Flipped learning, Involvement, Self-efficacy, Self-directed learning

Introduction

The needs for online academic help-seeking and flipped learning

Over the past two decades, teaching and learning processes have been influenced by technological, instructional and pedagogical advances (Chou & Tsai, 2002; Kavanoz, Yüksel & Özcan, 2015). Nowadays, students' demands are transforming because their study habits and learning strategies have already changed due to the pervasiveness of the Internet (Persico & Pozzi, 2015). Regardless of which teaching or learning mode is used, students' learning outcomes are one of the most important things for educators. In order to keep up with the rapid evolution of the education environment, teachers must update themselves on the potential of new teaching approaches frequently, and apply those to their instruction. Even though computers, digital tools, and educational technologies have been deemed as benefits to the education field, the potential advantages are not comprehensively understood (Wu, Kuo, Jen & Hsu, 2015).

As a result of the educational revolution, many colleges and universities now offer online programs or digital courses (Wei, Peng & Chou, 2015). Convinced that information technology (IT) can improve their teaching quality, relationships with their students, and provide students with effective educational experiences, many teachers have devoted themselves to apply IT and make effective use of it in class (Persico & Pozzi, 2015). A blended learning environment such as flipped classroom allows students to discover their own problems, encourages them in active learning and to have an open-minded attitude to create an atmosphere of cooperative learning (Tsai, Shen & Lu, 2015). Moreover, a web-based learning environment is helpful for improving learners' help-seeking behaviours and influences their learning processes (Mäkitalo-Siegl & Fischer, 2011). Therefore, students' online learning experience and related processes is a popular research topic, and has recently been investigated by several teams (Roby, Ashe, Singh, & Clark, 2013; Tsai & Tsai, 2013). However, online learning also introduces some difficulties; for example, students may suffer alienation and isolation when they study in an online environment (McInnerney & Roberts, 2004; Tsai, 2013a). Thus, the authors of this study applied online academic help-seeking (OAHS), which refers to the spontaneous behavior of students requesting assistance from others or peers through the Internet (Cheng & Tsai, 2011), and investigated the effects on students' learning in a flipped course.

In the 1990s, it was found that students felt physically isolated when they participated in online courses (Cereijo, Young & Wilhelm, 2001; Daugherty & Funke, 1998), especially when the instructor could not immediately provide feedback to learners (McIsaac, Blocher, Mahes, & Vrasidas, 1999). This problem remains till today; students suffer isolation when they study in an online environment and this situation is often considered to be unavoidable (McInnerney & Roberts, 2004). In Taiwan, most students of compulsory education are taught by didactic, or spoon-fed, education. Upon entering college and participating in an online course without teacher's on-the-spot support, students may not concentrate on learning materials, especially when seduced by potential distractions such as playing online games, surfing shopping websites, watching online series, and being addicted to social networks (Tsai, 2013b).

The importance of students' involvement, self-efficacy, and self-directed learning

Online, blended learning, or flipped learning (FL) provides flexibility and accessibility. Different from traditional teaching approach, FL refers to instructors asking students to watch prescribed videos before class with other teaching materials to acquire knowledge and basic concepts, while the following in-class time is devoted to exercises, projects, or discussions of that content (Davies, Dean, & Ball, 2013). However, it is difficult for teachers to involve students in an online or blended course in an environment that is full of shopping websites, online games, and social networking websites (Tsai, 2012a). Flipping the classroom is a teaching approach that focuses on students' learning involvement (McCallum, Schultz, Sellke, & Spartz, 2015). It is mentioned in earlier research that successful students' involvement, which can be defined as a person's perceived relevance of a certain object based on inherent needs, values, and interests (Zaichkowsky, 1985), could play a critical role in helping to elevate learning quality (Learning and Skills Council, 2007). Moreover, it is found that there are strong positive comments from students involved within a flipped class (McCallum et al., 2015). Therefore, the authors adopted FL in this study and measured whether students' involvement is improved in a FL environment with OAHS.

From the educational perspective, students may need more self-efficacy experiences to enable them to learn successfully (Chen, Tutwiler, Metcalf, Kamarainen, Grotzer & Dede, 2016). Self-efficacy, which includes the belief that an individual has the ability to create change by personal action (Bandura, 2004), is also a critical factor in online education. It is indicated that positive Internet attitudes and preferences for web-based learning environments can be predicted by Internet self-efficacy (Chu & Tsai, 2009; Joo, Bong & Choi, 2000). Moreover, self-efficacy has been shown to influence students' motivation and learning outcomes (Liang & Tsai, 2008; Tsai, 2012b). Furthermore, compared with traditional lecture-based learning, FL can facilitate students' cognitive engagement and guide them to interact more efficiently with the learning content (Ibrahim & Callaway, 2014). That is, it is important to improve students' self-efficacy in an online or blended course. In order to understand learners' self-directed use of technology for learning, it is necessary to understand what self-directed learning entails (Lai, 2015). In an online learning environment, students have to access the course independently and structure the time, pace, and strategy of their own learning (Puzziferro, 2008). Thus, it is important to develop students' self-directed learning to help them learn well at their own pace, anytime and anywhere (Tsai, Shen, & Huang, 2012). Knowles (1989) defined self-directed learning as "a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies and evaluating learning outcomes" (p. 18). In flipped classrooms, learners feel more confident during course discussions because they have already previewed and prepared the learning materials before class; this can prompt their self-directed learning for their learning activities (Bishop & Verleger, 2013; Halili, Razak & Zainuddin, 2015).

In previous studies related to computing education, this research team emphasized the cultivation of students' computing skills and the pass rate on computing certifications (Lee, Shen & Tsai, 2010; Shen, Lee & Tsai, 2011; Tsai, 2016; Tsai & Shen, 2014; Tsai, Shen & Tsai, 2011); these studies showed that it is also important to understand how to improve students' learning psychology, such as their involvement and self-efficacy. Therefore, the authors designed and integrated OAHS in the implementation of FL in a blended course titled "Applied Information Technology: Office Software," and explored their effects on improving students' involvement, self-efficacy, and self-directed learning.

The current study

Subjects

The current study provides an analysis of three classes of first-year university students in Taiwan (27 male and 75 female), and taking a compulsory course titled "Applied Information Technology: Office Software." Two classes were from the department of Finance, while one was from the department of Law. An experienced professor taught the three classes during the same semester, with each of the classes taught using a different teaching approach. In this study, G1 (which received treatments of online academic help-seeking and flipped learning, n = 33) and G2 (which received treatment of flipped learning only, n = 34) were the experimental groups, while G3 group (which received traditional teaching, n = 35) served as the control group.

Course setting

The experiment mainly targeted first-year students from non-computer or non-information departments of study, and was conducted in a semester-long, two credit-hour course entitled "Applied Information Technology: Office Software." Computing education is emphasized for students of each education level in Taiwan. Even students in university departments of Applied Japanese or Law are still required to take four compulsory computing courses before they graduate (Tsai, 2012a). Thus, this course aims to develop students' computing skills for using document processing software such as Microsoft Word and PowerPoint.

Treatments in this study

Three classes, each treated as a group, were involved in the experiment. The first class (G1) received the treatment of online academic help-seeking and flipped learning simultaneously. The second class (G2) received the treatment of flipped learning only. The last class (G3) received the traditional teaching approach, but in a blended learning environment.

Treatment of OAHS

According to an official report, 84.9% of Taiwanese Internet users aged 12 and above have smartphone-enabled Internet access (The National Development Council, 2014). In order to make sure that this study could be conducted well, students in G1 were divided into small teams at the beginning of the semester, each of the groups consisting of four to five members. In addition, the teacher also investigated smartphone ownership rate in class, and found that every student in this study possessed a smartphone, and regarded a smartphone as their main device for accessing the Internet. Moreover, all of the students had a Facebook account and had also downloaded and installed a mobile application called "LINE." Therefore, each group of students was required to form an online learning community through which group members could raise questions, discuss, share information and remind one another to submit homework.

In the process of help-seeking through LINE, the teacher was not directly involved, nor did he provide answers for students. Instead, the members of every team in G1 provided assistance for each other. Thus, the students who faced problems did not have to worry if they wasted teacher's and classmates' time in the classroom. In addition, students could post tips in the "Notes" section of LINE. They could even directly talk to their teammates via video conference in private or in the team group via LINE. Moreover, students had to take screenshots of online discussion, help-seeking, and problem-solving, then upload them to the course website every week. In that way, the researchers in this study could confirm that students really adopted OAHS and solved their problems.

Treatment of FL

In the implementation of FL learning approach, the authors adopted and followed Datig and Ruswick's (2013) suggestions that students should preview the teaching materials outside of class so that they can prepare themselves well for discussion in class. In this study, students in G1 and G2 were asked to watch two or three

video lessons with flash, video, and voice (each lasted 10 to 20 minutes) before class every week to help them absorb basic knowledge. Students could use computer or smartphone for this task.

In class, students were asked to discuss, share, reflect on, and practice what they learned from the teaching videos. In order to understand the effectiveness of learning, the teacher arranged short quizzes during the class, and regarded this as formative assessment. The teacher in this study raised questions for students' discussion and interaction in the class time. The teacher also selected students for asking questions to confirm whether students watched the teaching videos. Moreover, the teacher kept track of students' learning outcomes, solved problems that arose, and improved teaching strategy based on the quiz results.

Measurements

Students' learning performance

In this computing course, the researchers measured students' computing skills as their learning performance. In this study, students were required to take an examination for a certificate in Microsoft PowerPoint in the eleventh week and one for Word in the seventeenth week of the semester. These examinations were administered by Computer Skills Foundation in Taiwan. On the examination, students had forty minutes to complete the simulation problems. A student's score comes from her/his correctness and completeness of problem solving. A surrogate sum representing computing skills was averaged from the scores of these two examinations. Then, the authors tested the skills differences among the three groups of students as the measure of their learning performance.

Students' involvement, self-efficacy, and self-directed learning

In this study, the researchers used a quasi-experimental design and questionnaire to measure students' involvement, self-efficacy and self-directed learning. In order to measure students' involvement in the blended course, Zaichkowsky's (1994) Personal Involvement Inventory (PII) was adapted, which comprised ten items rated by the students about themselves on a seven-point scale used to evaluate about their personal psychological states. Besides, the Motivated Strategies for Learning Questionnaire (MSLQ), composed of seven items self-rated on a five-point scale, was adopted to investigate student's self-efficacy for learning and performance. Finally, the Self-directed Learning Readiness Scale (SLDRS) by Guglielmino (1977) was adopted for examining students' self-directed learning ability. SLDRS is a 58-item, 5-point Likert-type scale, where a score of 1 denotes "strongly disagree" and a score of 5 denotes "strongly agree." The higher scores students got, the better self-directed learning they exhibited.

All students were required to complete these three scales in the first week as a pretest, and then complete them again at the end of semester as a posttest. Students who did not complete the pretest, posttest and certificate examinations were removed from analysis in this study. At the end, 102 students, who completed all questionnaires and took the certificate examinations, were evaluated as participants in this study.

Results

Pretest

According to the analysis of pretests shown in Table 1, the difference of students' involvement, self-efficacy and self-directed-learning among G1, G2, and G3 are not significant statistically. Moreover, the authors also checked students' computing skills of using Microsoft Word or PowerPoint before the course began. In the first week of the semester, the teacher in this course asked if students had previously learned or used Microsoft Word or PowerPoint. The students who had learned Microsoft Word or PowerPoint were excluded from the experimental sample, although they still remained in this course. Based on the analysis in the pretest and teacher's check, it is believed that the participating students had equal levels of computing skills, involvement, self-efficacy and self-directed learning when the experiment started. Therefore, the potential threat of initial variance among students' computing skills, involvement, self-efficacy and self-directed learning can be excluded.

Table 1. One-way ANOVA: Pretest of students' involvement, self-efficacy and self-directed learning

Dependent variable	Group (I)	Group (J)	Mean difference (I-J)	Std. error	Sig.	*F*	*p*
Involvement	G1	G2	.16391	.11674	.377	.914	.404
		G3	.12072	.11585	.583		
	G2	G1	.00531	.03941	.991		
		G3	.01272	.03911	.949		
	G3	G1	-.01593	.09123	.985		
		G2	.09815	.09053	.558		
Self-efficacy	G1	G2	-.16391	.11674	.377	1.069	.347
		G3	-.04319	.11757	.935		
	G2	G1	-.00531	.03941	.991		
		G3	.00742	.03969	.983		
	G3	G1	.01593	.09123	.985		
		G2	.11408	.09188	.465		
Self-directed learning	G1	G2	-.12072	.11585	.583	.053	.948
		G3	.04319	.11757	.935		
	G2	G1	-.01272	.03911	.949		
		G3	-.00742	.03969	.983		
	G3	G1	-.09815	.09053	.558		
		G2	-.11408	.09188	.465		

Posttest

In this study, the Paired-samples *t*-test was applied to compare students' involvement in this blended computing course in G1 (OAHS and FL), G2 (FL), and G3 (traditional teaching method). As the results show in Table 2 and Table 3, it is revealed that the group which received OAHS with FL (G1) showed a significant increase in students' involvement at the end of the semester (mean = 4.4333) in contrast to their pretest involvement (mean = 4.1788) ($p < .05$). Moreover, G2, who received FL alone, also had a significant increase in students' involvement by the end of the semester (mean = 4.3059) in contrast to their pretest involvement (mean = 4.0647) ($p < .05$). These results suggest that OAHS and FL could have a positive effect on students' involvement. As for G3, who received the traditional teaching approach, the data show no significant difference between pretest (mean = 4.1629) and posttest (mean = 4.1057) ($p = .637$).

Table 2. Paired samples statistics: Involvement

Involvement	Pre-post	*M*	*n*	*SD*	*SE*
G1	Pretest	4.1788	33	.34978	.06089
	Posttest	4.4333	33	.49666	.08646
G2	Pretest	4.0647	34	.32369	.05551
	Posttest	4.3059	34	.48738	.08359
G3	Pretest	4.1629	35	.44131	.07460
	Posttest	4.1057	35	.49464	.08361

Table 3. Pair-wise comparison of students' involvement

Group	Mean	*SD*	*SE*	*t*-value	*df*	*p*
G1	.25455	.59007	.10272	2.478	32	.019*
G2	.24118	.57951	.09938	2.427	33	.021*
G3	-.05714	.71096	.12017	-.476	34	.637

Note. $^{*}p < .05$.

In terms of self-efficacy, Table 4 and Table 5 show the average scores for both G1 and G2 illustrate a statistically significant increase on the posttest. G1 showed a significant increase in students' self-efficacy at the end of the semester (mean = 4.3603) in contrast to their pretest self-efficacy (mean = 3.7915) ($p < .001$). Moreover, G2 also had a significant increase in students' self-efficacy at the end of the semester (mean = 4.3947) in contrast to their pretest self-efficacy (mean = 3.8347) ($p < .001$). However, G3 showed no significant differences between pretest (mean = 3.9554) and posttest (mean = 3.7103) ($p = .083$).

Table 4. Paired samples statistics: Self-efficacy

Self-efficacy	Pre-post	*M*	*n*	*SD*	*SE*
G1	Pretest	3.7915	33	.53125	.09248
	Posttest	4.3603	33	.69644	.12123
G2	Pretest	3.8347	34	.50499	.08661
	Posttest	4.3947	34	.56165	.09632
G3	Pretest	3.9554	35	.40105	.06779
	Posttest	3.7103	35	.66920	.11312

Table 5. Pair-wise comparison of students' self-efficacy

Group	Mean	*SD*	*SE*	*t*-value	*df*	*p*
G1	.56879	.76612	.13336	4.265	32	.000***
G2	.56000	.75792	.12998	4.308	33	.000***
G3	-.24514	.81310	.13744	-1.784	34	.083

Note. ***$p < .001$.

With regard to students' self-directed learning, it is shown in Table 6 and Table 7 that students in G1 had a significant difference between the scores for pretest (mean = 3.1521) and posttest (mean = 3.2679) ($p < .05$). These results suggest that OAHS and FL had a positive effect on developing students' self-directed learning. In addition, students from G2 also had significant difference between the pretest (mean = 3.1447) and posttest (mean = 3.2976) scores ($p < .01$). However, the control group (G3) did not have statistically significant difference in self-directed learning between their pretest (mean = 3.1574) and posttest (mean = 3.1820) ($p = .590$).

Table 6. Paired samples statistics: Self-directed learning

Self-directed learning	Pre-post	*M*	*n*	*SD*	*SE*
G1	Pretest	3.1521	33	.15562	.02709
	Posttest	3.2679	33	.13090	.02279
G2	Pretest	3.1447	34	.17664	.03029
	Posttest	3.2976	34	.25352	.04348
G3	Pretest	3.1574	35	.15413	.02605
	Posttest	3.1820	35	.22112	.03738

Table 7. Pair-wise comparison of students' self-directed learning

Group	Mean	*SD*	*SE*	*t*-value	*df*	*p*
G1	.11576	.24200	.04213	2.748	32	.010*
G2	.15294	.28911	.04958	3.085	33	.004**
G3	.02457	.26746	.04521	.543	34	.590

Note. *$p < .05$; **$p < .01$.

In order to understand students' learning performance after participating in this experiment, descriptive statistics were used. It is found that students in G1, who received the intervention of FL and OAHS, had the highest average score in computing skills (mean = 89.03) among the three groups. Following were G2, who received FL only, with the second highest average score (mean = 85.68). Though students from the control group (G3) received the lowest score in computing skill (mean = 84.29) among the three groups (see Table 8), the difference of students' computing skills among the three groups was not significant.

Table 8. Students' average scores

Group	*n*	Mean	*SD*	*SE*
G1	33	89.03	13.153	2.290
G2	34	85.68	13.847	2.487
G3	35	84.29	16.787	2.838

As illustrated in the posttest data, shown in Table 9, the differences of students' involvement and self-efficacy among the three groups were significant statistically. At the end of the semester, G1 students' involvement was higher than G3 in a statistically significant manner ($p < .05$). That is, students who simultaneously adopted OAHS and FL had better development of involvement that those did not. In addition, it is also found that students from the control group (G3), who received traditional teaching method, had the lowest degree of self-efficacy among the three groups ($p < .05$). However, the differences of students' self-directed-learning and their computing skills among G1, G2, and G3 are not significant statistically.

Table 9. One-way ANOVA: Posttest of students' involvement, self-efficacy, self-directed learning, and computing skills

Dependent variable	Group (I)	Group (J)	Mean difference (I-J)	Std. error	Sig.	*F*	*p*
Involvement	G1	G2	.12745	.12045	.573	3.831	.025*
		G3	.32762*	.11959	.027		
	G2	G1	-.12745	.12045	.573		
		G3	.20017	.11869	.246		
	G3	G1	-.32762*	.11959	.027		
		G2	-.20017	.11869	.246		
Self-efficacy	G1	G2	-.03440	.15756	.976	12.343	.000***
		G3	.65002*	.15645	.000		
	G2	G1	.03440	.15756	.976		
		G3	.68442*	.15526	.000		
	G3	G1	-.65002*	.15645	.000		
		G2	-.68442*	.15526	.000		
Self-directed Learning	G1	G2	-.02977	.05112	.844	2.849	.063
		G3	.08588	.05075	.244		
	G2	G1	.02977	.05112	.844		
		G3	.11565	.05037	.077		
	G3	G1	-.08588	.05075	.244		
		G2	-.11565	.05037	.077		
Computing Skills	G1	G2	3.353	3.688	.663	.920	.402
		G3	4.745	3.578	.418		
	G2	G1	-3.353	3.688	.663		
		G3	1.392	3.636	.929		
	G3	G1	-4.745	3.578	.418		
		G2	-1.392	3.636	.929		

Note. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Discussion and implications

Computers and the Internet are regarded as valuable tools that provide a wealth of information and useful online resources for assisting with learning activity (Cheng & Tsai, 2011). As not all online classes are created equal, to understand how different modes of information are related to student experiences and learning in online classes, teachers can clarify what constitutes effective instructional design in online contexts (Clark & Mayer, 2008; Limperos, Buckner, Kaufmann & Frisby, 2015). Therefore, the present study adopted online FL and OAHS, and verified their effects on enhancing students' involvement, self-efficacy and self-directed learning in a blended computing course.

According to the results, the authors believe this study could make some positive contributions to online learning environments in three different ways. Above all, this study reveals the effect of OAHS and FL, and how an instructor improved students' involvement, self-efficacy, and self-directed learning under simulated conditions by applying OAHS and FL. Secondly, this study also indicates that the sole application of FL could be helpful in students' development of their involvement, self-efficacy, and self-directed learning. Finally, this study may be one of the first attempts to simultaneously apply OAHS and FL in an online computing course to improve students' learning.

The combined effect of OAHS and FL

The online learning environment not only changes teaching and learning strategies, but also provides new possibilities for academic help-seeking (Cheng, Liang & Tsai, 2013). With respect to the combined effects of OAHS and FL, the authors in this empirical study find support from the analyses presented in Table 3, Table 5, and Table 7. That is, there is a significant increase at the end of the course in G1 students' involvement ($p = .019^{*}$), self-efficacy ($p = .000^{***}$), and self-directed learning ($p = .010^{*}$). In addition, Table 9 shows that the effect of OAHS and FL results in a significant difference in students' involvement ($F = 3.831$, $p = .025 < .05$) and self-efficacy ($F = 12.343$, $p = .000 < .001$). G1 students' involvement and self-efficacy were better than

those in G3. According to the results in this study, it is believed that OAHS and FL could lead to better development of students' involvement, self-efficacy, and self-directed learning.

The potential reasons for these results may be due to the Internet providing abundant information resources and flexible time and space for learning (Cheng, Liang & Tsai, 2013; Rouet, 2006). Students who are convinced that online information is an essential resource related to course content are willing to seek online academic help (Lee, Chiu, Liang & Tsai, 2014). Moreover, academic help-seeking behavior can be regarded as a kind of self-regulation learning strategy or self-efficacy, thus the high level of self-efficacy can affect the strategies of self-regulated learning (Cheng et al., 2011). In this study, it was found that even in a learning environment without teachers' on-site monitoring, students' online learning behavior can be effective with adoption of OAHS in a course. Therefore, it is suggested that teachers could combine and adopt OAHS and FL, so as to provide the opportunity for students' to seek academic help online by themselves, obtain prior knowledge before class and further contribute to their involvement, self-efficacy and self-directed learning in a blended computing course.

The effect of FL

In this empirical research, the use of FL is found to play a positive role in developing students' involvement, self-efficacy and self-directed learning in a blended computing course. As the data shows in Table 3, Table 5, and Table 7, there are significant differences by the end of the course in G2 students' involvement ($p = .021^{*}$), self-efficacy ($p = .000^{***}$), and self-directed learning ($p = .004^{**}$) in the flipped course. In addition, data presented in Table 9 shows that G2 students' self-efficacy was significantly higher than that of those in G3.

This study demonstrates that FL instruction is helpful and could result in a better development of students' involvement, self-efficacy and self-directed learning.

In previous research, it is reported that peers play an important role in the FL environment, as they help to improve the learning process and to internalize knowledge, and that the levels of comprehension and capability to resolve problems are much higher in FL than for those who are taught by traditional teaching approach (Dasgupta & Tuttle, 2013; Crouch & Mazur, 2001). Results of the present study are similar to those of Sams and Bergmann's (2013) and Tsai, Shen and Lu's (2015) studies, which indicate that the flipped classroom could help improve students' learning. Therefore, it is suggested that teachers could adopt FL to provide more channels for students' learning and reflection, enhance their interaction, develop regular learning habits, and further improve students' learning performance.

The effect of traditional teaching approach

Based on the data shown in Table 3, Table 5 and Table 7, there is no significant difference in G3 students' involvement ($p = .637$), self-efficacy ($p = .083$) or self-directed learning ($p = .590$) by the end of the semester. Traditional lecturing is one-way knowledge transfer, and students are expected to memorize and comprehend the learning concepts (Herreid & Schiller, 2013; Tsai, Shen & Lu, 2015). Thus, without redesigning the course and teaching approach for students, traditional teaching, even in a blended learning environment, may not be an effective approach (Tsai, 2015).

Finally, according to the data shown in Table 9, there is a warning signal for teachers who plan to provide flipped courses and researchers who investigate the effects of online education. Teachers who wish to directly transform their traditional teaching methods into a digital presentation, without re-designing the course and teaching methods, may find it is hard to achieve satisfactory learning effects. For example, students who adopted neither OAHS nor FL, in G3, had the significantly lowest self-efficacy among the three groups (see Table 9). G3 students' involvement, self-directed, and computing skills are lower than G1 and G2, though insignificantly. Based on our findings in this study, it is once again suggested that teachers should adopt innovative teaching approaches and redesign a course before directly providing a flipped or blended course for students, in order to fully exploit the benefits of the Internet and educational technologies (Tsai & Shen, 2009).

Limitations of this study

Although it is found that OAHS and FL improved students' involvement, self-efficacy, and self-directed learning in this blended course, some other potential factors may cause bias when evaluating students' learning

performance. For example, the potential effects of students' readiness for online learning may also influence their performance (Tsai, 2012a). Despite the researchers conducting a pretest to check students' involvement, self-efficacy, and self-directed learning when they first participated in this course, students' characteristics in the three groups are not necessarily all the same. In addition, there may exist the possibility that the students did not engage voluntarily but were forced to follow the course protocol for increasing their involvement, self-efficacy, and self-directed learning. Therefore, the existing differences may influence students' acceptance of blended course or traditional course and lead to bias of measurement (Shen, Lee, & Tsai, 2007).

Conclusion

With the appearance of technology-based learning, help seeking with information and communication technology tools has now become an important issue in contemporary learning environments (Lee, Chiu, Liang & Tsai, 2014). Students can search for online academic help-seeking through the plentiful resources on the Internet (Cheng, Liang & Tsai, 2013). In addition, the advantages of mobile learning and applications not only facilitate users to study anytime, anywhere, but also to get feedback immediately. Thus, how to use these benefits well and design an appropriate teaching approach is important (Huang, Hwang & Chang, 2010). It is indicated that many students may not log in their course website every day; however, they usually log in and browse social network sites or chat via mobile application every day (Tsai, in press). Thus, the authors utilized one of the most locally popular communication applications, LINE, and integrated FL and OAHS into an online computing course. Moreover, the researchers in this study measured the effects of innovative adoption of mobile technology and help-seeking on improving students' learning psychology, such as their involvement, self-efficacy, and self-directed learning, in this online computing course. Therefore, the integration and implementation of OAHS and FL could provide comprehensive implications for educators to design their future online or blended courses and help their students to involve themselves in the course.

As FL and blended learning become trends in innovative teaching approaches, OAHS and FL have become important factors in contemporary learning environments. Therefore, in this present study, the authors adopted OAHS and FL to involve students in a blended computing course. The findings of this study reveal that students with interventions of OAHS and FL, and FL alone had significant increase in the development of their involvement, self-efficacy, and self-directed-learning. On the contrary, under a traditional teaching approach, students may not be well involved, nor have a high level of self-efficacy or self-directed learning in a blended computing course. The authors hope that these results regarding the implementation of OAHS and FL can provide comprehensive insights for instructors to assist students construct high levels of involvement, self-efficacy and self-directed learning in blended learning environments, particularly for computing courses.

References

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior, 31*(2), 143-164.

Bishop, J. L., & Verleger, M. A. (2013, June). *The Flipped classroom: A Survey of the research*. Paper presented at ASEE National Conference and Exposition, Atlanta, GA.

Cereijo, M. V. P., Young, J., & Wilhelm, R. W. (2001). Factors facilitating student participation in asynchronous web-based courses. *The Journal of Computing in Teacher Education, 18*(1), 32-39.

Chen, J. A., Tutwiler, M. S., Metcalf, S. J., Kamarainen, A., Grotzer, T. A., & Dede, C. J. (2016). A Multi-user virtual environment to support students' self-efficacy and interest in science: A Latent growth model analysis. *Learning and Instruction, 41*, 11-22.

Cheng, K. H., & Tsai, C. C. (2011). An Investigation of Taiwan university students' perceptions of online academic help-seeking, and their web-based learning self-efficacy. *Internet and Higher Education, 14*(3), 150-157.

Cheng, K. H., Liang, J. C. & Tsai, C. C. (2013). University students' online academic help seeking: The role of self-regulation and information commitments. *Internet and Higher Education, 16*(1), 70-77.

Chou, C., & Tsai, C. C. (2002). Developing web-based curricula: Issues and challenges. *Journal of Curriculum Studies, 34*(6), 623-636.

Chu, R., & Tsai, C. C. (2009). Self-directed learning readiness, Internet self-efficacy and preferences towards constructivist Internet-based learning environments among higher-aged adults. *Journal of Computer Assisted Learning, 25*(5), 489-501.

Clark, R. C., & Mayer, R. E. (2008). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. San Francisco: CA: Pfeiffer Publishing.

Crouch, C. H., & Mazur, E. (2001). Peer instruction: Ten years of experience and results. *American Journal of Physics, 69*(9), 970-977.

Dasgupta, S., & Tuttle, K. L. (2013). Human genetic variation: A Flipped classroom exercise in cultural competency. *Genetics society of America peer-reviewed education portal (GSA PREP)*. doi:10.1534/gsaprep.2013.003

Datig, I., & Ruswick, C. (2013). Four quick flips: Activities for the information literacy classroom. *College & Research Libraries News, 74*(5), 249-257.

Daugherty, M., & Funke, B. L. (1998). University faculty and student perceptions of Web-based instruction. *Journal of Distance Education, 13*(1), 21-39.

Davies, R. S., Dean, D. L., & Ball, N. (2013). Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educational Technology Research and Development, 61*(4), 563-580.

Guglielmino, L. M. (1977). *Development of self-directed learning readiness scale* (Unpublished doctoral dissertation). University Georgia, Athens, GA.

Halili, S. H., Razak, R. A., & Zainuddin, Z. (2015). Enhancing collaborative learning in flipped classroom. *International Journal of Basic & Applied Sciences, 9*(7), 147-149.

Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. *Journal of College Science Teaching, 42*(5), 62-66.

Huang, Y. M., Hwang, W. Y., & Chang, K. E. (2010). Guest editorial-Innovations in designing mobile learning applications. *Educational Technology & Society, 13*(3), 1-2.

Ibrahim, M., & Callaway, R. (2014). Students' learning outcomes and self-efficacy perception in a flipped classroom. In T. Bastiaens (Ed.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2014* (pp. 899-908). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Joo, Y. J., Bong, M., & Choi, H. J. (2000). Self-efficacy for self-regulated learning, academic self-efficacy, and Internet self-efficacy in Web-based instruction. *Educational Technology Research and Development, 48*(2), 5-17.

Kavanoz, D., Yüksel, H. G., & Özcan, E. (2015). Pre-service teachers' self-efficacy perceptions on web pedagogical content knowledge. *Computers & Education, 85*, 94-101.

Knowles, M. S. (1989). *The Making of an adult educator: An Autobiographical journey*. San Francisco, CA: Jossey-Bass.

Lai, C. (2015). Modeling teachers' influence on learners' self-directed use of technology for language learning outside the classroom. *Computers & Education, 82*, 74-83.

Learning and Skills Council. (2007). *Developing a learner involvement strategy: A handbook for the further education sector for review*. Conventry, UK: Learning and Skills Council. Retrieved from http://dera.ioe.ac.uk/7012/1/nat-developingalearnerinvolvementstrategy-pu-feb2007.pdf

Lee, T. H., Shen, P. D., & Tsai, C. W. (2010). Enhance low-achieving students' learning involvement in Taiwan's higher education: An Approach via e-learning with problem-based learning and self-regulated learning. *Teaching in Higher Education, 15*(5), 553-565.

Lee, W. C., Chiu, Y. L., Liang, J. C., & Tsai, C. C. (2014). Exploring the structural relationships between high school students' Internet-specific epistemic beliefs and their utilization of online academic help seeking. *Computers in Human Behavior, 36*, 391-400.

Liang, J. C., & Tsai, C. C. (2008). Internet self-efficacy and preferences toward constructivist Internet-based learning environments: A Study of pre-school teachers in Taiwan. *Educational Technology & Society, 11*(1), 226-237.

Limperos, A. M., Buckner, M. M., Kaufmann, R., & Frisby, B. N. (2015). Online teaching and technological affordances: An Experimental investigation into the impact of modality and clarity on perceived and actual learning. *Computers & Education, 83*, 1-9.

Mäkitalo-Siegl, K., & Fischer, F. (2011). Stretching the limits in help-seeking research: Theoretical, methodological, and technological advances. *Learning and Instruction, 21*(2), 243-246.

McCallum, S., Schultz, J., Sellke, K., & Spartz, J. (2015). An Examination of the flipped classroom approach on college student academic involvement. *International Journal of Teaching and Learning in Higher Education, 27*(1), 42-55.

McInnerney, J. M., & Roberts, T. S. (2004). Online learning: Social interaction and the creation of a sense of community. *Educational Technology & Society, 7*(3), 73-81.

McIsaac, M. S., Blocher, J. M., Mahes, V., & Vrasidas, C. (1999). Student and teacher perceptions of interaction in online computer-mediated communication. *Educational Media International, 36*(2), 121-131.

Persico, D., & Pozzi, F. (2015). Informing learning design with learning analytics to improve teacher inquiry. *British Journal of Educational Technology, 46*(2), 230-248.

Puzziferro, M. (2008). Online technologies self-efficacy and self-regulated learning as predictors of final grade and satisfaction in college-level online courses. *American Journal of Distance Education, 22*(2), 72-89.

Roby, T., Ashe, S., Singh, N., & Clark, C. (2013). Shaping the online experience: How administrators can influence student and instructor perceptions through policy and practice. *The Internet and Higher Education, 17*(1), 29-37.

Rouet, J. F. (2006). *The Skills of document use: From text comprehension to Web-based learning*. Mahwah, NJ: Erlbaum.

Sams, A., & Bergmann, J. (2013). Flip your students' learning. *Educational Leadership, 70*(6), 16-20.

Shen, P. D., Lee, T. H., & Tsai, C. W. (2007). Applying web-enabled problem-based learning and self-regulated learning to enhance computing skills of Taiwan's vocational students: A Quasi-experimental study of a short-term module. *Electronic Journal of e-Learning, 5*(2), 147-156.

Shen, P. D., Lee, T. H., & Tsai, C. W. (2011). Applying blended learning with web mediated self-regulated learning to enhance vocational students' computing skills and attention to learn. *Interactive Learning Environments, 19*(2), 193-209.

The National Development Council. (2014). *2014 Digital opportunity survey for individuals and households report summary*. Retrieved from https://goo.gl/zq5vpz

Tsai, C. W. (2012a). The Role of teacher's initiation in online pedagogy. *Education + Training, 54*(6), 456-471.

Tsai, C. C. (2012b). The Development of epistemic relativism versus social relativism via online peer assessment, and their relations with epistemological beliefs and Internet self-efficacy. *Educational Technology & Society, 15*(2), 309-316.

Tsai, C. W. (2013a). An Effective online teaching method: The Combination of collaborative learning with initiation and self-regulation learning with feedback. *Behaviour & Information Technology, 32*(7), 712-723.

Tsai, C. W. (2013b). How to involve students in an online course: A Redesigned online pedagogy of collaborative learning and self-regulated learning. *International Journal of Distance Education Technologies, 11*(3), 47-57.

Tsai, C. W. (2015). The Effect of online co-regulated learning in the implementation of team-based learning on improving students' involvement. *Higher Education Research and Development, 34*(6), 1270-1280.

Tsai, C. W. (2016). Exploring the effects of online team-based learning and co-regulated learning on students' development of computing skills. *Interactive Learning Environments, 24*(4), 665-680. doi:10.1080/10494820.2014.917106

Tsai, C. W. (in press). Applications of social networking for universal access in online learning environments. In *Universal Access in the Information Society*. Retrieved from http://link.springer.com/article/10.1007%2Fs10209-016-0455-2

Tsai, C. W., & Shen, P. D. (2009). Applying web-enabled self-regulated learning and problem-based learning with initiation to involve low-achieving students in learning. *Computers in Human Behavior, 25*(6), 1189-1194.

Tsai, C. W., & Shen, P. D. (2014). Do open educational resources and cloud classroom really improve students' learning? In *Cloud Technology: Concepts, Methodologies, Tools, and Applications* (pp. 2126-2134). doi:10.4018/978-1-4666-6539-2.ch100

Tsai, C. W., Shen, P. D., & Huang, H. J. (2012). Applying open course ware to improve non-information majors' computer skills and self-directed learning. *International Journal of Open Source Software and Processes, 4*(2), 1-15.

Tsai, C. W., Shen, P. D., & Lu, Y. J. (2015). The Effects of problem-based learning with flipped classroom on elementary students' computing skills: A Case study of the production of Ebooks. In *Curriculum Design and Classroom Management: Concepts, Methodologies, Tools, and Applications* (pp. 836-845). doi:10.4018/978-1-4666-8246-7.ch046

Tsai, C. W., Shen, P. D., & Tsai, M. C. (2011). Developing an appropriate design of blended learning with web-enabled self-regulated learning to enhance students' learning and thoughts regarding online learning. *Behaviour & Information Technology, 30*(2), 261-271.

Tsai, P. S., & Tsai, C. C. (2013). College students' experience of online argumentation: Conceptions, approaches and the conditions of using question prompts. *The Internet and Higher Education, 17*(1), 38-47.

Wei, H. C., Peng, H., & Chou, C. (2015). Can more interactivity improve learning achievement in an online course? Effects of college students' perception and actual use of a course-management system on their learning achievement. *Computers & Education, 83*, 10-21.

Wu, H. K., Kuo, C. Y., Jen, T. H., & Hsu, Y. S. (2015). What makes an item more difficult? Effects of modality and type of visual information in a computer-based assessment of scientific inquiry abilities. *Computers & Education, 85*, 35-48.

Zaichkowsky, J. L. (1985). Measuring the involvement construct. *Journal of Consumer Research, 12*(3), 341-352.

Zaichkowsky, J. L. (1994). The Personal involvement inventory: Reduction, revision, and application to advertising. *Journal of Advertising, 23*(4), 59-70.

Appendix A

Self-directed learning readiness scale

Items	
1.	I'm looking forward to learning as long as I'm living.
2.	I know what I want to learn.
3.	When I see something that I don't understand, I stay away from it.
4.	If there is something I want to learn, I can figure out a way to learn it.
5.	I love learn.
6.	It takes me a while to get started on new projects.
7.	In a classroom, I expect the teacher to tell all class members exactly what to do at all times.
8.	I believe that thinking about who you are, where you are, and where you are going should be a major part of every person's education.
9.	I don't work very well on my own.
10.	If I discover a need for information that I don't have, I know where to go to get it.
11.	I can learn things on my own better than most people.
12.	Even if I have a great idea, I can't seem to develop a plan for making it work.
13.	In a learning experience, I prefer to take part in deciding what will be learn and how.
14.	Difficult study doesn't bother me if I'm interested in something.
15.	No one but me is truly responsible for what I learn.
16.	I can tell whether I'm learning something well or not.
17.	There are so many things I want to learn that I wish that there were more hours in a day.
18.	If there is something I have decided to learn, I can find time for it, no matter how busy I am.
19.	Understanding what I read is a problem for me.
20.	If I don't learn, it's not my fault.
21.	I know when I need to learn more about something.
22.	If I can understand something well enough to get a good grade on a test, it doesn't bother me if I still have questions about it.
23.	I think libraries are boring places.
24.	The people I admire most always learning new things.
25.	I can think of many different ways to learn about a new topic.
26.	I try to relate what I am learning to my long-term goals.
27.	I am capable of learning for myself almost anything I might need to know.
28.	I really enjoy tracking down the answer to a question.
29.	I don't like dealing with questions where there is not one right answer.
30.	I have a lot of curiosity about things.
31.	I'll glad when I'm finished learning.
32.	I'm not as interested in learning as some other people seem to be.
33.	I don't have any problem with basic study skills.
34.	I like to try new things, even if I'm not sure how they will turn out.
35.	I don't like it when people who really know what they're doing point out mistake that I am making.
36.	I'm good at thinking of unusual ways to do things.
37.	I like to think about the future.
38.	I'm better than most people are at trying to find out the things I need to know.
39.	I think of problems as challenges, not stop signs.
40.	I can make myself do what I think I should.
41.	I am happy with the way I investigate problems.
42.	I become a leader in group learning situations.
43.	I enjoy discussing ideas.
44.	I don't like challenging learning situations.
45.	I have a strong desire to learn new things.
46.	The more I learn, the more exciting the world becomes.
47.	Learning is fun.
48.	It's better to stick with the learning methods that we know will work instead of always trying new ideas.
49.	I want to learn more so that I can keep growing as a person.
50.	I am responsible for my learning – no one else is.
51.	Learning how to learn is important to me.
52.	I will never be too old to learn new things.

53. Constant learning is a bore.
54. Learning is a tool for life.
55. I learn several new things on my own each year.
56. Learning doesn't make any difference in my life.
57. I am an effective learner in the classroom and on my own.
58. Learners are leaders.