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Learning Instructional Design in a Flipped Classroom: A Comparison of Online and Face-to-Face Formats

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This study examines a flipped classroom model to enhance student learning in graduate-level courses about instructional design. One section of the two-course sequence was conducted online while the other was conducted face-to-face. Survey data was gathered to examine student perceptions (n = 37) of learning in a flipped classroom (online vs. face-to-face). The results compare the two groups' learning experience in six critical areas: Engagement, Effectiveness, Benefits, Challenges, Individual learning, and Group learning. The results support the flipped classroom model and suggest that such paradigms may support high-quality group collaboration and project-based learning in online environments.

Keywords: Flipped classroom, online learning environment, instructional design, project-based learning

Introduction

Instructional design is a "system of procedures for developing education and training programs in a consistent and reliable fashion" (Gustafson & Branch, 2007, p. 11). It aims to create "instructional experiences which make the acquisition of knowledge and skill more efficient, effective, and appealing" (Merrill, Drake, Lacy, & Pratt, p. 2)." To do so, instructional designers continuously ask questions like: How do people learn? What motivates learning? How does the human mind work, What's the best way to present information?

Accordingly, teaching students about the principles and procedures of instructional design requires an emphasis on *practice* in applying *theoretical framework* from various fields. For that reason, many instructional design courses use project-based learning models. Such models organize learning around design and technology projects (Thomas, 2000) and have proven to be effective in many contexts (Clinton & Rieber, 2010, Dabbagh & Blijd, 2010). Although often effective, project work involving instructional design can be, however, difficult for students, in particular if they are new to the field. In addition, the group work associated with project-based learning can be especially challenging for students, who need to work on it online.

With these challenges in mind, the authors, faculty members in a graduate program implemented a flipped classroom model into their instructional design courses. The flipped classroom model "represents a unique combination of learning theories once thought to be incompatible—active, problem-based learning activities founded upon a constructivist ideology and instructional

lectures derived from direct instruction methods founded upon behaviorist principles" (Bishop & Verleger, 2013, p. 1). Excitement about flipped classrooms has resulted in research documenting many of the benefits and drawbacks of such instructional strategies (see Enfield, 2013; Horn, 2013; Roehl, Reddy, & Shannon, 2013).

Drawing on this previous work, a two-course instructional design sequence that used a flipped classroom was designed, developed and implemented in two distinct settings: face-to-face and online. While conducting these courses over a two year period, the authors gathered data about students' perceptions of the learning experience in an effort to better understand how flipped classroom models work on and offline. This paper presents the findings of this comparison and discusses the potential of the flipped classroom model to address some of the challenges associated with conducting project-based courses online.

Background of Study

The idea behind flipped classrooms is straightforward: work traditionally completed as homework, such as problem solving, writing, and group work, is better undertaken *in class* with the support and guidance of classmates and the instructor (Enfield, 2013). In contrast, activities such as listening to a lecture or watching a pre-recorded video are better accomplished at home (Herreid, & Schiller, 2013). Thus, a truly flipped classroom uses in-class time for *active* learning and problem solving on the part of students.

Literature shows that there are many benefits to this classroom approach. For example, Millard (2012) argues that flipped classrooms encourage active and independent learning thereby increasing student engagement, strengthening team-based skills, personalizing student guidance, and focusing classroom discussion. Roehl, Reddy, and Shannon (2013) explain that by having online lectures available in advance, flipped classrooms allow teachers to provide students with a wide range of learner-centered opportunities in class, resulting in greater teacher-to-student mentoring and peer-to-peer collaboration. Similarly, while observing flipped high school math classes, Fulton (2012) reported the approach allowed for group discussion and peer instruction on difficult problems.

In addition to the theoretical benefits of the flipped classroom model, there are a number of empirical studies demonstrating improved learning outcomes. For example, Fulton (2012) reported significant increases in student math learning measured by standardized external examinations when comparing a flipped classroom to a more traditional, lecture-based classroom. Tune, Sturek, and Basile (2013) showed that the flipped classroom model improved graduate student performance compared to a traditional lecture-based curriculum, as measured by multiple-choice exams in cardiovascular, respiratory, and renal physiology. These authors concluded after analyzing blinded student surveys that the use of homework and in-class quizzes were critical motivating factors that likely contributed to the increase in student exam performance. Another study by Love, Hodge, Grandgenett, and Swift (2014) compared two applied linear algebra courses, one using a flipped paradigm and the other a traditional lecture format. These authors found that the flipped classroom resulted in a more significant increase between sequential exams, although students in both formats performed similarly well on the final exam. That said, the results highlighted that students in the flipped classroom expressed

positive experiences and appreciated the student collaboration and instructional video components. Further still, Mason, Shuman, and Cook (2013) compared a flipped classroom to a traditional classroom in an undergraduate engineering course. In this case, the students participating in the flipped classroom performed as well as, or better than, students in the traditional course as measured by quizzes, exam questions, and open-ended design problems. Importantly, they also found that while students struggled initially with the new format, they adapted quickly, ultimately finding the flipped classroom approach satisfactory and effective.

There are, however, a number of concerns about flipped classrooms in the literature. First, flipped classroom require that all students have connectivity and access to all materials being provided online. In addition, some students may come to class unprepared to participate meaningfully in the scheduled classroom activities. Also, the use of recorded lectures to provide instruction may disregard individual student learning styles. Further still, online prerecorded lectures are not interactive and students cannot ask questions, therefore, just-in-time information will not be provided when needed (Freeman & Schiller, 2013; Horn, 2013; Milman, 2012; Mull, 2012). Relatedly, researchers have identified a number of drawbacks to the pre-recorded videos often used in flipped classrooms, including the significant amount of time needed to prepare them and the likelihood of poor video quality (Blair, Maharaj, & Primus, 2016; Milman, 2012; Wong & Chu, 2014). In addition, Nielsen (2012) has argued that it might be challenging for teachers to justify the increased time requirement outside of class without improved pedagogy in class. Such trade-offs paired with concerns about a lack of accountability for students when it comes to completing out-of-class instruction, can limit the desire of some teachers to try this new strategy (Schmidt & Ralph, 2016).

Along with the concerns mentioned so far, some studies have found no noticeable benefit in terms of learning outcomes when using a flipped classroom approach. For instance, Moffett and Mill (2014) conducted a study comparing a flipped classroom to a traditional classroom in a veterinary professional skills course. While they found students preferred the flipped classroom method, there was no improvement in student performance, as assessed by written examination. Clark (2015) found similar results with secondary mathematics students. In this study, students reported that more engagement and communication within the flipped classroom model. However, no significant changes were found in terms of academic performance between the flipped model of instruction and those taught in a traditional classroom environment.

As shown, researchers have discussed the benefits and challenges of the flipped classroom model. They have also examined the potential impact on learning outcomes in a variety of subject areas and age groups. Importantly, inconclusive results and lingering questions underscore the need for further research into the flipped classroom paradigm. Do flipped classrooms work for all the domains of learning? Do they work for students of all ages? Do they only work in particular educational settings?

With these questions in mind, this study focuses on the flipped classroom model in an online learning environment. In particular, the study investigates if a flipped classroom will support project-based learning in graduate level online courses. To do so, the study compares graduate students' perception of their experiences with the flipped classroom model between online and face-to-face contexts.

Methods

Course Development

The courses chosen for redevelopment in this project were the first two instructional design courses students take in the first year of their Learning Design and Technology Master's degree program. Both are core courses aimed at preparing instructional design professionals. The first course, *Theory and Practice in Educational Technology,* covers foundational processes, methods, theories, and strategies, and discusses how these are put into practice. The second course, *Instructional Design and Development,* covers the complete process of instructional design. Both use authentic projects and teamwork.

The platform for the course was a university-based version of Sakai, a learning management system. Over the first year, online lectures of narrated slideshows were produced that were carefully recorded and edited to increase the production value and decrease the length of the videos. A YouTube channel was created for open access to these for other instructors of instructional design (https://www.youtube.com/channel/UCPqBgPU1IGL-xdN9QhpuC0g). Also, research literature, web resources, professional examples, and past exemplary student projects were collected and prepared as a part of course materials. To ensure accountability related to students accessing and using the required materials, a discussion group was set up for students to post weekly reflections on the material they had watched and read.

During the scheduled class time, the instructors made short presentations to follow-up on the week's topic, note interesting comments or questions from students' reflections, and clarify the assignments for the next week. Then, activities were designed to engage students in active learning of the topic. Students were given time to work in teams on their course projects, and then present progress and receive critical feedback from their peers. The peer review sessions in both courses encouraged students to learn from each other and learn the role of designers often used in the workplace.

Participants

Two sections of each course were offered in two different platforms over a two-year period. A total of 47 first year Master's students (25 students in Year 1 and 22 students in Year 2) took the two sequential courses. For each course, one section was taught face-to-face (11 students in Year 1 and 12 students in Year 2) and the other was taught online (14 students in Year 1 and 10 students in Year 2). While there were slightly different schedules and class activities due minor difference in class time, the online and face-to-face sections were almost identical.

Procedure

This paper evaluates student perceptions regarding the design and use of the flipped classroom model particularly investigating any differences between the face-to-face and online settings. A questionnaire was distributed at the end of the 2nd year to all participants. There were 48 Likert-scale items covering: Engagement & Effectiveness, Comparison with traditional classrooms,

Benefits, and Challenges. Questions also covered Individual Space, and Group Space as defined by Winter (2016) and in used Fulford and Paek (2017). The items were anchored with the "not" side equal to 1 and the "very" side equal to 5. In all cases, with the exception of Challenges, "not" signified negative and "very" signified positive. There were 14 open-ended questions for additional comments on each topic.

Of the 47 students in the courses, 37 (79%) responded. The sample consisted of 70% females and 30% males. Also, there were a relatively high percentage of older students. (See Table 1.)

Table 1
Participants' demographic information

	N	Gender		Age	
		Female	Male	Under 30	30 and above
Online	17	13	4	2	15
Face-to-face	20	13	7	10	10
Total	37	26 (70%)	11 (30%)	12 (32%)	25 (68%)

Results

To examine if there were any differences between the online section and the face-to-face section in terms of how students perceived the flipped classroom model, the survey data was analyzed using independent samples *t*-tests in six sections. Results of this study are reported using a 2-tailed significance at the (p<.05) level.

Engagement & Effectiveness

While students in both groups reported high effectiveness, efficiency, and engagement for the two courses, a significant difference was found between online students and face-to-face students in terms of effectiveness of the courses, $t(31.2)=-2.264$, $p=.031$. More specifically, online students reported significantly higher effectiveness ($M=4.24$, $SD=.66$) than face-to-face students ($M=3.55$, $SD=1.15$). In addition, the online students reported higher efficiency and engagement than the face-to-face students, results that were marginally significant. (See Table 2.)

Table 2
Engagement & Effectiveness of Flippled Classroom

	Section	*M*	*SD*	*t*	*df*	*p*
I was comfortable with the flipped classroom.	F2F	4	0.65	-1.087	35	0.284
	Online	4.24	0.66			
What I needed to do in the flipped classroom was clear.	F2F	3.7	1.03	-1.532	31.268	0.136
	Online	4.12	0.60			
I enjoyed working	F2F	3.85	0.81	-0.848	35	0.402

in the flipped classroom.	Online	4.06	0.66			
I was satisfied with the format of the flipped classroom.	F2F	3.65	1.04	-1.218	35	0.231
	Online	4	0.61			
I think the flipped classroom was effective.	F2F	3.55	1.15	-2.264	31.2	0.031*
	Online	4.24	0.66			
I think the flipped classroom was efficient.	F2F	3.70	0.98	-2.023	35	0.051
	Online	4.29	0.77			
I think the flipped classroom was engaging.	F2F	3.65	1.09	-1.695	35	0.099
	Online	4.18	0.73			
Average	F2F	3.73	0.85	-1.781	35	0.084
	Online	4.16	0.56			

* $p < .05$

Engagement & Effectiveness compared to Traditional Classroom Models

When students were asked to compare the effectiveness of flipped classrooms to traditional classrooms, there was no statistical difference found between students in the online and face-to-face sections. It was, however, interesting to find that students in both sections reported relatively low rating for the statement, "I think the flipped classroom was easier than a traditional class." Another interesting finding was that participants gave a relatively high rating to the following statements, "I think the flipped classroom was more engaging than a traditional class," and "I think the flipped classroom was more efficient than a traditional class." (See Table 3.)

Table 3
Flipped Classroom compared to Traditional Classroom

	Section	*M*	*SD*	*t*	*df*	*p*
I think the flipped classroom was more motivating than a traditional class.	F2F	3.50	1.43	-1.198	29.524	0.24
	Online	3.94	0.75			
I think the flipped classroom was more engaging than a traditional class.	F2F	3.84	1.26	-0.283	34	0.779
	Online	3.94	0.75			
I think the flipped classroom was more efficient than a traditional class	F2F	3.65	1.31	-1.152	32.519	0.258
	Online	4.06	0.83			
I think the flipped classroom was more effective than a traditional class.	F2F	3.60	1.19	-0.996	35	0.326
	Online	3.94	0.83			

I think the flipped classroom was easier than a traditional class.	F2F	2.95	1.05	-0.853	35	0.4
	Online	3.24	0.97			
I learned more in the flipped classroom that a traditional class	F2F	3.50	1.15	0.267	35	0.791
	Online	3.41	0.80			
Average	F2F	3.51	1.07	-0.809	35	0.424
	Online	3.75	0.68			

Benefits

In terms of possible benefits such as working at one's own pace, having the ability to rewind and repeat the lectures, having more class time to work in groups, the responses from the online students were higher than the face-to-face students. This difference was marginally significant. Furthermore, the online students reported valuing having more time to reflect on their learning significantly higher than the face-to-face students: $t(27.16)=-.3.086$, $p=.005$. In this instance, the online students averaged 4.65 ($SD=.49$) compared to the face-to-face students' 3.80 ($SD=1.11$) average. (See Table 4.)

Table 4
Benefits of Flipped Classroom

	Section	*M*	*SD*	*t*	*df*	*p*
Working at my own pace.	F2F	4.15	0.99	-1.641	32.379	0.11
	Online	4.59	0.62			
Having materials in various formats - video – text, web.	F2F	4.40	0.68	-1.244	35	0.222
	Online	4.65	0.49			
Having the ability to rewind and repeat the lecture.	F2F	4.60	0.68	-0.502	35	0.619
	Online	4.71	0.59			
Having more class time to work with my group.	F2F	4.45	0.76	-1.572	31.099	0.126
	Online	4.76	0.44			
Having the instructor help with our project in class.	F2F	4.55	0.76	-0.689	35	0.496
	Online	4.71	0.59			
Having the time to reflect on my learning.	F2F	3.80	1.11	-3.086	27.16	0.005**
	Online	4.65	0.49			
Not having to listen to and follow a lecture.	F2F	3.95	1.05	-0.51	35	0.613
	Online	4.12	0.93			
Average Benefits	F2F	4.27	0.63	-1.974	30.761	0.057
	Online	4.60	0.35			

** p <.01

Challenges

There was no difference found between the students in the two sections in terms of the challenges encountered because of the flipped classroom model. Students in both sections recognized having more homework as the most challenging aspect of the course, with group work being the least challenging aspect. The lower numbers here indicate less challenge. (See Table 5.)

Table 5
Challenges of Flipped Claasrrom

	Section	*M*	*SD*	*t*	*df*	*P*
There is more homework because of the recorded lecture.	F2F	3.42	0.96	-0.365	34	0.717
	Online	3.53	0.80			
Recorded lectures are less detailed than in class lectures.	F2F	3.05	1.28	0.635	33.722	0.53
	Online	2.82	0.88			
Recorded lectures don't allow you to ask questions or get clarification.	F2F	3.00	1.17	-1.196	35	0.24
	Online	3.41	0.87			
The schedule regarding what we do when is confusing.	F2F	3.25	0.85	1	35	0.324
	Online	2.94	1.03			
Working in class in groups with the instructor watching.	F2F	2.10	1.12	-0.94	35	0.354
	Online	2.47	1.28			
Average Challenge	F2F	2.96	0.65	-0.361	35	0.72
	Online	3.04	0.61			

Individual Space

With regard to strategies used for individual space, there were significant differences found between the two groups. The online students reported higher usefulness related to the personal reflections compared to the face-to-face students: $t(35)=-3.212$, $p=.003$. A similar comparison of the usefulness of reading other students' reflections, found the online students reporting a significantly higher rating compared to the face-to-face students: $t(34)=-2.669$, $p=.011$. (See Table 6.) It should be noted that most scores are relatively high indicating an overall appreciation of the materials used in the course. The highest of these are for video lectures and past student example. Since the videos took the most time to create, this is a useful result.

Table 6
Individual Learning in Flipped Classroom

	Section	*M*	*SD*	*t*	*df*	*p*
Laulima modules	F2F	4.10	1.07	-0.058	35	0.954
	Online	4.12	0.70			
Video lectures	F2F	4.10	1.12	-0.603	35	0.55

	Online	4.29	0.77			
Required readings	F2F	4.05	1.00	0.526	35	0.602
	Online	3.88	0.93			
Recommended readings	F2F	3.37	1.21	-0.786	34	0.437
	Online	3.65	0.86			
Web resources	F2F	4.35	0.67	-0.289	35	0.774
	Online	4.41	0.62			
Past students' examples	F2F	4.80	0.41	1.244	35	0.222
	Online	4.59	0.62			
Personal reflections	F2F	3.00	1.12	-3.212	35	0.003**
	Online	4.06	0.83			
Reflection discussions	F2F	2.90	1.25	-2.669	35	0.011*
	Online	3.88	0.93			
Sharing your group's work in Laulima Discussions	F2F	4.05	1.05	-0.392	35	0.697
	Online	4.18	0.88			
Seeing other group's work in Laulima Discussions	F2F	4.30	0.92	-0.677	35	0.503
	Online	4.47	0.51			
Average – Individual learning	F2F	3.91	0.58	-1.376	35	0.177
	Online	4.15	0.48			

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

Group Space

In terms of group space, the online students reported higher ratings for the group learning activities. (See Table 6.) Their overall rating was significantly higher than the face-to-face group, $t(35)=-2.245$, $p=.031$. In addition, their ratings for the group presentation and critique and team evaluation were significantly higher than the face-to-face students: $t(35)=-2.199$, $p=.035$ and $t(33.05)=-2.568$, $p=.015$ respectively. (See Table 7.) Again most means are relatively high.

Table 7
Group Learning in Flipped Classroom

	Section	*M*	*SD*	*t*	*df*	*P*
Course content	F2F	4.40	0.82	-0.562	35	0.577
	Online	4.53	0.51			
Short instructor presentations to review content & preview of the next week.	F2F	4.30	0.73	-1.659	35	0.106
	Online	4.65	0.49			
Class activities	F2F	4.06	0.80	-1.701	33	0.098
	Online	4.47	0.62			
In class group time to work on projects	F2F	4.65	0.59	-0.316	35	0.754
	Online	4.71	0.47			
Group presentations to share and critique work	F2F	4.15	0.81	-2.199	35	0.035*
	Online	4.65	0.49			

Peer reviews of projects	F2F	4.35	0.81	-1.241	35	0.223
	Online	4.65	0.61			
Team Evaluations	F2F	3.80	0.95	-2.568	33.05	0.015*
	Online	4.47	0.62			
Final project presentations	F2F	4.45	0.61	-0.987	35	0.331
	Online	4.65	0.61			
Average Group Learning	F2F	4.28	0.46	-2.245	35	0.031*
	Online	4.60	0.40			

* $p < .05$

Significance of the Study

After two years implementing the two-course instructional design sequence and studying student experiences, the results found that students overall seemed satisfied with their experiences in the flipped courses. The survey suggests the students viewed the flipped classroom design as effective, efficient, and engaging. They also reported that the flipped classroom was more motivating even though it required more homework and was not as easy as a traditional classroom model. In considering whether the student perceptions vary between groups, the online students rated the effectiveness, efficiency, and engagement of the flipped classroom model more highly than the face-to-face students. Specifically, the online students valued several aspects of the class more highly than the face-to-face students, including: time for reflection, group presentations/critiques, and team evaluations.

These findings are encouraging for a couple of reasons. First, they show that the re-design project met its goal of being able to deliver course content while providing better support for student projects. Second, the results show that using a flipped classroom model in an online learning environment has potential to better support project-based learning and to promote group collaboration. Many instructional strategies that try to integrate more group work and collaboration into online environments, and flipped classroom models appear to be another viable option. As a result, the researchers are planning to continue studying how to organize and support group projects of varying scope and sequence within a flipped classroom course.

Importantly, the authors also recognize that lower ratings from the face-to-face students might be due to their lack of understanding of, or familiarity with, the flipped classroom model. That is, online students might have a better understanding of what they are expected to do outside of the classroom, and they might be more familiar with learning content through recorded presentations, readings and assignments. Meanwhile, face-to-face students might expect a lecture during class time, as opposed to the intense group work associated with the project-based flipped classroom. Accordingly, it is important to set clear expectations with students—online and face-to-face—when implementing a new instructional strategy in a class.

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