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Flipped classroom experiences: student preferences and flip strategy in a higher education context

Brenton McNally[1] · Janine Chipperfield[1] · Pat Dorsett[2] · Letitia Del Fabbro[3] · Valda Frommolt[3] · Sandra Goetz[3] · Joanne Lewohl[4] · Matthew Molineux[5] · Andrew Pearson[4] · Gregory Reddan[5] · Anne Roiko[6] · Andrea Rung[7]

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Abstract Despite the popularity of the flipped classroom, its effectiveness in achieving greater engagement and learning outcomes is currently lacking substantial empirical evidence. This study surveyed 563 undergraduate and postgraduate students (61 % female) participating in flipped teaching environments and ten convenors of the flipped courses in which the student sample was enrolled. Results suggest that higher education students can be differentiated based on their preferences for elements of a flipped classroom, resulting in two clusters of students: those who embrace most aspects of a flipped classroom environment as well as prefer it (labelled "Flip endorsers") and those who are close to neutral on some elements of a flipped classroom environment but who especially do not endorse the pre-learning aspects (labelled "Flip resisters"). Flip endorsers were found to have more positive attitudes towards the course activities (both pre-class and in-class) and to have felt more involved and engaged in the content. These findings shed some light on the types of students who might prefer flipped classrooms, but more importantly identify those who are likely to resist a change to a flipped classroom environment. The findings also suggest that although students may find the flipped classroom more difficult, student outcomes and active participation in class activities do improve when course convenors (a) use a theoretical perspective to inform their flipped teaching strategy, (b) integrate assessment into the design of their flipped classroom, and (c) flip the entire course.

✉ Brenton McNally
Brenton.McNally@griffithuni.edu.au

[1] Griffith Health Institute for the Development of Education and Scholarship (Health IDEAS), Griffith University, Brisbane, Australia

[2] School of Human Services and Social Work, Griffith University, Brisbane, Australia

[3] School of Nursing and Midwifery, Griffith University, Brisbane, Australia

[4] School of Medical Science, Griffith University, Brisbane, Australia

[5] School of Allied Health Sciences, Griffith University, Brisbane, Australia

[6] School of Medicine, Griffith University, Brisbane, Australia

[7] School of Dentistry and Oral Health, Griffith University, Brisbane, Australia

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Introduction

Although many examples and definitions of a flipped, or inverted, classroom exist in a higher education context, there remains a lack of consensus on its definition and a lack of scholarly research determining its effectiveness (Abeysekera and Dawson 2015; Bishop and Verleger 2013; Pierce and Fox 2012). Broadly, a flipped classroom occurs when events that have typically and traditionally happened inside classrooms now occur outside classrooms and vice versa (Lage et al. 2000). Following Strayer's (2012) description of the flipped classroom as a type of blended learning, the use of technology has permeated definitions. For example, Bishop and Verleger (2013) define flipped classrooms as interactive, group-based learning activities occurring inside the classroom and direct, computer-based individual instruction occurring outside the classroom.

Key elements of what constitutes a flipped classroom include (a) an opportunity for students to gain exposure to content prior to class (e.g. recorded lectures), (b) an incentive for students to prepare for class (e.g. pre-class quizzes), (c) a mechanism to assess student understanding (e.g. graded pre-class quizzes), and (d) in-class activities that focus on higher-level cognitive activities involving active learning, peer learning, and/or problem solving (Brame 2013; Abeysekera and Dawson 2015). To assess the impact of a variety of different approaches to flipped classrooms in the current study, a flipped classroom was broadly identified if events that have typically and traditionally happened inside the "classroom" (e.g. lectures) occurred outside the "classroom".

As an indirect indicator of interest and possible prevalence of implementation, the popularity of the web-search term "flipped classroom", first noted in May 2011, is currently at its highest level and projected to increase (Google 2015). Countries that search this term most include Sweden, the USA, Australia, Canada, and Spain (Google). Despite this apparent popularity, there remains insubstantial empirical evidence illustrating the effectiveness of the flipped classroom to achieve greater engagement and learning outcomes (Abeysekera and Dawson 2015; Bishop and Verleger 2013; Butt 2014; Pierce and Fox 2012).

The effectiveness of flipped classrooms in a higher education context

Much of the existing research assessing the effectiveness of the flipped classroom in higher education contexts (a) compares a flipped course to previous more traditional iterations (e.g. Morin et al. 2013; Reyneke and Fletcher 2014; Rossi 2014; Talley and Scherer 2013), (b) utilises pre-post designs assessing changes from the beginning of the flipped course to the end (e.g. Bates and Galloway 2012; Marks et al. 2014; Sarawagi 2014; Vaughn 2014; Warter-Perez and Dong 2012), and/or (c) is focused on student perceptions and satisfaction with the course (e.g. Butt 2014; Critz and Knight 2013; Kim et al. 2014; Schwartz 2014). The flipped classroom literature, as cited above, varies greatly in methodological rigour, which adds further weight to arguments regarding the lack of evidence supporting this pedagogical approach. Despite these variances in methodological rigour, findings from studies appear consistently positive (Bishop and Verleger 2013).

Some quasi-experimental research have compared the flipped environment with more traditional teaching environment for its effectiveness in improving student grades (e.g. Day

and Foley 2006; Lape et al. 2014; Lewis and Harrison 2012; Mason et al. 2013; Wong and Chu 2014; Zoe et al. 2014). These studies typically assessed quiz or examination scores and ensured student groups did not differ on a pre-test (some employing random assignment). Results from these studies found either no differences in final examination (or post-test) scores between the two teaching environments or higher scores in the flipped classroom environment. Whilst promising, these findings do not provide an adequate justification to promote the use of flipped classrooms in higher education.

Research has also focused on students' preferences for the flipped teaching environment over a traditional teaching environment. While Anderson et al. (2013) suggest that students are differentially predisposed to be somewhat suited to a flipped teaching environment, most results have found students tend to prefer flipped to traditional teaching environments (Bachnak and Maldonado 2014; Bates and Galloway 2012; Christiansen 2014; Clark et al. 2014; Lage et al. 2000; McLaughlin et al. 2013; Sarawagi 2014; Tague and Baker 2014). Further, few studies aim to identify the characteristics of students who prefer a flipped classroom environment. According to Tague and Baker (2014), highly motivated students perform better in a flipped environment. Enfield (2013), despite a relatively small sample size, suggests that low achievers find pre-class videos less engaging and more difficult. Overall, the existing literature has evaluated student satisfaction with particular components of specific flipped courses but has not yet aimed to compare preferences for common components of flipped courses.

A recent review (Bishop and Verleger 2013) of the theoretical underpinnings associated with flipped classroom approaches demonstrates evidence to support the theoretical framework (i.e. student-centred learning) on which the flipped classroom environment is based (also see Strayer 2007). At the heart of most student-centred learning theories and methods is active learning (Bishop and Verleger 2013). Active learning requires students to engage in meaningful learning activities that allow them to think about what they are doing (Bonwell and Eison 1991), where some control of the learning environment is shifted from the teacher to the learner (Gleason et al. 2011), and as such encompasses modes of collaborative learning, cooperative learning, and problem-based learning (Prince 2004). In Prince's (2004) review, these aspects of active learning were found to have positive influences on learning, student engagement, and information retention. More recently, a comprehensive meta-analysis of undergraduate STEM education found that student performance on examinations and concept inventories increased under active learning (Freeman et al. 2014). Despite findings that support active learning as a preferred and empirically validated teaching practice (Freeman et al. 2014), no substantial evidence currently exists to suggest that using a theoretical perspective, whether that be student-centred learning or any other perspective (e.g. behavourist, information-processing), to design a flipped course in a higher education context has better learning outcomes for students than designing a flipped course solely on the basis of intuition and experience.

As discussed, two key elements of a flipped classroom are providing an incentive for students to prepare for class and a mechanism to assess student understanding (Brame 2013). In the literature, both of these elements rely on summative assessment (typically quizzes) being part of the flipped classroom design (e.g. Love et al. 2014; Teoh and Wan 2014). However, no substantial evidence currently exists to support that an assessment-driven flipped classroom design has better learning outcomes for students than a flipped classroom where summative assessment is not integrated with the flipped aspect of the teaching.

Finally, for many different reasons instructors decide to incorporate a flipped environment into only part of the course. For example, Zoe et al. (2014) reasoned that flipping

the entire course seemed too drastic a change for the first time they attempted it. Although "partial flips" may be the most common form of flipped classroom due to the effort, time, and persistence required to fully implement a complete flipped classroom environment (Herold et al. 2012; Vaughn 2014; Xin et al. 2013), Bishop and Verleger (2013) excluded these studies from their literature review. At present, no substantial evidence exists to support that using a flipped environment for the entire course has better learning outcomes for students than a partially flipped classroom.

Current research aims

Based on previous findings and gaps in the literature, our research had two aims: (1) to categorise students within higher education based on their preferences for different components of flipped classrooms and then to assess any associated differences in terms of demographics, attitudes towards pre- and in-class activities, perceptions of the learning environment, engagement, academic self-efficacy, and final grades; and (2) to identify whether student preferences, attitudes, perceptions, engagement, academic self-efficacy, and grades differed significantly according to whether a course: (a) was flipped with an underpinning theoretical perspective, (b) had flip-related assessable items, and (c) was entirely or partially flipped.

Method

Participants

A convenience sample of 563 undergraduate and postgraduate students (341 or 61 % females) participated in the research. Ages ranged from 17 to 65 years ($M = 22.83$, $SD = 7.40$). Most (95 %) were full-time students (3 + courses a semester), 77 % were domestic Australian students, and 78 % reported English as their first language. Students were eligible to participate based on their enrollment in a course in which the convenor had indicated to the research team that they were implementing a flipped classroom environment. All courses were from the health domain of the university and included exercise science, physiotherapy, human services and social work, nursing, medical science, environmental health, and dentistry. Courses varied in how the flipped environment was incorporated into the teaching practice. To ascertain these differences, ten course convenors participated in the research by answering questions about their courses.

Materials

Participants completed a paper-and-pencil questionnaire measuring a number of variables concerning their experience of the flipped classroom environment as well as demographic and study variables. Attitudes towards pre- and in-class activities were assessed by four and six items, respectively. Participants were asked to think about these activities in their course and indicate their opinion of statements about whether the pre-class activities (a) were helpful to their learning, (b) motivated them to learn more, (c) enabled them to learn at their own pace, and (d) prepared them for the in-class activities, and whether the in-class activities helped (a) clarify and (b) apply what they had learnt in the pre-class activities, (c) develop problem-solving skills, (d) improve group work skills, (e) develop better learning and study

skills, and (f) improve communication skills. These items were chosen based on the outcomes typically intended through activities in a flipped classroom approach (Bishop and Verleger 2013; Strayer 2012) and were piloted in the previous semester to ensure the appropriateness of phrasing as well as other characteristics. Participants were required to respond on a five-point Likert scale, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). The means of the four and six items were calculated so that higher scores represent more positive attitudes toward the pre- or in-class activities. Reliability estimates (Cronbach's alpha) were calculated for all continuous variables and are reported in the Results section. A copy of this instrument can be observed in "Appendix".

Classroom environment was assessed with a shorter, revised version of the College and University Classroom Environment Inventory (CUCEI; Fraser and Treagust 1986; Fraser 1998). Four of the more relevant dimensions to the study were chosen, negatively worded items were avoided (only one included), and the four items with the highest factor loadings for each dimension were assessed (based on previous research; Nair and Fisher 1999; Logan et al. 2006). This resulted in a 16-item instrument assessing four dimensions of classroom environment: involvement, task orientation, innovation, and cooperation. Participants were asked to indicate their opinion about each of the 16 statements twice; once for their current course and once for what they would consider an ideal university course. Sample items include "I put effort into what I do" (Involvement), "I know exactly what has to be done" (Task Orientation), "The instructor thinks up innovative activities for students to do" (Innovation), and "Social skills and collaboration are important" (Cooperation). Participants responded on a five-point Likert scale, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*), with the means of each dimension calculated for the current course and an ideal course. Higher mean scores indicate a stronger perceived prevalence of that variable in the classroom environment (e.g. felt more involvement in that course).

Student engagement was assessed with a modified version of the Utrecht Work Engagement Scale for Students (UWES-S; Schaufeli et al. 2002). The scale was modified in reference to Schaufeli et al. (2006), with a 9-item scale used to assess student engagement, covering domain areas of vigour, dedication, and absorption. Academic self-efficacy was assessed with the academic efficacy scale from the Patterns of Adaptive Learning Scales (PALS; Midgley et al. 2000). For both scales, participants were asked to indicate their opinion about each of the statements using a five-point Likert scale, ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). The means for respective items were calculated, with higher scores on the UWES-S scale indicating higher self-reported engagement in the current course and higher scores on the PALS scale indicating stronger beliefs in one's own capabilities to complete the classwork of the current course.

Preference for flipped classrooms was assessed with nine items created specifically for the current research. For each item, participants were asked to indicate their preference, and level of preference, between two statements. One statement was designed to describe an aspect of a flipped classroom environment and the other to describe the equivalent aspect in a traditional teaching environment (based on flipped classroom literature e.g. Bishop and Verleger 2013; Strayer 2012). For example, in terms of when content is first experienced, the two statements were "The first time I learn about content to happen at home before class" (Flipped) and "The first time I learn about content to happen in-class" (Traditional). Participants indicated their preference by choosing a number closer to the statement they preferred; the closer the number to the statement, the stronger their preference for that aspect. Numbers ranged from 1 to 4, with lower numbers (1 and 2) representing a preference for the traditional aspect and higher numbers (3 and 4) representing a preference for the flipped aspect. A copy of this instrument is provided in "Appendix".

Course convenors also completed a short online survey with questions directed towards how the course was taught as well as their own experiences. Of import to the current study, course convenors were asked questions relating to whether any kind of theoretical perspective was used to inform their flipped classroom strategy (e.g. student-centred learning), whether summative assessment was incorporated into their flipped classroom strategy (e.g. graded quizzes or flipped in-class activities with an assessable component), and whether all aspects of their course (e.g. lectures, tutorials/workshops/laboratories) incorporated a flipped classroom strategy or only some aspects. The answers to these questions were used as the basis for differentiating courses as underpinned by a theoretical perspective, using flip-related assessment, or as partially or completely flipped.

Procedure

All student data were collected through paper-and-pencil survey methods at the end of the course semester or at the last physical contact session of the course. Surveys were distributed in-class, and students were asked to complete the surveys after consenting to do so. Students had the opportunity to elect not to participate without consequences. Completed surveys were collected, and aggregate results withheld from course convenors until after the distribution of course grades. The questionnaire, which also included questions not related to the current study, took approximately 20 min to complete. After the end of semester, course convenors were provided a link to a survey hosting Web site (www.surveymonkey.com) and were asked to complete an online survey. The online survey took approximately 10 min to complete. All aspects of the research were conducted in accordance with university and national ethical guidelines. The university granted ethical approval for the research.

Statistical analysis

All analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 22. With reference to the study's first aim, students were categorised based on their preferences for flipped classrooms and then assessed for any differences in their demographics, attitudes, perceptions, engagement, self-efficacy, and grades. To achieve this, a cluster analysis was performed using SPSS's 2-step procedure to identify the optimal number of clusters ($n = 561$), an approach recommended by Garson (2012) and Hair et al. (2010) to explore data when the predicted number of clusters is unknown.

Regarding the study's second aim, student preferences, attitudes, perceptions, engagement, self-efficacy, and grades were compared to ascertain whether differences exist on the basis of whether each flipped course in the study was flipped in accordance with a theoretical perspective, had "flipped" assessment items, or was entirely flipped or not. Welch's t test was used due to unequal variances and sample sizes.

Results

Table 1 provides an overview of descriptive statistics for each of the variables in the current study. Also shown is the reliability of scale items, with each scale achieving at least acceptable internal consistency (Cronbach's alpha ranging from 0.68 to 0.88). Notably, the negatively worded item in the classroom environment variable of cooperation was

Table 1 Descriptive statistics and reliability coefficient for scale variables included in the current study

Variable	Items	*M*	SD	Min	Max	Reliability[a]
Pre-class attitudes	4	3.64	0.54	1.20	5.00	0.83
In-class attitudes	6	3.79	0.60	1.00	5.00	0.85
Current-involvement	4	3.99	0.54	2.00	5.00	0.70
Current-task-orientation	4	3.77	0.67	1.50	5.00	0.79
Current-innovation	4	3.70	0.67	1.50	5.00	0.79
Current-cooperation	3	4.04	0.63	1.67	5.00	0.68
Ideal-involvement	4	4.46	0.51	1.00	5.00	0.80
Ideal-task-orientation	4	4.62	0.49	2.50	5.00	0.86
Ideal-innovation	4	4.31	0.67	1.50	5.00	0.88
Ideal-cooperation	3	4.09	0.84	1.00	5.00	0.82
Engagement	9	3.16	0.65	1.00	5.00	0.87
Self-efficacy	5	3.65	0.72	1.40	5.00	0.86
Age	1	22.83	7.40	17.00	65.00	–
GPA (current semester)	–	5.38	1.02	2.64	7.00	–
Current course grades	–	72.04	14.22	21.86	99.19	–

[a] Cronbach's alpha

discarded when calculating the scale mean due to negative impacts on the scale's internal consistency.

Preference for flipped classrooms

Table 2 provides the means, standard deviations, and percentage response rates for each of the nine items measuring student preferences for flipped classrooms for the entire student sample. With higher scores indicating greater preferences for aspects of a flipped classroom environment (provided in italics in Table 2), the most preferred aspects of the flipped classroom environment tended to be using technology to assist learning and to be active and collaborate with other students in class. The least preferred aspect of the flipped classroom tended to be being quizzed at the beginning of class on content available before class. Overall, students tended to have a preference for more traditional aspects. However, students preferred four of the nine aspects in the flipped teaching direction.

Cronbach's alpha was calculated for a scale consisting of the nine preference items, determining that they could be reasonably summarised ($\alpha = 0.64$). The mean score for the nine items (see Table 2) reiterated the finding that students tended to have an overall preference for more traditional aspects, but only slightly. When comparing overall preference for flipped classrooms for the entire student sample, significant differences were found for gender, $t(535) = 2.12$, $p < .05$, $d = 0.18$, whether English was a student's first language or not, $t(156) = 2.17$, $p < .05$, $d = 0.25$, and course year level, $F(3, 544) = 9.67$, $p < .001$. Within these differences, males ($M = 2.36$, SD = 0.48) had a lower preference than females ($M = 2.45$, SD = 0.51), English first language students ($M = 2.39$, SD = 0.47) had lower preference than English second or more language students ($M = 2.52$, SD = 0.58), and students in 3rd year courses ($M = 2.62$, SD = 0.51) had significantly higher preferences than students in 1st year ($M = 2.37$, SD = 0.49), 2nd year ($M = 2.31$, SD = 0.50), and beyond-3rd year courses ($M = 2.34$, SD = 0.46).

Table 2 Descriptive statistics and percentage response rates for preference for flipped classroom items ($n = 561$)

Preference (range 1–4)	*M*	SD	Mdn	Response rates (%)			
				1	2	3	4
Lectures (In-person vs *online*)	2.26	0.88	2	19.1	45.4	25.7	9.8
In class activities (New content vs *practical*)	2.68	0.98	3	12.9	30.4	32.2	24.5
First time to learn content (In-class vs *pre-class*)	2.19	1.02	2	30.7	32.7	23.0	13.6
Technology (Avoid vs *use*)	2.81	1.00	3	11.2	27.6	29.8	31.4
Quizzes (On in-class content vs *on pre-class content*)	1.64	0.96	1	62.4	19.2	10.4	8.1
Required learning (In-class vs *pre-class*)	2.22	0.97	2	26.6	35.9	25.9	11.5
Participation (Only listen vs *collaborate*)	2.87	0.98	3	10	25.7	31.7	32.6
Pre-class activities (Optional vs *required*)	2.29	1.02	2	26.4	33.4	24.8	15.4
Preference (Traditional vs *flipped*)	2.76	1.07	3	16.6	22.7	28.9	31.8
Total preference for flipped classroom	2.42	0.50					

Table 3 Item mean scores for both flip endorsers and flip resisters, with the results of associated independent groups *t* tests

Variable	Flip endorsers ($n = 287$)		Flip resisters ($n = 274$)		*t* test		
	M	SD	*M*	SD	*t*	*df*	*d*
Lectures (*Online* vs in-person)	2.35	0.86	2.13	0.88	3.01**	559	0.25
In Class activities (*Practical* vs new content)	3.01	0.92	2.35	0.93	8.41***	559	0.71
First time to learn content (*Before* vs in-class)	2.44	1.10	1.90	0.85	6.49***	537	0.55
Technology (*Use* vs avoid)	3.23	0.85	2.47	1.00	9.74***	535	0.82
Quizzes (*On pre-class content* vs on in-class content)	1.67	0.99	1.50	0.81	2.17*	547	0.19
Required learning (*Before* vs in-class)	2.62	0.93	1.71	0.75	12.77***	544	1.08
Participation (*Collaborate* vs only listen)	3.36	0.78	2.35	0.90	14.20***	539	1.20
Pre-class activities (*Required* vs optional)	2.83	0.95	1.67	0.72	16.37***	531	1.38
Preference (*Flipped* vs traditional)	3.33	0.82	2.21	1.03	14.20***	521	1.20

* $p < .05$, ** $p < .01$, *** $p < .001$

A cluster analysis suggested two clusters based on the nine items measuring preference for flipped classrooms. Cluster quality was deemed satisfactory, with a ratio of cluster sizes equal to 1.05. Item mean scores by cluster can be seen in Table 3. Independent groups *t* tests revealed that participants in Cluster 1 had significantly higher mean scores for all items. Based on the effect sizes of these differences (Cohen's *d*), the largest effect sizes were found when assessing whether students preferred (a) to have required learning before they go to class or not, (b) to be active and collaborate with other students in class or not, (c) to have materials (pre-recorded lectures, readings) available prior to class and have in-class activities be practical and focus on problem solving or having new content delivered

in lectures and laboratories/tutorials, with more practical exercises assigned to outside of class (e.g. in assignments), and (d) to have readings, videos, and/or other pre-class activities be required or optional. For these aspects, Cluster 1 tended to prefer the more "flipped" approach whereas Cluster 2 tended to prefer the more traditional approach.

From the differences found, Cluster 1 was deemed to describe individuals who embrace most aspects of a flipped classroom environment as well as prefer it (labelled "Flip endorsers"). Cluster two was deemed to describe individuals who are close to neutral on some elements of a flipped classroom environment but especially do not endorse the pre-learning aspects (labelled "Flip resisters"). Interestingly, approximately half the participants were identified as flip endorsers and half were identified as flip resisters.

These two clusters were then assessed for any differences in student demographics, attitudes, perceptions, engagement, self-efficacy, and grades. Independent groups *t* tests (see Table 4) revealed that, when compared to flip resisters, flip endorsers reported significantly more positive attitudes towards both the pre- and in-class activities and significantly higher perceptions that they participated actively and attentively in class discussions and activities within the flipped classroom they experienced and also significantly higher perceptions that in their ideal university course (a) they would participate actively and attentively in class discussions and activities, (b) the instructor would implement new, unusual class activities, teaching techniques, and assignments, and (c) they would interact with other students in class and be reliant on other students to succeed in the class. Although no differences were found between the two clusters in terms of academic self-efficacy, flip endorsers reported significantly higher engagement in the flipped classroom environment. The two clusters did not differ in the grades they achieved for the flipped classroom they experienced or the grades they had achieved for previous

Table 4 Mean scores of variables of interest for both flip endorsers and flip resisters, with the results of associated independent groups *t* tests

Variable	Flip endorsers		Flip resisters		*t* test		
	M	SD	*M*	SD	*t*	*df*	*d*
Pre-class attitudes	3.71	0.52	3.59	0.56	2.44*	469	0.22
In-class attitudes	3.89	0.57	3.70	0.62	3.80***	507	0.32
Current-involvement	4.08	0.54	3.91	0.53	3.47**	486	0.32
Current-task-orientation	3.82	0.65	3.82	0.62	0.01	478	–
Current-innovation	3.73	0.66	3.67	0.66	0.98	475	–
Current-cooperation	4.07	0.64	4.00	0.63	1.27	479	–
Ideal-involvement	4.54	0.46	4.40	0.53	3.37**	523	0.28
Ideal-task-orientation	4.64	0.47	4.63	0.49	0.36	516	–
Ideal-innovation	4.41	0.60	4.20	0.72	3.68***	513	0.32
Ideal-cooperation	4.26	0.70	3.93	0.93	4.48***	479	0.40
Engagement	3.30	0.60	3.08	0.66	4.09***	547	0.35
Self-efficacy	3.70	0.71	3.63	0.81	1.12	553	–
GPA	5.41	1.08	5.43	1.10	0.28	505	–
Age	23.89	8.38	21.46	5.67	3.99***	492	0.34
Grades	72.66	13.86	71.55	15.30	0.83	477	–

* $p < .05$, ** $p < .01$, *** $p < .001$

courses (GPA at the start of the semester). However, flip endorsers were significantly older and more likely to be female, X^2 (1) = 13.04, $p < .001$.

The effects of flipped classroom strategy

Table 5 displays the results of a series of Welch's *t* tests comparing variables of interest between students in courses where convenors had employed a theoretical perspective (such as student-centred learning) to inform their flipped classroom strategy and those in courses where the convenor had not. The results suggest that students in the classes where a theoretical perspective was used (a) had less positive attitudes towards the pre-class activities, (b) felt they participated more actively and attentively in class discussions and activities, (c) believed the class activities were less clear and organised, (d) believed the instructor employed less new, unusual class activities, teaching techniques, and assignments, (e) felt they interacted more with other students in class and were more reliant on other students to succeed in the class, (f) had lower beliefs that they had the capabilities to complete the classwork, and (g) achieved higher grades in their specific course.

Similarly, Table 6 displays the results of a series of Welch's *t* tests comparing variables of interest between students in courses where convenors incorporated summative assessment into their flipped classroom strategy and those in courses where convenors had not. The results suggest that students in the classes that used summative assessment as part of the flipped classroom strategy: (a) had less positive attitudes towards both pre- and in-class activities, (b) felt they participated more actively and attentively in class discussions and activities, (c) believed the class activities were less clear and organised, (d) believed the instructor employed less new, unusual class activities, teaching techniques, and assignments, (e) felt they interacted more with other students in class and were more reliant on other students to succeed in the class, and (f) achieved higher grades in their specific course.

Finally, Table 7 displays the results of a series of Welch's *t* tests comparing variables of interest between students in courses where convenors flipped all aspects of the course and

Table 5 Mean scores of variables of interest for students in courses where a theoretical perspective was used to inform flip strategy or not, with the results of associated Welch's *t* tests

Variable	Used theory ($n = 111$)		Did not use theory ($n = 501$)		*t* test		
	M	SD	*M*	SD	*t*	*df*	*d*
Preference	2.47	0.52	2.41	0.50	1.025	543	–
Pre-class attitudes	3.43	0.67	3.68	0.51	3.01**	85	0.42
In-class attitudes	3.69	0.65	3.80	0.59	1.47	560	–
Current-involvement	4.14	0.50	3.96	0.55	2.64**	492	0.34
Current-task-orientation	3.40	0.75	3.84	0.63	4.81***	95	0.64
Current-innovation	3.55	0.71	3.72	0.66	2.10*	481	0.25
Current-cooperation	4.18	0.65	4.01	0.62	2.18*	485	0.27
Engagement	3.25	0.54	3.15	0.66	1.34	554	–
Self-efficacy	3.49	0.75	3.68	0.75	2.12*	563	0.25
Grades	75.54	9.32	71.30	14.96	3.64***	220	0.34

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 6 Mean scores of variables of interest for students in courses where assessment was used in flip strategy or not, with the results of associated Welch's *t* tests

Variable	Flip uses assessment ($n = 179$)		Flip does not use assessment ($n = 433$)		*t* test		
	M	SD	*M*	SD	*t*	*df*	*d*
Preference	2.39	0.52	2.42	0.50	0.63	543	–
Pre-class attitudes	3.50	0.59	3.69	0.52	3.42**	521	0.34
In-class attitudes	3.63	0.68	3.84	0.57	3.39**	217	0.33
Current-involvement	4.14	0.50	3.96	0.55	2.64**	492	0.34
Current-Task-orientation	3.40	0.75	3.84	0.63	4.81***	95	0.64
Current-innovation	3.55	0.71	3.72	0.66	2.10*	481	0.25
Current-cooperation	4.18	0.65	4.01	0.62	2.18*	485	0.27
Engagement	3.21	0.56	3.14	0.67	1.06	554	–
Self-efficacy	3.63	0.74	3.66	0.76	0.44	563	–
Grades	75.00	9.99	70.83	15.48	3.80**	463	0.32

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 7 Mean scores of variables of interest for students in courses where the entire course was flipped or not, with the results of associated Welch's *t* tests

Variable	All aspects flipped ($n = 135$)		Some aspects flipped ($n = 477$)		*t* test		
	M	SD	*M*	SD	*t*	*df*	*d*
Preference	2.54	0.52	2.38	0.49	3.06**	543	0.32
Pre-class attitudes	3.52	0.64	3.68	0.50	2.41*	163	0.28
In-class attitudes	3.69	0.63	3.81	0.59	2.07*	560	0.20
Current-involvement	4.15	0.51	3.93	0.54	4.00***	492	0.42
Current-task-orientation	3.38	0.78	3.91	0.56	6.89***	167	0.78
Current-innovation	3.61	0.73	3.72	0.65	1.57	481	–
Current-cooperation	4.08	0.64	4.03	0.62	0.84	485	–
Engagement	3.18	0.65	3.15	0.65	0.38	554	–
Self-efficacy	3.51	0.70	3.70	0.76	2.53*	563	0.26
Grades	74.63	9.57	71.41	15.09	2.80**	264	0.25

* $p < .05$, ** $p < .01$, *** $p < .001$

those in courses where only some aspects of the course were flipped. Results suggest that students in courses that had all aspects flipped (a) had a higher preference for flipped classrooms, (b) had less positive attitudes towards both pre- and in-class activities, (c) felt they participated more actively and attentively in class discussions and activities, (d) believed the class activities were less clear and organised, (e) had lower beliefs that they had the capabilities to complete the classwork, and (f) achieved higher grades in their specific course. In all of the comparisons made in terms of flipped classroom strategy, no differences in the proportion of flip endorsers or flip resisters were found for any group of

students and no interaction effects were found when including flip endorser/resister as an additional independent variable.

General discussion

The first aim of the current research was to categorise students within higher education based on their preferences for different components of flipped classrooms and to assess associated differences in their demographics, attitudes, perceptions, engagement, academic self-efficacy, and final grades. The results suggest that higher education students can be differentiated based on their preferences for elements of a flipped classroom, resulting in two clusters of students ("Flip endorsers" and "Flip resisters"). Flip endorsers were found to have more positive attitudes towards the course activities (both pre- and in-class) and felt more involved and engaged in the content. Also, flip endorsers rated their ideal courses higher in terms of involvement, innovation, and cooperation than flip resisters. This suggests that flip endorsers have higher expectations: (a) to participate actively and attentively in class discussions and activities, (b) for the instructor to employ new, unusual class activities, teaching techniques, and assignments, and (c) to interact with other students in class and be reliant on other students to succeed in the class. Although the two groups did not differ in their grades for the current course or previous courses (GPA) and did not differ in their academic self-efficacy beliefs, flip endorsers were found to be older and more likely to be female. This supports research that females prefer collaborative environments and abstract conceptualisations (a potential consequence of student-centred learning strategies; Bartlett 1996; Magolda 1992; Madison 1995).

The current findings shed some light on the types of students who might prefer flipped classrooms, but more importantly identify those who are likely to resist a change to a flipped classroom environment and that these students may represent a large proportion of all students. This highlights the importance of tailoring the introduction of flipped teaching to a class to better engage those students who may be likely to resist this change. Kugler et al. (2013) suggest that training students to be active learners may promote flipped classroom success; Estes et al. (2014) suggest that resistance to flipped teaching could be diminished through orientation to learner-centred approaches, personally relevant instruction, and transparent teaching practices.

Although differences were found between those who endorse and those who resist flipped teaching environments (particularly in their expectations of higher education courses and engagement), this differentiation based on preferences did not correspond to differences in their final grades in a flipped course. This suggests that preferences alone may not be the most informative aspect on which to evaluate a flipped classroom environment, especially since preferences could result from a number of different factors other than a fundamentally improved pedagogical approach (e.g. novelty, use of interesting technology). Despite this, the prevalence of evaluating preferences in previous research is high (Bachnak and Maldonado 2014; Bates and Galloway 2012; Christiansen 2014; Clark et al. 2014; Lage et al. 2000; McLaughlin et al. 2013; Sarawagi 2014; Tague and Baker 2014). The current findings do provide some limited support for the proposition that students may be differentially predisposed to be somewhat suited for a flipped teaching environment (Anderson et al. 2013) in that younger, male students tended to resist the flipped classroom environment. However, further research into what differentiates student grades in a flipped teaching environment is required (e.g. Enfield 2013).

Other interesting findings include a strong overall preference for the use of technology and for collaborative learning, which supports previous research acknowledging the numerous benefits of collaborative learning practices (Prince 2004) and technology in flipped classroom contexts (Bergmann and Sams 2012). Additionally, a strong overall preference away from quizzes on pre-class content was found. This supports the tendency for students to be more accepting, and perceiving the flipped environment as more favourable, when less pre-class preparation is required (Doyle et al. 2013). Also, a stronger preference for flipped teaching in students with English as an additional language was found, which may be due to online resources and self-directed learning facilitating the ability to revisit content multiple times (especially with difficult terms or phrases) and active classes providing more interaction such that content can be explained in different ways by peers, subsequently providing context and further understanding (Bishop and Verleger 2013). However, more research is needed in order to understand whether these students perform better in a flipped classroom environment in addition to preferring it.

The second aim of the current research was to identify whether student preferences, attitudes, perceptions, engagement, academic self-efficacy, and grades differ significantly on the basis of whether a course was flipped with an underpinning theoretical perspective, had flip-related assessment items, or whether the course was entirely flipped or not. The results suggest that when a theoretical perspective is used to inform the flipped classroom design, when summative assessment is integrated into the design of the flipped classroom, and when an entire course is flipped, students felt they had participated more actively and attentively in class activities; they also achieved better grades in their specific course. This is despite having no effect on engagement with the course, being related to less positive attitudes towards pre-class activities, and the belief that class activities were less clear and organised.

The finding that more positive attitudes towards the activities were found when a theoretical perspective was not specifically reported contradicts previous research that suggests that not using learner-centred approaches (i.e. no theoretical perspective) is related to lower course satisfaction and students perceptions (Elliott et al. 2013). However, the finding supports research that suggests exercises that demand higher in-class performance are less preferred (Fisher and Assa-Eley 2013) and that more preparation required for the in-class discussion is related to lower student acceptance and less favourable perceptions (Doyle et al. 2013). The findings also support research suggesting that more demanding online preparation and in-class activities (i.e. aspects of a flipped environment), the less preference students will show for those tasks (Doyle et al.; Fisher and Assa-Eley) and that timing of the examination of questions in a flipped design can affect student performance (Fisher and Assa-Eley). However, the current research has been focussed on student-centred approaches when conceptualising the impact of theoretical perspectives. Future research would benefit from evaluating the broad scope of theoretical perspectives and whether basing a flipped approach on a specific theoretical perspective (e.g. student-centred learning) has better outcomes than other perspectives (e.g. behaviourist, information-processing).

A major implication of these findings is the suggestion that student grades may improve when course convenors flip more of the course, flip based on a theoretical perspective, and use summative assessment when flipping. These aspects seem to represent a stronger investment in the flipped classroom strategy that has subsequent advantages for learning outcomes. Two recommendations can be made from these findings: (a) that these aspects of flipping strategy require more empirical attention and (b) that these aspects should be strongly considered when designing a flipped classroom environment. However,

improvements in learning outcomes appear to coincide with less positive perceptions of the course activities. This can be problematic when (a) university courses and teacher evaluations are often based on student perceptions and satisfaction and this influences teaching decision-making (d'Apollonia and Abrami 1997; Ryan et al. 1980) and (b) evaluations of flipped classrooms similarly rely on student perceptions and satisfaction with the course (e.g. Butt 2014; Critz and Knight 2013; Kim et al. 2014; Schwartz 2014).

This issue has the potential to discourage teaching academics from adopting a flipped classroom approach, despite potential advantages for student learning. As discussed earlier, a potential remedy to this issue could be to train students to be active learners through an orientation to learner-centred approaches, personally relevant instruction, and transparent teaching practices (Estes et al. 2014; Kugler et al. 2013). In any case, this appears to be a concern requiring further attention, especially on how best to introduce a flipped classroom to students who have never experienced this environment before. Additionally, the results provide evidence to suggest that relying on student perceptions and satisfaction when evaluating flipped classrooms is not indicative of assessing student engagement and academic achievement and that future research in this area should attempt to measure more than student perceptions.

This research should be understood within a few limitations. The results are largely based on self-report data and are not immune to response biases. In particular, future research can achieve more objective estimates of student perceptions and engagement through third-party observation or teacher perceptions (e.g. Strayer 2012; Lage et al. 2000). A more objective estimate of the degree to which a course meets the definition of a flipped classroom could also be ascertained through independent examination of class materials by experts. Additionally, the current results could potentially be unclear due to teacher quality or course content, for example, when differences are found between students in classes in which the course convenor used a theoretical perspective to inform their flip strategy and students in classes where the course convenor did not, the potential exists for differences to be a result of teacher quality (those using a theoretical perspective could be more experienced instructors) or course content (some content may be more suited to this teaching style). These variables were not measured in the current study but could be in future research through comparing student evaluations of teaching (or attempting to keep instructors and instructor style similar in experimental comparisons) and comparing the same course where the course convenor does not use a theoretical perspective to inform practice and then does.

Conclusion

Despite these limitations, the current research serves as preliminary evidence that a course convenor should consider incorporating a theoretical perspective into their flipped design, have flip-related assessment items, and flip the entire course, if they are focused on improving student outcomes. However, due to the novelty of student-centred learning for many students, resistance to the flipped teaching approach may occur. This could result in lowered attitudes towards course activities, a belief that the course is disorganised, and lowered beliefs in their ability to complete the set work. In addition, the results suggest that a large proportion of students will be inclined to resist the flipped classroom environment due to their preferences for learning in-class as opposed to pre-class. This should not dissuade teaching academics from flipping their courses and evaluating them appropriately.

Although this preliminary evidence is supportive, additional evidence for the effectiveness of flipped classrooms is still required.

Appendix

Please circle the most relevant response

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Pre-class activities in this course (e.g. reading, lecture videos, quizzes, workbook):					
Were helpful to my learning	1	2	3	4	5
Motivated me to learn more	1	2	3	4	5
Enabled me to learn at my own pace	1	2	3	4	5
Prepared me for in-class activities	1	2	3	4	5
The *in-class* sessions helped me:					
Clarify what I had learned in pre-class activities	1	2	3	4	5
Apply what I had learned in pre-class activities	1	2	3	4	5
Develop problem-solving skills	1	2	3	4	5
Improve my group work skills	1	2	3	4	5
Develop better learning and study skills	1	2	3	4	5
Improve my communication skills	1	2	3	4	5

Please indicate your preference, and level of preference, by circling the most relevant response. I.e. If you prefer a statement on the right, circle a number closer to the right

If I could choose, I would like:					
Lectures delivered live and in person only	1	2	3	4	Lectures available online only
In-class activities to deal with teaching new content	1	2	3	4	In-class activities to deal with practical and applied problems
The first time I learn about content to happen in-class	1	2	3	4	The first time I learn about content to happen at home before class
To avoid technology in my learning	1	2	3	4	To use technology to assist my learning
To be quizzed on content only after it has been discussed in class	1	2	3	4	To be quizzed at the beginning of class on content available before class
To learn everything I have to learn in class	1	2	3	4	To have required learning before I go to class
To not participate in class but only listen	1	2	3	4	To be active and collaborate with other students in class
Readings, videos, and/or other pre-class activities to be optional	1	2	3	4	Readings, videos, and/or other pre-class activities to be required

To have new content delivered in lectures and laboratories/tutorials with more practical exercises assigned to outside of class (e.g. in assignments)	1	2	3	4	To have materials (pre-recorded lectures, readings) available prior to class and have in-class activities be practical and focus on problem solving

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