Article

Studying Learner's Perception of Attaining Graduate Attributes in Capstone Project Units Using Online Flipped Classroom

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Abstract: This article describes an empirical study to evaluate how the flipped learning (FL) approach has impacted a learner's perception in attaining the graduate attributes (GAs) of five capstone project units offered at Melbourne Institute of Technology in Australia, where the authors are affiliated. The subjects include one undergraduate and one postgraduate business unit, and one undergraduate and two postgraduate units in networking. Our study is distinguished from previous research in two novel aspects. First, the subject matter concerns capstone project units which are taken by students in the final year of their degree. In these units, students are expected to apply a variety of knowledge and skills that they have acquired thus far in carrying out an industry-based project of substantial complexity. The learning outcomes (LOs) require students to apply skills and knowledge that they have learned across completed units and connect them with real-world problems. Second, the FL approach has been applied wholly in an online virtual classroom setting due to the social distancing restrictions enforced by local authorities in response to the COVID-19 pandemic. Our hypothesis is that FL has positively influenced the perception of learners in their attaining the GAs. We tested this hypothesis by using data collected by an online survey administered to the student cohorts of the five chosen units at the end of Trimester 1 of 2021. The survey, which comprised 14 questions, assesses a student's perception of achieving the LOs through developments in three dimensions, including cognitive, affective, and behavioural, acquired in a real-world client setting. Statistical analyses of the survey data reveal that the FL approach resulted in a positive perception by students of their attaining the GAs through achieving the LOs of the capstone project units, which in turn is supported by the responses to the three measured dimensions.

Keywords: flipped classroom; capstone project; online learning; instructional pedagogy; higher education; problem-based learning; work integrated learning; online survey

1. Introduction

Studies and applications of the flipped classroom pedagogy as an enabling teaching strategy for students to achieve better learning outcomes and improve skills and knowledge for better employability in their area of study abound in the research literature. Most existing studies share similarities, including: (1) the subject matter of concern is largely limited to a specific knowledge area within a wider program of study; for example, a unit on introduction to programming in a computing degree or a subject on business communication in a marketing degree, and (2) learning activities are carried out in a face-to-face classroom setting. The COVID-19 pandemic has brought unprecedented challenges to all levels of education, ranging from primary to secondary and to university in most countries. In Australia, online teaching and learning via virtual classrooms, facilitated by digital platforms like Zoom, Skype, Adobe Connect, to name some, have become a

norm at most higher education providers. The integration of flipped classrooms and online teaching has brought both opportunities and challenges.

This article describes an empirical study aimed to evaluate how learners perceive the flipped learning (FL) approach has impacted their attainment of institute-wide graduate attributes (GAs) across five capstone projects units, one at the undergraduate and four at the postgraduate level, offered in the School of IT and Engineering and School of Business at the Melbourne Institute of Technology. Our study distinguishes from existing research in two novel aspects: (1) The subject matter concerns capstone project units which are taken by students towards the end of their study program. In these units, students are expected to apply a variety of knowledge and skills acquired in their study until then in conducting a substantial industry-based project in a work-integrated learning (WIL) setting, which mimics increasingly prevalent use of remote working environment. In other words, the learning outcomes anticipated are broader than those of a single subject with a narrower scope which reflect the learners' comprehensive employability; (2) The flipped learning approach has been carried out entirely in an online fashion as social distancing restrictions due to COVID-19 being enforced by the local authority, thereby disallowing face-to-face classes being held on campuses.

As a leading private higher education provider in Australia, Melbourne Institute of Technology (MIT) has been proactive in experimenting with innovative teaching practices and adopting new educational technologies to deliver enhanced learning experiences to students. Since the early stage of the COVID-19 pandemic, MIT has implemented the FL approach in several of its units that were delivered wholly online. To date, the FL approach has been applied at MIT for close to two years across four trimesters that have spanned 2020 and 2021. For the current study, our primary research question can be stated as:

- *Is learner's perception of attaining the graduate attributes through achieving the Learning Outcomes of capstone project units using Flipped Learning positive or negative?*

To address our question, we resort to an online survey which was administered to student cohorts of the five capstone project units towards the end of the Trimester 1 of 2021. It was designed to test our hypothesis that FL has positively influenced the perception of learners in their attaining the GAs. By understanding the students' perspectives on the flipped learning approach, teachers can gain insights into their students' learning outcomes in a realistic environment, which involves various conflicting commitments and time constraints the students normally face. The use of a combination of synchronous and asynchronous activities in a flipped learning approach also helps teachers to identify the students' learning interests, engagement and ongoing developments. The implications from these findings are expected to clarify the effectiveness of FL augmented by online tools on graduate employability in the rapidly developing remote learning environment.

The rest of the paper is organized as follows. The section on Literature Review will overview related research to our study. The Materials and Methods section will describe the approach and methodology we adopt for this study and describe the empirical data collected using an online survey we developed to survey students' feedback on how they perceive the effect of the flipped learning approach on their attaining the MIT graduate attributes in the capstone project units. The Results section will present statistical analyses of the survey data, while the Discussion section explains the implications of our study based on the results. Lastly, the Conclusion summarises the objectives and contributions of this research, as well as highlights future works arising from this study.

Literature Review

Research reported in the existing literature on the effectiveness of flipped classrooms on graduate employability, in different disciplinary areas is far from conclusive. Flipped learning requires students to complete pre-class activities and participate in interactive learning in classroom time, according to Chen et al. [1], where they applied flipped learning in teaching statistics units. Flipped learning can be considered a specific type of blended learning [2] that requires students to combine various types of learning in order to improve

engagement and use teaching resources effectively [3,4]. The adoption of flipped classroom is also partly driven by the decreasing attendance rate of lectures and the increasing demand for flexible learning approach [5]. The key objective of using a flipped approach is to utilise class time productively by moving substantial information transmission out of the classroom and promote active exchanges and socialising between teachers and learners and among learners in class [4,5]. Strelan et al.'s (2020) meta-analysis shows that flipped classroom provides a positive impact to student performance regardless of the level of education and disciplines, but the effect differs according to the flipped design [5].

Recent advances in computing saw the use of online learning in conjunction with flipped learning [6] with some advantages and disadvantages. The disadvantages, being the lack of readiness or preparedness of the students in flipped classes, are well discussed in [7]. The perception of the students on flipped learning is also studied in [8]. In specific to affective and behavioural developments, students are found to improve their attitude and learning skills, in terms of their motivation to learn, self-efficacy, strategy selection and time management, after they are exposed to learning in a flipped classroom [9]. Evidence shows that students can achieve better learning experience and outcomes when flipped learning exposes them to different learnings styles and enhance their accountability with their own learning [10]. This is further supported by Pérez et al. [11] who found that students' independent learning skills improve with flipped learning, and most importantly, their increased level of engagement contributes to the positive development in their learning. Flipped learning faces many challenges despite the positive effects found in the literature. An advanced student will benefit immensely from the high-level classroom engagements, while the intermediary and struggling students may suffer from the limited learning opportunities to grasp the fundamental concepts of the topics [12]. In particular, if the student lacks the study skills or self-discipline in studying, the flipped learning can invoke a serious consequence.

Instructors should recognise the different level of skills and developments learners achieve throughout their studies. For example, as discussed by Michael and Michael [13], foundational learning involving processing fundamental information may be most effectively achieved in a face-to-face environment, while higher-order learning, such as analysis, application, evaluation and design, which requires long-term memory and advanced cognitive developments, may be more suitable to using technological tools in an online or flipped learning environment. Another challenge of flipped learning is its susceptibility towards the session structure and associated learning tools/methodologies. The class session structure must examine the background (study) information of the students carefully. Some students may possess highly developed self-analytic skills, whereas the other students may lack such skills [6]. Flipped classroom as a blended learning approach often requires a coherent structure combining online learning and face-to-face collaboration and interactions [14]. The design and structure of pre-class asynchronous online learning and in-class synchronous learning affect how students prepare for their learning, build appropriate learning skills and confidence, and the level of engagement with the content [15]. It is critical for the instructors to recognise and accommodate the differing traits and skill levels between students and actively support them with adjustments in the design and structure of flipped learning. This is especially true in the capstone project units which involve online learning and a remote working environment between students, academic and industry clients.

As flipped learning aims to help learners develop independently and in a team environment, combining both synchronous and asynchronous activities during and outside of class time, it is important that the research related to this approach needs to include the study of student mindset, knowledge, and skills development that affect their attainments in employability [16]. A flipped classroom can serve as an effective approach to cultivate independent learning/working, critical thinking and problem-solving skills that will develop students' employability, especially with advancing digital tools in remote working environments. This is evident in [17], which explores the use of a flipped class-

room in a capstone project, where students perceive an improvement in their preparation for their future employment and enhanced communication skills. The study shows that while they face many challenges in the beginning of their projects, students successfully develop independence in collaboration, innovation and conflict resolution through the coaching they receive in the flipped classroom. Instead of being instructed or told what to do, they eventually become a professional working group. This is consistent with using flipped classroom to support the advanced level of cognitive [13], affective and behavioural developments in capstone projects that prepare students for their future employments.

Our work aims to measure student's perception of the effect of selected flipped learning methodologies on their learning in a capstone project unit. We believe it is important to gauge students' perception about a teaching mode, as it affects how well they engage and adapt to the chosen approach [18]. The COVID-19 pandemic has forcefully shifted many higher education institutions to use a purely online learning environment. Therefore, this study explores the unique setting of an online learning environment for capstone project units using a flipped classroom, while the industry clients also work remotely when they supervise students on their projects. We anticipate that the findings of our study will add to the body of knowledge among the higher education community about the impact of flipped learning on developing graduate employability.

The MIT capstone projects assessed by this study employ a flipped learning approach where students are required to engage with weekly pre-class activities involving video recordings of key theoretical concepts followed by online forums and preparation work to reflect on their understanding and experience. The video recordings were initially adopted from internet resources when flipped classroom was introduced, as many instructors do when they first use the approach [4]. As the instructors gain more experience using flipped classroom, they develop their own video recordings and other materials. During class time, students present and discuss their project work and challenges using various online tools involving technical, written and presentation work. Students also have meetings with their project supervisors and clients to discuss their progress and further developments. There are post-class activities and instructions set up by the instructors that help students reflect and apply their skills and knowledge using various online tools. It has been shown in Fadol et al. [18] that students who access online materials in a flipped learning environment perform better and miss fewer classes than students who study in a traditional mode. This is based on the notion that the MIT capstone projects employ a flipped learning structure that combines synchronous participation and engagement involving several 20 min blocks of mini lectures, online discussions and activities during a 2 h (networking) or 3 h (business) workshop every week. This is complemented by asynchronous pre- and post-class online materials and activities available on the learning management system.

This study involves measuring the students' perception of their learning and engagement through a survey comprising three dimensions, namely cognitive, affective and behavioural. The self-assessment of students' learning is analysed with the collected survey data of students' perception, data cleansing, transformation, and analysis to understand the positive and negative perception of flipped learning applied to several cohorts of capstone students. To the best of our knowledge, this is the first study that involves a student sample that includes both undergraduate and postgraduate students in their final year across different disciplines in IT and business. In order to be able to investigate the impact consistently across the different disciplines, the items used to assess the *behavioural dimension* focus on the development of professional skills in terms of job readiness, conflict resolution and teamwork. Hence, the *behavioural* dimension will be represented as *professional* in the analysis hereafter. This article provides insight into the effectiveness and usefulness of flipped learning in capstone project units in an online learning and remote working environment and has the potential to offer guidelines for future deployments of flipped learning in similar and comparable contexts.

2. Materials and Methods

2.1. Methodological Approach

Similar to all higher education providers in Australia, MIT has adopted a set of *graduate attributes* (GAs) by which students enrolled in its courses are expected to develop by the time they complete their study at MIT. These graduate attributes include:

- Communication—The ability to communicate effectively and appropriately in a range of contexts to achieve high order speaking, listening, reading, writing, numeracy and information technology communication skills.
- Independent and lifelong learning—A capacity to be a self-directed learner and thinker and to study and work independently, resulting in continuous learning, resilience, confidence, learning transferable and time management skills and an ability to learn independently.
- Ethics—Awareness, sensitivity, and commitment to ethics and ethical standards in personal, social, business and professional contexts.
- Analytical and Problem Solving—The ability to collect, analyse, and evaluate information and ideas and to solve problems by thinking clearly, critically and creatively to solve problems and issues using established methods of enquiry.
- Cultural and Global Awareness—An acknowledgment of and respect for: equality of opportunity; individual and social responsibility; and a recognition and appreciation of other cultures and times recognizing the global context of business.
- Teamwork Cooperation, Participation and Leadership—A capacity to relate to, collaborate with, and where appropriate, lead others, and to exchange views and ideas in order to achieve desired outcomes through teamwork, negotiation, conflict resolution, and leadership.
- Specialist knowledge of a field of study—Comprehensive specialist knowledge of a field of study and defined professional skills ensuring work readiness.

In this study, we employed a survey research method to collect data from the students enrolled in five capstone project units by using an online questionnaire. We have modelled our survey after Chen et al. [1], which has been validated for evaluating students' perspective on flipped learning based on several dimensions, with several items included in each dimension.

Our aim is in investigating students' perception of the flipped classroom approach on their achieving the graduate attributes in specific to their *cognitive*, *affective* and *professional* developments. By design, the MIT graduate attributes represent a set of high-level qualities, skills and understandings that it expects students to gain over the course of their study. While developing our survey, we observed that the MIT graduate attributes address all of Bloom's taxonomy categories, i.e., *cognitive* (knowledge), *affective* (attitude), and behavioural (professional skills), as shown in Table 1. The cognitive dimension is related to the learner's knowledge, while the affective and the behavioural dimensions concern the behaviour, attitude and the professional skills.

At MIT, in each unit's description, the unit learning outcomes (ULOs) are mapped against the graduate attributes. With the use of the flipped classroom approach in the capstone project units, the items in our survey are designed to link with the three dimensions as illustrated in Table 1. The survey has 14 items across the three dimensions, namely *cognitive* (C1-C5), *affective* (A1–A5), and *professional* (P1–P4). These items were developed based on the MIT graduate attributes.

The capstone units are delivered using a project-based learning approach where each team of students work with their industry client on a project that is relevant to a real-world business or industry problem. As such, students who enrol in capstone project units are expected to attain an individual level of success in each of the three objective dimensions, which in turn enable them to satisfy the MIT GAs. A student's degree of perception, ranging from 1 to 5, of attaining the graduate attributes (GAs) varies across the capstone project units. The variation is dependent upon the specific unit learning outcomes (ULOs) in each unit.

Table 1. Dimensions, instrument items, and associated codes.

Dimension	Item	Code
Cognitive	Improved my critical analysis and creative thinking skills	C1
	Improved my complex problem-solving skills	C2
	Enhanced my skills to study and work independently	C3
	Improved my ability to collect, analyse, and evaluate data	C4
	Improved interaction with academic staff that helped my learning	C5
Affective	Improved my ability to communicate with my team members	A1
	Enhanced my understanding of the global context of business	A2
	Helped my awareness, sensitivity, and commitment to ethical standards	A3
	Helped my recognition and appreciation of multi-cultures	A4
	Helped my written and oral communications skills to present professionally	A5
Professional	Improved my ability to lead, resolve conflicts and negotiate consensus	P1
	Improved my capacity to exchange views and ideas	P2
	Improved my ability to work as a team member	P3
	Helped me comprehend industry requirements for job readiness	P4

2.2. Online Survey

Five capstone project units offered in the School of IT and Engineering (SITE) and School of Business (SoB) were selected to trial the flipped classroom model in Trimester 1, 2021. In SITE, the capstone project units were offered in two parts, namely Capstone 1 and Capstone 2, in two successive trimesters. In SoB, the capstone project was completed in a single unit. The online survey was developed in Google Form and was distributed among students to complete voluntarily. The survey included their consent for utilization of the collected data for research. Approval was obtained from the MIT Research Committee for the survey data collection and use for research purposes only.

Data was collected in the SITE units, including Bachelor of Networking (BN301/BN304) and Master of Networking (MN691/MN692), similarly, in Bachelor of Business (BB330) and Master of Professional Accounting (MA618) in the School of Business. Overall, 184 participated out of a total of 400 enrolled students across the six units, that is 46% (see Table 2). The ratios of the proportion of participants to the total number of students enrolled in (BN301) and (BN304) were 79.4% and 72%, respectively. The ratios of the proportion of participants to the total students enrolled in the (MN691) and (MN692) were 36.84% and 34.7%, respectively. Similarly, the ratio of the proportion of participants to the total number of students enrolled in the Master of Professional Accounting (MA618) was 63.26%. No response was received from the Bachelor of Business unit. Out of the 184 participants, 3 did not indicate their gender. Therefore, out of the 181 candidates, the ratios of the male and female responses were 70.7% and 29.3%, respectively. The Master of Networking units have a higher ratio of female responses, while the Bachelor of Networking units have a lower ratio of female responses.

Table 2. No. of participants grouped by level, subject, and gender.

Level	Unit Code	No. of Enrolment (Population)	Male	Female	Prefer Not to Say	No. of Responses
Undergraduate	BN301	34	25	2	0	27 (79.4%)
	BN304	36	21	2	3	26 (72%)
	MA618	49	18	13	0	31 (63.26%)
Postgraduate	MN691	114	27	15	0	42 (36.84%)
	MN692	167	37	21	0	58 (34.7%)
Total		400	128	53	3	184 (46%)

3. Results

In this section, we present a statistical analysis of the online survey based on the data collected. First, we assess the reliability of the online survey by referring to the Cronbach's α coefficients computed. Next, we study the strength and the direction of mutual relations between the three dimensions of learner's development based on the survey data. Third, we evaluate the students' perception of their attaining the MIT GAs by analysing the responses to the survey items within each of the three dimensions. Fourth, we assess if there are any significant differences in the survey responses across the different units.

3.1. Cronbach's α Coefficients

A total of 184 responses were collected and each response comprises 14 items. The Cronbach's α coefficients were calculated for all three dimensions (i.e., *cognitive*, *affective*, and *professional*) to examine the reliability across individual items in each dimension and of the overall survey. Table 3 shows that the individual dimension's reliability measured in terms of the α coefficients that ranged between 90% to 91%, whereas the overall reliability of the survey is 96.5%. The α coefficients computed highlighted the high internal consistency among the survey items.

Table 3. Dimensions, no. of items, and Cronbach's α coefficients of the survey instrument.

Dimension	Item (5-Point Likert Scale) (1 = Strongly Disagree, 5 = Strongly Agree)	No. of Items	Reliability (α)
Cognitive	C1, C2, C3, C4, C5	5	0.9098
Affective	A1, A2, A3, A4, A5	5	0.9139
Professional	P1, P2, P3, P4	4	0.9052
Total scale		14	0.9648

3.2. Correlation Matrix

The correlation matrix is used to examine the relations between the three dimensions as shown in Table 4. The results show that all three dimensions are strongly correlated with each other. The corresponding correlation scatter plots of *cognitive* vs. *affective*, *cognitive* vs. *professional*, and *affective* vs. *professional* are shown in Figures 1–3. This result is consistent with the Bloom's taxonomy, which supports the capstone project units providing advanced level of knowledge building, skills development, and active application to real world problems. In addition, the more advanced development of one dimension is correlated to a more advanced level of development in another dimension. For example, *affective* development is positively and significantly correlated with the *cognitive* development (Corr = 0.88, $p < 0.00$). This is consistent across all three dimensions. This provides the support that the unit learning outcomes in the capstone project units measure the graduate attributes appropriately.

Table 4. Correlation Matrix over the three skills dimensions.

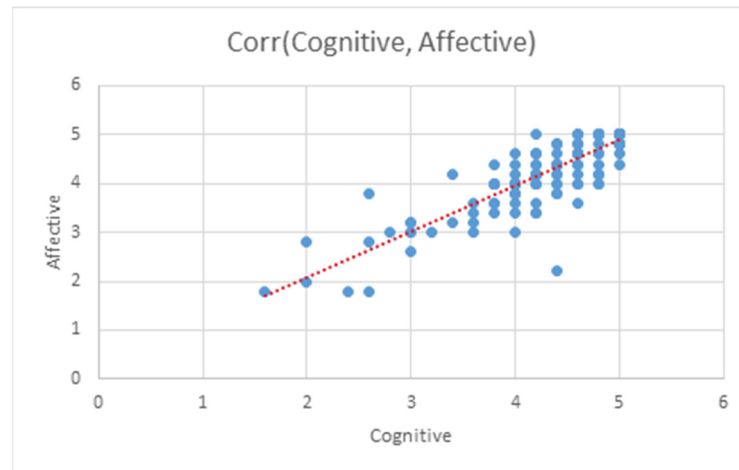|	Cognitive	Affective	Professional
Cognitive	1		
Affective	0.875325131	1	
Professional	0.880869624	0.862381212	1
	p-value		
Corr (cognitive, affective)	<0.00001	The result is significant at $p < 0.05$	
Corr (cognitive, professional)	<0.00001	The result is significant at $p < 0.05$	
Corr (affective, professional)	<0.00001	The result is significant at $p < 0.05$	

Figure 1. Scatter plot showing correlation of cognitive vs. affective dimensions.
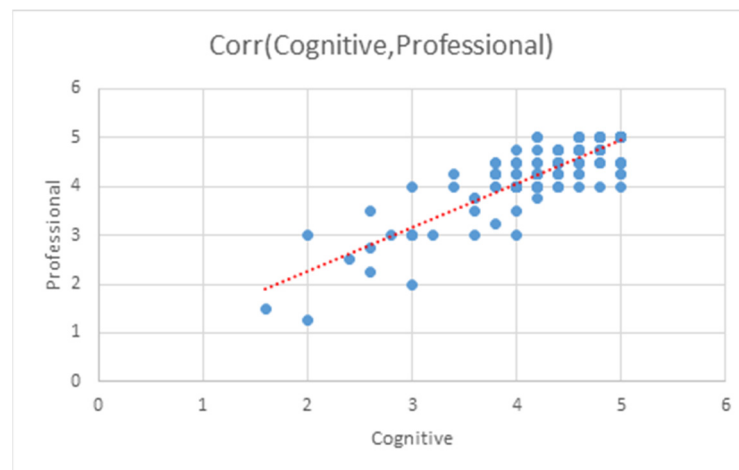

Figure 2. Scatter plot showing correlation of cognitive vs. professional dimensions.
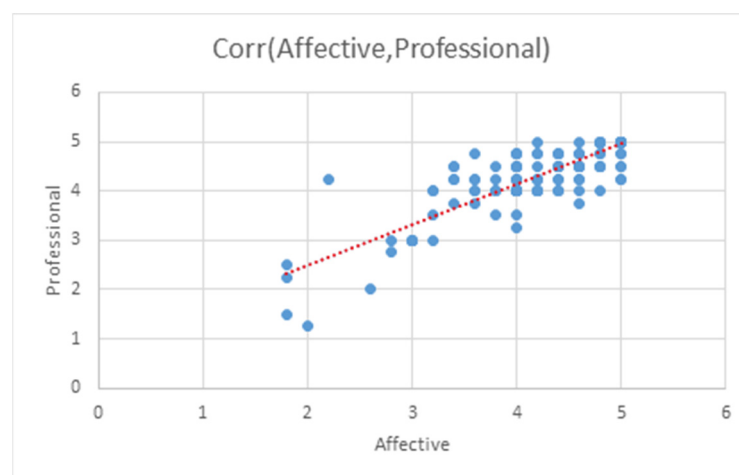

Figure 3. Scatter plot showing correlation of affective vs. professional dimension.

As the Cronbach's α coefficients data reliability test and correlation matrix results are both positive, we provide further statistical analysis in the subsequent sections.

3.3. Summary Statistics

In the subsequent sections, the summary statistics of each dimension are presented based on the data collected from a total of 184 respondents.

3.3.1. Cognitive (Learning Effectiveness)

In Table 5, the responses for the *cognitive* dimension are shown. The overall item responses are $184 \times 5 = 920$. It can be observed that the mean of all individual *cognitive* responses (C1–C5) is greater than 4 and the standard deviation is lower than 1. The student's perception of "flipped learning has improved my ability to collect, analyse, and evaluate data" (C4) shows the highest level of agreement (M = 4.42). This was followed by C3: Enhanced my skills to study and work independently (M = 4.40), C5: Improved interaction with academic staff that helped my learning (M = 4.39), C2: Improved my complex problem-solving skills (M = 4.35), and C1: Improved my critical analysis and creative thinking skills (M = 4.35). Overall, the responses strongly support that flipped learning in an online capstone project unit is associated with a positive *cognitive* development among the students.

Table 5. Students' responses on the "cognitive" items (*n* = 184).

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
C1. Improved my critical analysis and creative thinking skills	0 (0%)	6 (3%)	16 (9%)	70 (38%)	92 (50%)	4.35	0.77
C2. Improved my complex problem-solving skills	0 (0%)	3 (1%)	18 (10%)	75 (41%)	88 (48%)	4.35	0.72
C3. Enhanced my skills to study and work independently	2 (1%)	4 (2%)	18 (10%)	54 (29%)	106 (58%)	4.40	0.84
C4. Improved my ability to collect, analyse, and evaluate data	0 (0%)	5 (3%)	14 (7%)	64 (35%)	101 (55%)	4.42	0.75
C5. Improved interaction with academic staff that helped my learning	2 (1%)	6 (3%)	15 (8%)	56 (31%)	105 (57%)	4.39	0.86
Overall	4 (0.43%)	24(2.6%)	81(8.8%)	319(34.67%)	492(53.47%)	4.382	0.788

As shown in Table 5 overall, the rate of "Strongly Agree" is more than 50%, while "Strongly Disagree" is only 1% or less across all items. The responses to "Agree" ranges between 29% and 38%, whereas the "Disagree" is no more than 6% in any individual item of this dimension. "Neutral" is in the range of 14–18% across all five items. The "Agree" and "Strongly Agree" responses in the *cognitive* dimension are 34.6% and 53.47%, respectively, with a cumulative response of 88.07%.

3.3.2. Affective (Learning Motivation and Interest)

Table 6 shows the students' responses on the *affective* dimension. The overall item responses are $184 \times 5 = 920$. The mean of all individual *affective* items (A1–A5) is greater than 4 and the standard deviation (SD) is lower than 1. However, the maximum SD in this dimension is 0.9, reflecting a larger variation in responses, as compared to 0.86 in the case of the *cognitive* dimension. The students' perception of the flipped learning, A1: Improved my ability to communicate with my team members has highest level of agreement (M = 4.47). This is followed by A5: Helped my written and oral communications skills to present professionally (M = 4.43), A3: Helped my awareness, sensitivity and commitment to ethical standards (M = 4.29), A4: Helped my recognition and appreciation of multi-cultures (M = 4.23), and A2: Enhanced my understanding of the global context of business (M = 4.21). Consistent with the results of the *cognitive* dimension, the responses show a significant level of agreement.

Table 6. Students' responses on the "affective" items (*n* = 184).

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
A1. Improved my ability to communicate with my team members	2 (1%)	5 (3%)	14 (8%)	47 (25%)	116 (63%)	4.47	0.84
A2. Enhanced my understanding of the global context of business	2 (1%)	6 (4%)	28 (15%)	63 (34%)	85 (46%)	4.21	0.90
A3. Helped my awareness, sensitivity and commitment to ethical standards	3 (2%)	3 (2%)	22 (11%)	66 (36%)	90 (49%)	4.29	0.86
A4. Helped my recognition and appreciation of multi-cultures	2 (1%)	5 (3%)	27 (14%)	64 (35%)	86 (47%)	4.23	0.88
A5. Helped my written and oral communications skills to present professionally	0 (0%)	3 (2%)	19 (10%)	57 (31%)	105 (57%)	4.43	0.74
Overall	9 (0.97%)	22 (2.4%)	110 (11.9%)	297 (32.3%)	482 (52.4%)	4.326	0.844

Overall, 11.9% provides a neutral response, slightly greater than the *cognitive* dimension with 8.8%. Nevertheless, the "Agree" and "Strongly Agree" responses are 32.2% and 52.3% respectively for the *affective* dimension. This is consistent with the overall results of the *cognitive* dimension.

3.3.3. Professional (Cultivation of Diversified Skills and Teamwork)

The students' responses on the *professional* dimension are presented in Table 7. The overall item responses are 184 × 4 = 736. The mean for each of the individual items (P1–P4) is greater than 4 and the standard deviation (SD) is lower than 1. The student perception of the flipped learning, P2: Improved my capacity to exchange views and ideas has the highest level of agreement (M = 4.43). This is followed by P1: Improved my ability to lead, resolve conflicts and negotiate consensus (M = 4.41), P3: Improved my ability to work as a team member (M = 4.39), and P4: Helped me comprehend industry requirements for job readiness (M = 4.37). The results show that students perceive flipped learning in an online capstone project unit is an effective way to help them develop their professional skills.

Table 7. Students' responses on the "professional" items (*n* = 184).

Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	M	SD
P1. Improved my ability to lead, resolve conflicts and negotiate consensus	1 (1%)	3 (2%)	14 (8%)	67 (36%)	99 (53%)	4.41	0.75
P2. Improved my capacity to exchange views and ideas	1 (1%)	4 (3%)	13 (7%)	62 (33%)	104 (56%)	4.43	0.76
P3. Improved my ability to work as a team member	3 (2%)	3 (2%)	17 (9%)	57 (31%)	104 (56%)	4.39	0.85
P4. Helped me comprehend industry requirements for job readiness	2 (1%)	2 (1%)	14 (8%)	73 (40%)	93 (50%)	4.37	0.76
Overall	7 (0.93%)	12 (1.6%)	58 (7.7%)	259 (34.5%)	400 (53.3%)	4.4	0.78

The 5-point Likert scale for the mean and standard deviation of all three dimensions is shown in Figure 4.
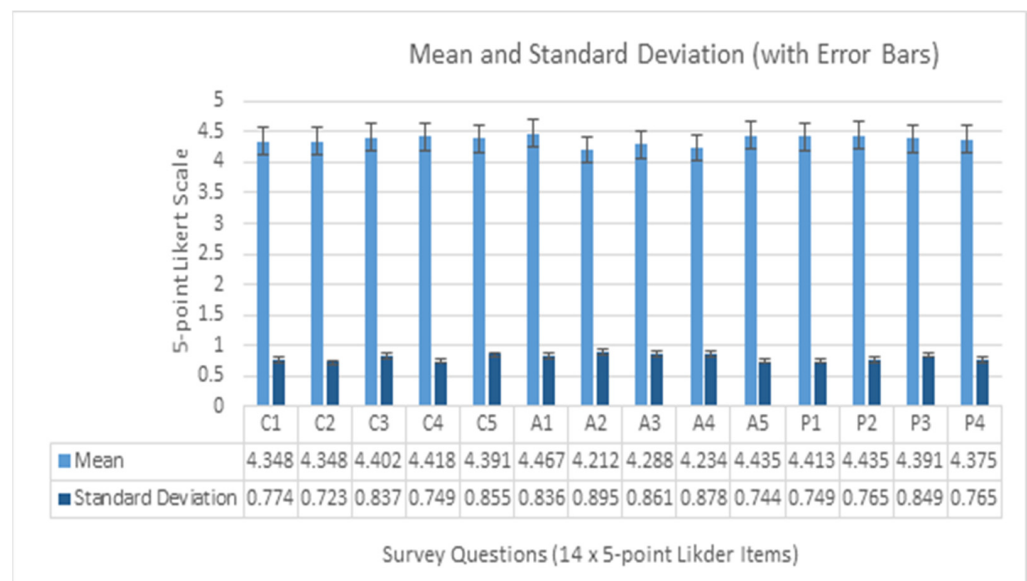
Figure 4. Mean and Standard Deviation over 14 items across 3 dimensions (C, A, P).

3.4. One-Factor ANOVA Test

The analysis of the variance for each item in each of the three dimensions across the units studied was conducted and is shown in Tables 8–10, respectively.

Table 8. One-factor ANOVA comparing any significant difference in the mean of each item among the five units surveyed for the cognitive dimension.

	C1	**C2**	**C3**	**C4**	**C5**
BN301	3.81	3.92	3.85	4.00	3.74
BN304	4.42	4.27	4.38	4.50	4.54
MA618	4.26	4.32	4.29	4.16	4.22
MN691	4.36	4.36	4.55	4.47	4.48
MN692	4.60	4.58	4.62	4.67	4.65
Between group (F-stat) *	5.423	4.240	4.718	5.272	6.591
p-value	3.82×10^{-4}	0.00265	0.00121	0.00049	5.70×10^{-5}
Sig. at $p < 0.05$	Yes	Yes	Yes	Yes	Yes

* Effect size.

Table 9. One-factor ANOVA comparing any significant difference in the mean and variance of each item among the five units surveyed for affective domain.

	A1	**A2**	**A3**	**A4**	**A5**
BN301	3.78	3.67	3.74	3.67	3.89
BN304	4.42	4.19	4.15	4.31	4.46
MA618	4.35	4.03	4.10	3.87	4.26
MN691	4.67	4.21	4.31	4.36	4.52
MN692	4.72	4.57	4.69	4.57	4.71
Between group (F-stat) *	7.706	5.643	7.312	7.426	6.982
p-value	9.44×10^{-6}	0.00027	1.78×10^{-5}	1.48×10^{-5}	$3..03 \times 10^{-5}$
Sig. at $p < 0.05$	Yes	Yes	Yes	Yes	Yes

* Effect size.

The results given in Tables 8–10 show that the responses are consistent across all cohorts except BN301, which provides a lower mean in all items of the *affective* dimension. This is a unit where the Bachelor of Networking students complete the first part of their capstone project, involving research and analysis that will lead into the second part of their capstone project (BN304) involving implementation. In addition, unlike postgraduate

students, undergraduate students may require more time to develop their experience and knowledge about working with real world clients and problems, hence resulting in their responses being different from other cohorts. This is evident in the respondents in BN304 (second project) being consistent with other cohorts. In addition, there is no significant difference between Networking and Business students, except for item A4, with regard to the flipped classroom helping them to recognise multi-cultural aspects of their work. This result is similar to the BN301 group. This may be due to constraints faced by clients, academics, and students working in a remote setting, where constant new approaches and digital tools are being developed and trialled by education institutions and businesses.

Table 10. One-factor ANOVA comparing any significant difference in the mean and variance of each item among the five units surveyed for professional skills.

	P1	**P2**	**P3**	**P4**
BN301	3.96	3.89	4.00	3.85
BN304	4.42	4.35	4.27	4.27
MA618	4.13	4.32	4.22	4.26
MN691	4.43	4.60	4.52	4.48
MN692	4.76	4.67	4.62	4.65
Between group (F-stat) *	7.608	6.173	3.342	6.228
p-value	1.11×10^{-5}	0.00011	0.01146	0.00010
Sig. at $p < 0.05$	Yes	Yes	Yes	Yes

* Effect size.

4. Discussion

Through the online survey, we studied how the flipped learning approach has impacted students enrolled in capstone project units by assessing their perception of attaining the MIT graduate attributes across the three dimensions of learning objectives, including cognitive, affective, and professional. Overall, our results support the meta-analysis by Strelan et al. (2020), that flipped learning can yield effective outcomes regardless of disciplines [5], as our study involves both IT and Business capstone projects. Furthermore, the results offer strong evidence that support flipped learning as being perceived to be an effective approach in capstone projects, resulting in positive developments across all three dimensions. The empirical results obtained are consistent with Shih and Tsai (2017) [6] over all three dimensions, including the developments of problem solving, critical thinking, communication and teamwork skills. The positive perception obtained may also be attributed to the advanced independent learning skills and self-paced interactive learning and teamwork environment that the students are able to establish and share with their peers, academic mentors, and clients involved in the capstone projects. This supports Altemueller and Lindquist's [12] argument that a flipped learning approach should consider the level of learning skills and the curriculum for students at different levels. Hence, our results show that students perceive the flipped learning approach as effective for advanced studies such as capstone units.

4.1. Students' Perception of the cognitive Dimension

The perception by students is overwhelmingly positive with regard to how flipped learning supports their *cognitive* development in their capstone projects. In this dimension, the lowest mean (4.35) is observed in C1 and C2, in terms of how flipped learning improved critical analysis and creative thinking, and complex problem-solving skills. These items are closely followed by C5 (4.39), which assesses how flipped learning improved students' interaction with academic staff that helped their learning. The two items with the highest mean are C4 (4.42) which reflects students' perception of improvement in their ability to collect, analyse and evaluate data, and C3 (4.40) which measures whether flipped learning improved their skills to study and work independently.

The results show that students are capable and confident of their ability to conduct independent learning and activities, such as collecting, analysing, and evaluating data. While similarly, responses on how flipped learning contributes to the positive development of other cognitive measures are obtained. The results support Michael and Michael's [13] notion that a flipped classroom approach may be more effectively support advanced *cognitive* development, such as a design and analysis that uses long-term memory for the development of higher-order learning and skills. Our evidence is based solely on the student perception survey, which complements yet differs from Michael and Michael's findings, which employed a comparison of student assessment performance. Common challenges [6] currently faced by students and professionals in remote learning and working environments need to be further addressed by innovative activities and collaborative tools that are able to support students to solve problems and interact with one another and their industry clients more effectively. Our results complement Shih and Tsai's [6] findings of positive student perception in how flipped learning facilitate their development in problem solving, critical thinking and knowledge integration skills in a marketing online project. As the MIT's capstone projects involve a high level of research, design and implementation, our results align with Shih and Tsai's [6] suggestion that the flipped learning approach is suitable for research and instruction-based learning, with the appropriate design and implementation.

4.2. Students' Perception of the Affective Dimension

The perception of the students through their responses supports that using flipped learning in online capstone project units positively affect attaining the *affective* dimension of the MIT graduate attributes, consistent with previous studies such as [8–10].

Overall, more than 50% of the respondents strongly agree that flipped learning has improved their *affective* development. Specifically, 63% of respondents strongly agree that flipped learning helped improve their ability to communicate with their team members (A1), while only a cumulative 4% either strongly disagree or disagree. A majority of the respondents ("Strongly Agree": 57%; "Agree": 31%) support that flipped learning in their capstone project units helped them to develop their written and oral communications skills to present professionally. This follows from their positive response with how flipped learning improves their ability to collect, analyse and evaluate data measured in the *cognitive* dimension, which reflects on the effectiveness of the flipped learning approach in helping students develop the analytical and professional communication skills as part of the graduate attributes.

Although the A2 and A4 items have the lowest number of respondents who strongly agree that flipped learning enhanced their understanding of the global context of business and helped them to recognise and appreciate multi-cultures, 46% respectively and strongly agree while only 1% in both items strongly disagree. This may relate to the need to further enhance the activities and tools to support students to collaborate and interact effectively with their counterparts, academics, and industry clients. This is consistent with the challenges inherent in a flipped learning approach that involves synchronous and asynchronous activities [1] and different learning and engagement methods [3] and design [5]. Similarly, flipped learning in capstone projects does not compromise the development of ethical practices in work-integrated learning, with 49% that strongly agrees and only 2% that strongly disagrees that shows that the innovative approach helps their awareness, sensitivity, and commitment to ethical standards. Unlike Michael and Michael's [13] findings that flipped learning is less effective in ethical education measured in terms of short-term questions (testing short-term memory), in this study, our focus is on how students perceive their development and application of ethical standards in an interactive environment of capstone projects in dealing with their peers, academic mentors and clients, hence yielding different results.

Overall, 11.9% provides a neutral response, slightly greater than the *cognitive* dimension with 8.8%. Nevertheless, the "Agree" and "Strongly Agree" responses are 32.2% and

52.3%, respectively, for the *affective* dimension. This is consistent with the overall results of the *cognitive* dimension.

4.3. Students' Perception of the Behavioural (Professional Skills) Dimension

Similar to the other two dimensions, student responses are overwhelmingly positive that flipped learning helps develop their professional skills and teamwork, with 50% or more strongly agree across all items. This is consistent with how flipped learning is effective in capstone projects [7]. Conversely, only 2% of respondents strongly disagree with flipped learning failing to improve their ability to work as a team member (P3), while only 1% strongly disagree with other items (P1, P2, and P3). P3 has the lowest cumulative percentage (87%) of "Agree" and "Strongly Agree" responses, while P4 has the highest (90%). This reflects a positive perception of flipped learning in cultivating their professional skills and teamwork to be job ready. Our results support that flipped learning can facilitate the development of teamwork and other professional skills that affect graduate employability [16]. Likewise, our results are consistent with Shih and Tsai's [6] and Foster and Yaoyuneyong's [17] that communication skills and teamwork are positively perceived to be effectively developed by students in capstone and online projects. This can be explained by the positive impact on development of independent learning skills when working in an interactive and collaborative environment, as well as the use of coaching to replace direct instructions based on the principles of flipped classroom approach [17].

The highest standard deviation is observed in P3 (0.85) that flipped learning has improved the respondents' ability to work as a team member and lowest in P1 (0.75) that is flipped learning improved the respondent's ability to lead, resolve conflicts and negotiate consensus. As found in the *affective* dimension (A1 and A5), the respondents perceive that they can communicate effectively. This is consistent with the findings in P3 and P1 that the majority of the respondents feel positive about their ability to resolve conflicts and work effectively as a team member, despite the differences in the standard deviations.

5. Conclusions

This study explores the unique setting of an online learning environment for final year capstone project units using a flipped learning pedagogy, with the industry clients also working remotely while they are supervising students on their projects. The study attempts to address the primary research question, "Is learner's perception of attaining the graduate attributes through achieving the Learning Outcomes of capstone project units using Flipped Learning positive or negative?" To answer this question, we conducted an online survey which was administered to student cohorts of five capstone project units offered at Melbourne Institute of Technology (MIT) in Australia towards the end of Trimester 1 of 2021. The online survey was designed to test our hypothesis that Flipped Learning has positively influenced the perception of learners in their attaining the MIT graduate attributes.

By understanding the students' perception on the flipped learning approach, we argue that educators can gain insights into their students' learning outcomes in a realistic environment, which involves various conflicting commitments and time constraints the students normally face. Specifically, our study measures students' perception across three dimensions, namely *cognitive*, *affective* and *behavioural* (*professional skills*). Through analysing the survey data, our findings reveal that students' overall perception of flipped learning in enabling them to attain the MIT graduate attributes through achieving the unit learning outcomes is strongly positive. This is supported by statistical analyses on all three dimensions which individually and collectively show strong support on the positive perception of flipped learning on students' achieving the graduate attributes.

To the best of our knowledge, this is the first study that involves a student sample which includes both undergraduate and postgraduate students in their final year across more than one discipline in a work integrated learning setting. Our study complements the limited literature that show support for the effectiveness of flipped learning in the

development of advanced learning, work-integrated learning, and graduate employability. While our results provide strong evidence that students perceive flipped learning positively in their capstone projects, we can further extend future research to include focused group interviews to assess the learners' perspective and identify the difficulties they face in learning and engagement with and without the flipped learning approach. This will allow the examination of the flipped classroom design, as the activities may be tailored accordingly to address the limitations of this study. Future work may also include a triangulation of the perceptions of the industry client and the academics (i.e., unit lecturers and tutors) on the learning and engagement of the learners using flipped learning. This can gauge a comprehensive feedback based on the interactions between the learners, teachers and industry clients that may have significant effects on cultivating graduate employability. The secondary data source obtained from the learning management system may also be used to investigate the learning and engagement design in the flipped learning model by collecting time-stamped learners activities involving assessment submissions, asynchronous and synchronous activities, such as text mining of the online discussion forum, reflective journal assessment reports, and peer review feedback.

The results of this study can offer important implications and insights into the future deployments of flipped learning in similar and comparable contexts. In turn, we anticipate that the results reported will add to the body of knowledge among the higher education community about the impact of flipped learning on developing graduate employability.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data used in this project has been collected by approval from the MIT Human Ethics Research Sub-Committee (May 2021 meeting). The data can be made available for interested readers by formal correspondence to Chair, Human Ethics Research Committee, Melbourne Institute of Technology, 288 La Trobe Street, Melbourne, VIC 3000, Australia.

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References

1. Chen, L.; Chen, T.-L.; Chen, N.-S. Students' perspectives of using cooperative learning in a flipped statistics classroom. *Australas. J. Educ. Technol.* **2015**, *31*, 621–640. [CrossRef]
2. Bonk, C.J.; Graham, C.R. *The Handbook of Blended Learning: Global Perspectives, Local Designs*; John Wiley & Sons: Hoboken, NJ, USA, 2012.
3. Davies, R.S.; Dean, D.L.; Ball, N.L. Flipping the classroom and instructional technology integration in a college-level information systems spreadsheet course. *Educ. Technol. Res. Dev.* **2013**, *61*, 563–580. [CrossRef]
4. Brewer, R.; Movahedazarhouligh, S. Successful stories and conflicts: A literature review on the effectiveness of flipped learning in higher education. *J. Comput. Assist. Learn.* **2018**, *34*, 409–416. [CrossRef]
5. Strelan, P.; Osborn, A.; Palmer, E. The flipped classroom: A meta-analysis of effects on student performance across disciplines and education levels. *Educ. Res. Rev.* **2020**, *30*, 100314. [CrossRef]

6. Shih, W.-L.; Tsai, C.-Y. Students' perception of a flipped classroom approach to facilitating online project-based learning in marketing research courses. *Australas. J. Educ. Technol.* **2017**, *33*, 32–49. [CrossRef]

7. Li, Y. Current problems with the prerequisites for flipped classroom teaching—A case study in a university in Northwest China. *Smart Learn. Environ.* **2018**, *5*, 2. [CrossRef]

8. Colomo-Magaña, E.; Soto-Varela, R.; Ruiz-Palmero, J.; Gómez-García, M. University students' perception of the usefulness of the flipped classroom methodology. *Educ. Sci.* **2020**, *10*, 275. [CrossRef]

9. Okmen, B.; Kilic, A. The effect of layered flipped learning model on students' attitudes and self-regulation skills. *Int. J. Res. Educ. Sci.* **2020**, *6*, 409–426. [CrossRef]

10. Karapetian, A.O. Creating ESP-based language learning environment to foster critical thinking capabilities in Students' papers. *Eur. J. Educ. Res.* **2020**, *9*, 717–728.

11. Pérez Ruiz, A.; Collado Agudo, J.; García de los Salmones, M.D.M.; Herrero Crespo, A.; San Martín Gutiérrez, H. An Empirical exploration of the perceived effectiveness of a 'flipped classroom' in a business communication course. *J. Sch. Teach. Learn.* **2019**, *19*, 47–65. [CrossRef]

12. Altemueller, L.; Lindquist, C. Flipped classroom instruction for inclusive learning. *Br. J. Spec. Educ.* **2017**, *44*, 341–358. [CrossRef]

13. Michael, B.; Michael, R. Show me and I'll remember: Association between instructional modality and memory for learning. *J. Int. Educ. Bus.* **2019**, *12*, 95–110. [CrossRef]

14. Li, J.; Kim, C.; Kim, H. Development of an instructional design model for flipped learning in higher education. *Educ. Technol. Res. Dev.* **2017**, *65*, 427–453.

15. Alkhalidi, I. Developing a flipped learning model for teaching EAP students struggling with multi-level challenges in a college context. *Int. J. Appl. Linguist. Engl. Lit.* **2020**, *9*, 1–12. [CrossRef]

16. Wu, J.-C.; Chi, S.-C.; Wu, C.-C.; Kang, Y.-N. Helps from flipped classroom in learning suturing skill: The medical students' perspective. *PLoS ONE* **2018**, *13*, e0204698. [CrossRef] [PubMed]

17. Foster, J.; Yaoyuneyong, G. Teaching innovation: Equipping students to overcome real-world challenges. *High. Educ. Pedagog.* **2016**, *1*, 42–56. [CrossRef]

18. Fadol, Y.; Aldamen, H.; Saadullah, S. A comparative analysis of flipped, online and traditional teaching: A case of female Middle Eastern management students. *Int. J. Manag. Educ.* **2018**, *16*, 266–280. [CrossRef]