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Article

A Study to Evaluate Students' Performance, Engagement, and Progression in Higher Education Based on Feedforward Teaching Approach

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Abstract: Learners who enter higher education (HE) at the foundational level are susceptible to many challenges that impact their performance, engagement, and progression. Not all students who enter HE at the foundational level will progress and attain their course qualifications. In addition, many university lecturers struggle to give effective support to their students. This study focuses on feedforward teaching approaches that define ways to enhance learning by using advanced organisational strategies to offer relevant supporting concepts and meaningful verbal material. To date, there are insufficient literature reviews on feedforward approaches to facilitate students' subsequent learning. Providing better academic support for students and a strong foundation for independent learning is the focus of this paper. Therefore, the main contributions of this paper are identifying the key feedforward features and suggesting effective feedforward approaches. This study was undertaken to rigorously implement feedforward approaches that would support groups of students in modules at the foundational entry-level. At the end of module delivery, different students' data sets were analysed related to the progression rates, standard deviation, and mean. In addition, the student satisfaction questionnaire (module evaluation survey) and feedback survey were also considered for engagement and retention purposes. The outcomes from this exercise suggest that feedforward approaches allow students to increase their overall effort when attempting summative assessments and, thus, improve their performance, engagement, and retention.

Keywords: higher education; feedforward; foundational level; assessment; performance; engagement; retention; student evaluations of teaching

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1. Introduction

Passing assessments is a vital goal for most students throughout their studies; however, in higher education (HE), early-stage learners experience a variety of challenges, one of which can be failing to engage with assessment tasks. In turn, this discourages students and lowers confidence, preventing them from fully understanding how to maximise their results [1]. Students prefer to be guided and receive feedback on their performance while working on their assessment tasks [2]. This type of feedback is referred to as "feedforward": feedback or comments provided by academics to their students on their assessment drafts prior to submission (feedback before submitting tasks).

The main problems facing many higher education establishments are centered on student retention, engagement, and performance [3,4]. Not all students who enter HE at the foundational level will progress and attain their course qualifications. Our observations and statistics [5] show that the majority of students entering the early (foundational) years of higher education are subject to constraints due to one or more of the following factors [6]: mature students returning to education after a long break, students with weak entry qualifications, time management issues (juggling education with employment and

family commitments), financial pressures, diverse cultural backgrounds, language barriers, and personal issues (e.g., family problems and lack of confidence).

The aim of the research in this paper is to explore a range of supported feedforward approaches as a means of providing better student engagement, satisfaction, and performance. Applying these approaches at the entry-level of university can aid the smooth transition to higher levels and support student retention.

Research Question 1: What are the feedforward key features?

The research question above leads us to identify and conclude the key features associated with feedforward. These features will be adopted for feedforward approaches for particular modules prior to the final assessment in order to evaluate the impact on students' future summative assessments.

Research Question 2: Does feedforward improve student performance, engagement, and progression for early starters in higher education?

The question above leads us to focus on evaluating feedforward strategies to prove their effectiveness, the approaches that, therefore, provide better academic support for students who start their higher education journey and lay the foundation for independence at higher levels.

2. Literature Review

In the research, it was found that a mechanism is needed to integrate the processes of teaching, learning, and assessment; some of the essential approaches are feedback and feedforward [7]. An easier way to understand the contrast between feedback and feedforward is that feedback focuses on students' performance (past and present focused), whereas feedforward looks ahead to subsequent assessments and offers constructive criticism on how to do better (future-focused). A combination of both feedback and feedforward helps ensure that assessments have a developmental impact on learning [8]. They are considered key elements in students' learning and crucial in supporting one beset by a multitude of challenges.

2.1. Feedback

Researchers examined student engagement with 'feedback' and proposed many ideas to increase student performance, such as the Carless and Boud [9] conceptual paper, which demonstrated student responses and discussed several barriers to student uptake of feedback. Carless and Boud proposed and illustrated a framework to underpin students' feedback literacy. The framework consists of four inter-related features: appreciating feedback, making judgments, managing affect, and taking action. Narciss [10] describes an interactive tutoring feedback model (ITF-model) and how it can be applied to the design and evaluation of feedback strategies for digital learning environments. Furthermore, Carless [11] recommended the double-loop feedback model to remedy a variety of unpleasant experiences that students encountered and looked at ways to secure long-term student engagement. Carless investigated feedback loops by using the concepts of single-loop and double-loop learning to interrogate student responses to feedback. Single-loop learning tackles an identified problem or task, whereas double-loop learning additionally re-evaluates how the problem or task is approached.

2.2. Feedforward

The term feedback is constantly being replaced by the principles of 'feedforward' through which developmental comments on improving work are provided rather than focusing on the shortcomings of an assignment [12]. The concept of feedforward is similar to Ausubel's [13] idea of enhancing learning by using advanced organisational strategies to offer relevant supporting concepts and meaningful verbal material. Therefore, "Feedforward is an educational strategy focusing on providing students with prior exposure to,

and prior practise with assessment in order to clarify expectations and standards" ([14] p. 1.)

In many cases, conventional feedback given to students at the end of a module is difficult to feedforward into future assessments, given that the module has finished [15]. For processing feedback, the individual's role is crucial. Gagné et al. [16] focused on students' feedback processing during regular classroom instruction. A qualitative analysis of retrospective reports revealed diverse ways of processing feedback and suggested two mechanisms that led to the withdrawal of attention to feedback. One was the student's perception that he or she could not understand feedback, and the other was dwelling on the negative effect produced by making errors. This is shown clearly in Ghazal et al. [17], where students preferred receiving feedforward instead of feedback from their instructors. The comments provided to them on drafts prior to the actual assignment submission were beneficial and enhanced their learning. Furthermore, Qadir et al. [18] considered feedforward approaches as a formative assessment prior to the summative assessment. Dickson et al. [19] believe that feedforward is the most effective part of feedback; their peer-reviewed article demonstrates a positive impact on students' perception, understanding, performance in summative assessments, and overall satisfaction with assessment practices. Similarly, Ghazal et al. [16] conducted a quasi-experimental study to determine the effectiveness of feedforward on outlines versus drafts. They divided undergraduate nursing students into two groups: control and experimental. Where traditional feedback (no feedback before submission) was the technique applied to the control group through standard practice, the experimental group received feedforward on their draft work. The experimental group's performance in the assessment was much better. The feedforward process stretched and challenged strong students to improve their grades and guided weak students to improve their work in order to pass [20]. Hence, feedforward is beneficial to all students.

2.3. Related Research Theories

To date, there is insufficient guidance in the literature reviewed on the ideal approach of feedforward to facilitate students' subsequent learning. Wolstencroft and De Main [21] demonstrated the effectiveness of audio-based methods as an alternative approach to feedback and feedforward over written communication. The research showed that an increased number of students accessing feedback is directly proportional to the student's engagement. Similarly, Hill and West [22] suggest that the dialogic feedforward process enabled a positive influence on the learning experience of students in a number of interrelated cognitive and effective ways, such as supporting student performance and raising student satisfaction with feedback. Furthermore, Reimanna et al. [23] recommended more research to address the division between theoretical and practical perspectives. The authors classified the effects of feedforward into three future horizons: within-module, beyond-module, and beyond-programme. They concluded that the modular system restricts long-term (beyond-module and beyond-programme) future horizons and sustainable practices. It is significant to transform students' experience through assessment. The Transforming the Experience of Students Through Assessment (TESTA) project [24], carried out by the University of Dundee, supports this idea of a more positive and comfortable experience with assessment feedback. The project's key features were timeliness, regularity, approach to feedback, passive learners, missed opportunities, and understanding feedback. In 2013, these features were examined with positive outcomes in a case study at the University of Birmingham as part of the HEA's Assessment and Feedback Change Programme [25]. Additionally, the specificity of online and distributed learning environments has not been considered by many feedforward researchers. Baker and Zuvela [14] developed a feedforward-based approach for a large cohort that involved exemplars and clear assessment guidance. The authors stated that this approach improved task compliance and quality throughout the course by encouraging self and peer assessment, which

guarantees students' meaningful engagement with assessments and better performance in the unit.

3. Methodology

Feedback has a great impact on a learner's progression and improvement. Although feedback is mostly effective, a combination of both feedback and feedforward helps ensure that assessments have a developmental impact on learning [26]. As noted, feedback and feedforward can be formal and informal [27]. The literature reviewed in the previous section covers the theoretical aspects of feedforward, but there is little evidence of empirical practices to demonstrate its effectiveness. Therefore, this study was undertaken based on Nicol and MacFarlane's [28] seven principles of good feedback and the key features proposed in the TESTA project [24] to rigorously implement feedforward techniques to improve student engagement and assessment outcomes.

3.1. Research Model and Procedure

The main steps of the proposed research model are illustrated in Figure 1. As shown, the teaching model used was lecture-based, and the topic taught was enriched with demonstrations, followed by tasks to encourage class interaction in solving the given problems. It is also worth mentioning that this study was based on mixed methods: a combination of quantitative (i.e., numerical) and qualitative (i.e., non-numerical) data [29].

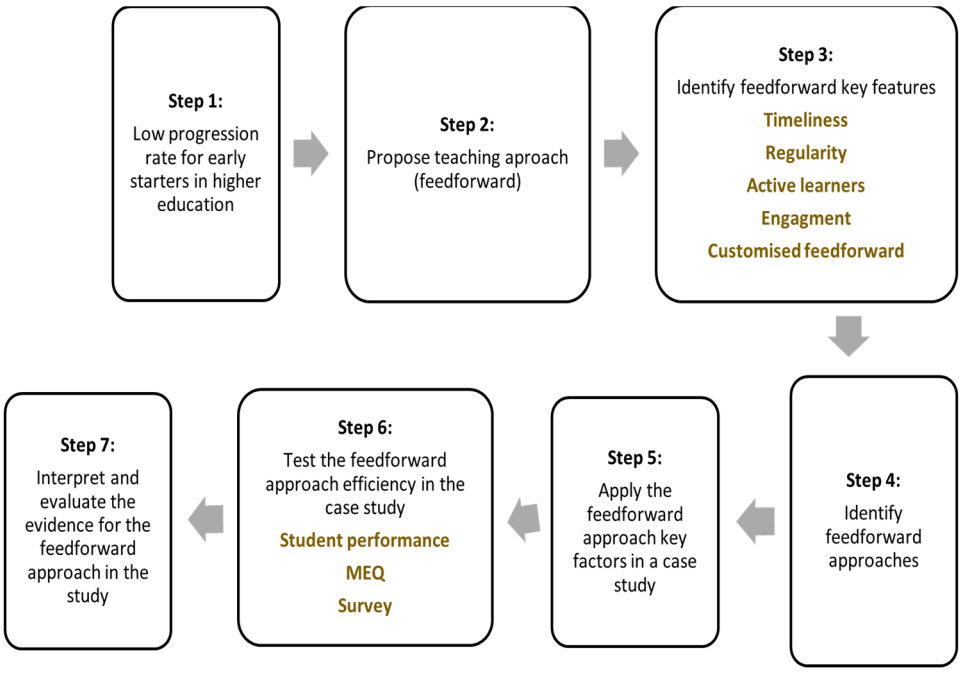


Figure 1. Research model.

3.2. Feedforward Key Features

The feedback key features by TESTA [24] were modified to the current feedforward approach, and a new feature, customised feedforward, was added, as shown in Figure 2.

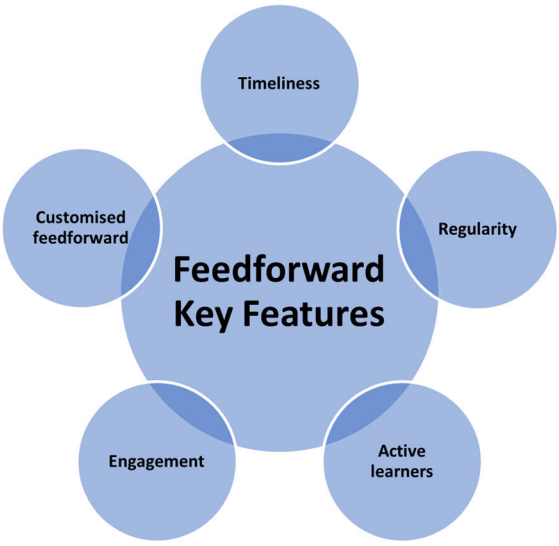


Figure 2. Feedforward key features.

The main features can be classified and re-defined as follows: Timeliness*:* feedforward can only be effective if it is timely, i.e., received at a point when meaningful action can be taken. Regularity: feedforward needs to be given in regular intervals to sustain progression and engagement. For example, regular feedforward intervals could come after finishing teaching a topic and before students start their work on the related assignment; regular intervals can be a week or every other week. Active learners: this term defines students involved in completing tasks and thinking about their actions when completing instructional activities [30]. Students often perceive feedback as justification for the marks given for their attempt(s) at an assigned task(s). Feedback does not engage in meaningful dialogue to establish how students can improve their marks and performance. With the feedforward approach, students become active learners. They are encouraged to understand tutors' comments, take heed, and, thus, achieve better outcomes to enhance their academic development. Engagement: the use of feedforward to provide feedback on draft work can encourage students to engage in their learning and not miss out on opportunities to develop academically and achieve better results. Customised feedforward: due to the different formats and the way feedback is expressed and contextualised, students do not always understand feedback, although this may not seem obvious and straightforward to tutors. Therefore, when dealing with students who have diverse abilities, it is necessary to consider each student individually when giving any type of feedback. This could be in person, recorded, or in writing, and, most importantly, the feedback should be expressed with close attention paid to the choice of words and language. Some students need to be encouraged to try harder and aim for a higher level, and others need to be tackled diplomatically so that they are not discouraged from learning and engaging. Feedforward should be tailored to suit an individual student's ability and performance.

3.3. Feedforward Approaches

In the literature, a number of strategies were used, such as continuous assessment, peer assessment, feedback on drafts, and answers or comments provided by lecturers. Figure 3 presents the range of feedforward approaches that proved their effectiveness as constructive guidance for improving student development within the course beyond focusing on assessments, such as self-assessing [29], peer marking exercises [31,32], discussion of work-in-progress [33], past assessment evaluation and exemplars [34–37], submission of draft work [22], and feedforward interviews [38].

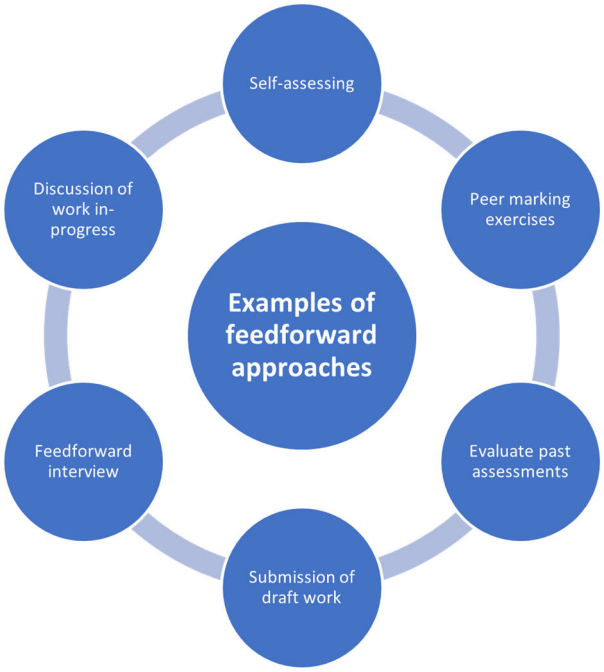


Figure 3. Feedforward approach examples.

3.4. Research Context and Samples

The student population at the University of West London (UWL) is comprised of those who come from underprivileged backgrounds with a range of abilities and demographics. This study was limited to a specific group of students, mainly the foundational year students from two separate subject areas, Computing and Engineering, taking Introduction to Computing Mathematics (47 students) and Personalised Learning (63 students), respectively, at the foundational level, as shown in Figure 4. A range of feedforward approaches (illustrated in Figure 3) was applied in this study. It should be emphasized that the approach applied depended on the nature of the assessment task. Most sessions were held in allocated PC laboratories because digital technology was heavily utilised in accomplishing the various activities [39]. At the foundation stage, a typical assessment consisted of a portfolio of miscellaneous weekly tasks that contributed to one overall summative assessment at the end of the module. These tasks were varied and included online multiple-choice questions (MCQs), short essays, group presentations, demonstrations of lab work, and small problem-solving tasks.

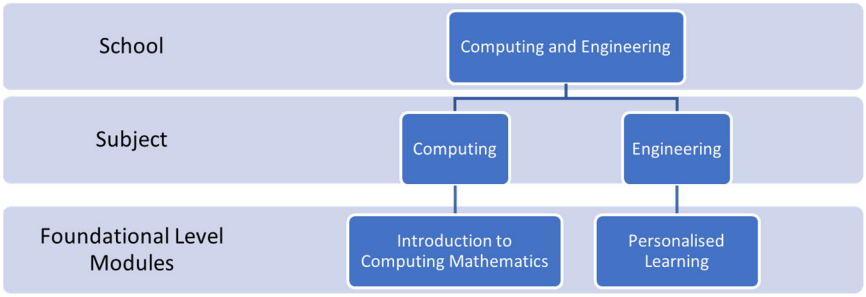


Figure 4. Study subjects and modules.

After the lecturer's lesson, standard practice started by discussing the task allocated and set work, followed by generic feedback on observations during group tutorials. Small-group tutorials facilitated the use of peer marking exercises and peer-to-peer learning and allowed tutors to engage with students to provide individual feedforward support [40,41]. Throughout

the delivery of the module, references to past assessment tasks were made to steer students towards the correct approach in their ways of thinking and analysing problems.

3.5. Research Data Set

The research in this study is based on four data sets. The data were from foundational students from Computing and Engineering. The data were collected to evaluate the study [42], answer the second research question, and determine the success of the feedforward techniques implemented, which demonstrate student performance and response following module evaluations and their feedback. The data sets are as follows:

Set 1 consists of data for six modules; three from Computing and three from Engineering, AY 2018–2019. As shown in Table 1, the Computing modules are Introduction to Computing Mathematics (ICM), Introduction to Web Design and Development (IWDD), and Introduction to Software Development (ISD). The Engineering modules, as shown in Table 2, are Personalised Learning (PL), Essential Technology (ET), and Fundamentals of Electrical and Electronic Engineering (FEEE).

Table 1. Performance of Computing students, AY (2018–19).

Computing AY2018–19	Pass Rate	StDev	Mean
Introduction to Computing Mathematics	89%	21	77
Introduction to Web Design and Development	78%	20	73
Introduction to Software Development	79%	22	67

Table 2. Performance of Engineering students, AY 2018–2019.

Engineering AY2018–19	Pass Rate	StDev	Mean
Personalised Learning	92%	20	60
Essential Technology	67%	26	49
Fundamentals of Electrical & Electronic Engineering	60%	21	60

Set 2 contains student performance data from the ICM module (Computing) and PL module (Engineering) for two consecutive academic years: 2017–2018 and 2018–2019.

Set 3 includes MEQ data for the ICM module (Computing) and PL module (Engineering) for two consecutive academic years: 2017–2018 and 2018–2019. Each semester, our university asks all students to complete Module Evaluation Questionnaires (MEQ) for all modules. This gives the students an opportunity to provide feedback about their satisfaction and any changes they would like.

Set 4 includes students' survey data for the ICM module (Computing) and PL (Engineering) module, AY 2018–2019. The survey consisted of 12 questions with a section for students to add their comments. As shown in Table 3, the questions were categorised under the headings of performance, engagement, and retention.

Table 3. Student survey questions.

Performance	Engagement	Retention
Did the feedback from your lecturer improve the quality of your work?	Do you prefer to receive the lecturer's feedback before submitting your work for assessment?	Feedback given in class improved my confidence, self-awareness, and enthusiasm for learning.
Did you receive the lecturer's feedback before submitting your work?	Feedforward feedback helped me to understand things better.	Getting feedback from my tutors on an ongoing basis has made me attend classes regularly and

		motivated me to do well in my studies.
Feedforward will allow students to get a better result in their final summative assessment.	I had to put the hours in regularly every week to do well in my studies.	
Feedback from my tutors helped me to understand what I needed to do to improve.	The assessment demands meant that I had to study hard.	
I was able to apply learning from feedforward to final assessment work.	Tutor interaction in class, ongoing feedback, and getting involved in discussions allowed me to be part of a team and get to know my tutors and fellow classmates much better.	

4. Results and Analysis

This section introduces the results and the analysis for the four data sets mentioned in the previous section. Results were considered in percentages to overcome the difference in student cohort numbers

4.1. Students' Performance for Semester 1 Modules, AY 2018–2019

The first evaluation tool used in this study is the performance of Computing and Engineering students for the modules taken in the AY 2018–2019. Tables 1 and 2 show the students' performance according to the pass rate, standard deviation (StDev), and mean. The ICM module implemented feedforward techniques, whereas IWDD and ISD used traditional methods. Table 1 clearly indicates that the pass rate of ICM (89%) is higher than the other two modules (78% and 79%).

The StDev for ICM was 21, the second-lowest number after IWDD, but the ICM mean shows most of the students' marks are close to the mean of 77. Figure 5 clearly shows that the ICM pass rate is higher than the other two modules.

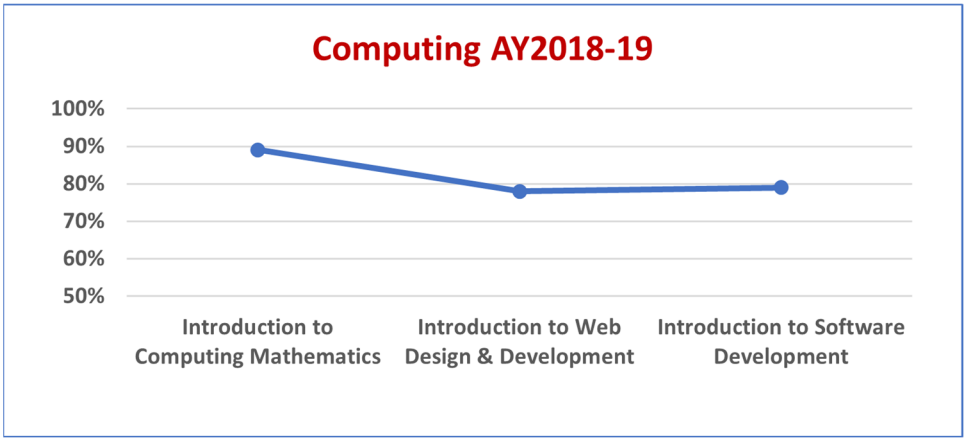


Figure 5. Pass rate of Computing students, AY 2018–2019, Semester 1.

The PL module implemented feedforward techniques, whereas ET and FEEE used traditional methods. Table 2 demonstrates that the pass rate of PL (92%) is higher than the other two modules (67% and 60%). Moreover, it was noted that the StDev for PL, which

is 20, is the lowest compared to the other two modules, which means most of the students' marks are close to the mean of 60.

Figure 6 indicates that the PL pass rate is greater than the other two modules. It is worth mentioning that PL and FEEE had the same mean (60), but the pass rate (PL is 92% and FEEE is 60%) difference between the two was vast (32%), which validates the effect of the feedforward techniques used.

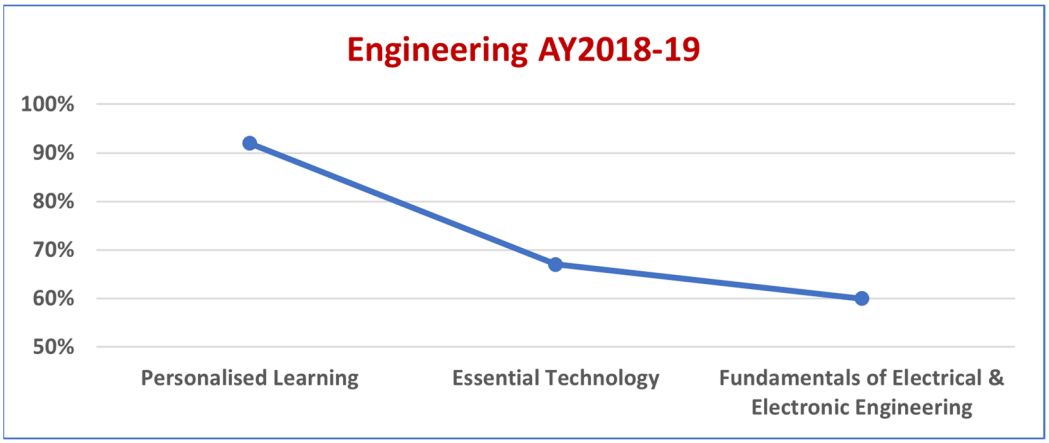


Figure 6. Pass rate of Engineering students, AY 2018–2019, Semester 1.

4.2. ICM and PL Students' Performance for Two Consecutive Years

To evaluate the study, student performance over two academic years for the same modules was compared. Figure 7 shows student performance in Computing and Engineering for the AY 2018–2019 with feedforward approaches in place and the previous AY, 2017–2018, with traditional supporting methods. By comparing the pass rates in the academic year 2017–2018 with 2018–2019 shown in Figure 7, it was found that the pass rate in the Computing field for the Introduction to Computing Mathematics module increased from 68% to 89%, a noticeable increment of 21%. Whereas within the field of Engineering, for the Personalised Learning module, the pass rate increased from 70% to 92% with an increment of 22%.

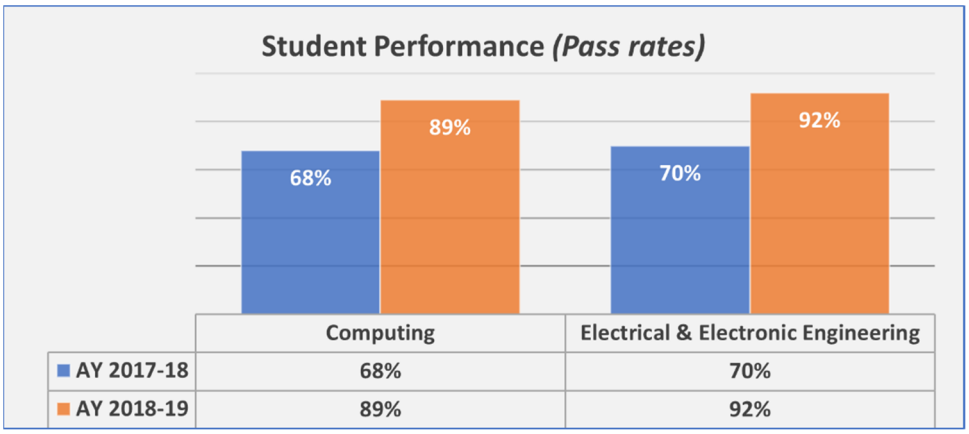
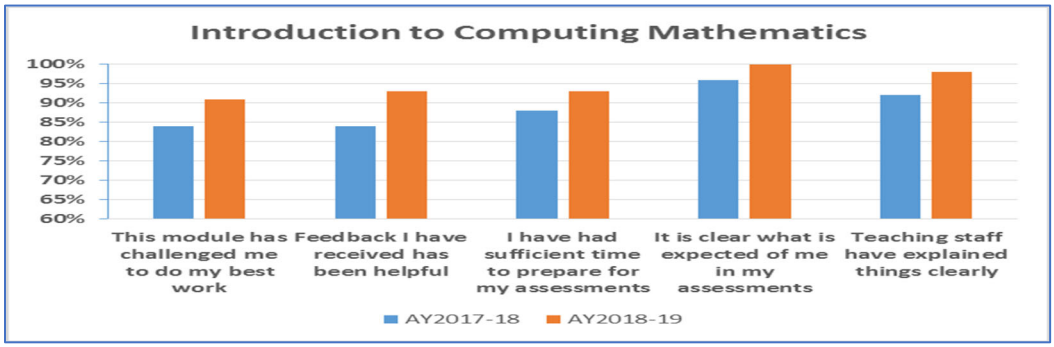


Figure 7. Performance comparison.

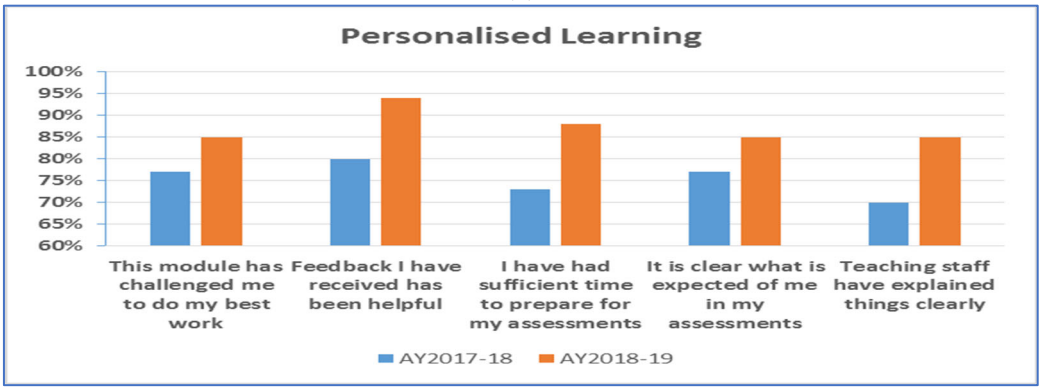
4.3. Module Evaluation Questionnaire (MEQ)

Other supporting data was investigated from the Module Evaluation Questionnaires (MEQ) used to measure student satisfaction. To evaluate the use of the feedforward techniques within our two chosen modules, MEQ responses (AY 2018–2019) were analysed and compared with the MEQ outcomes of the same modules in AY 2017–2018. Figure 8

represents the results of foundational students' satisfaction over the two academic years within the modules chosen for this study: ICM for Computing students and PL for Engineering students. Figure 8a illustrates the Computing students' satisfaction in the academic years 2017–2018 and 2018–2019, whereas Figure 8b illustrates the Engineering students' satisfaction in the academic years 2017–2018 and 2018–2019.



(**a**)



(**b**)

Figure 8. MEQ results (student satisfaction) for ICM and PL modules in SCE: (**a**) Computing; (**b**) Engineering.

Data received from the Module Evaluation Questionnaires demonstrated interesting results. The charts in Figures 8a and b prove that the use of feedforward techniques and vigorous nurturing in the foundational year for students in our two chosen modules demonstrates remarkable improvements in student evaluation of teaching, support, and feedback. There was an average increase of 6% (89% to 95%) for the ICM module and an increase of 12% (75% to 87%) for the PL module.

4.4. Survey Results

A group of 30 students from the two subject disciplines completed the questions using the online survey tool within the university's e-learning platform, Blackboard. The collected results are presented in the bar charts shown in Figure 9. The survey also considered students' overall comments, which are shown in Table 4.

Table 4. Students' comments.

What Changes (If Any) to the Current Method Would You Recommend for Improving the Feedback System?
"I would like to change nothing; I am satisfied with the feedback system that already exists."
"Make accessing feedback easier, as some students get confused with accessing feedback, or are unable to access it."
"Marking turnaround potentially marking with students in class to help them identify ways to better themselves or where they could've improved"
"All feedback was received on time. Thank you."

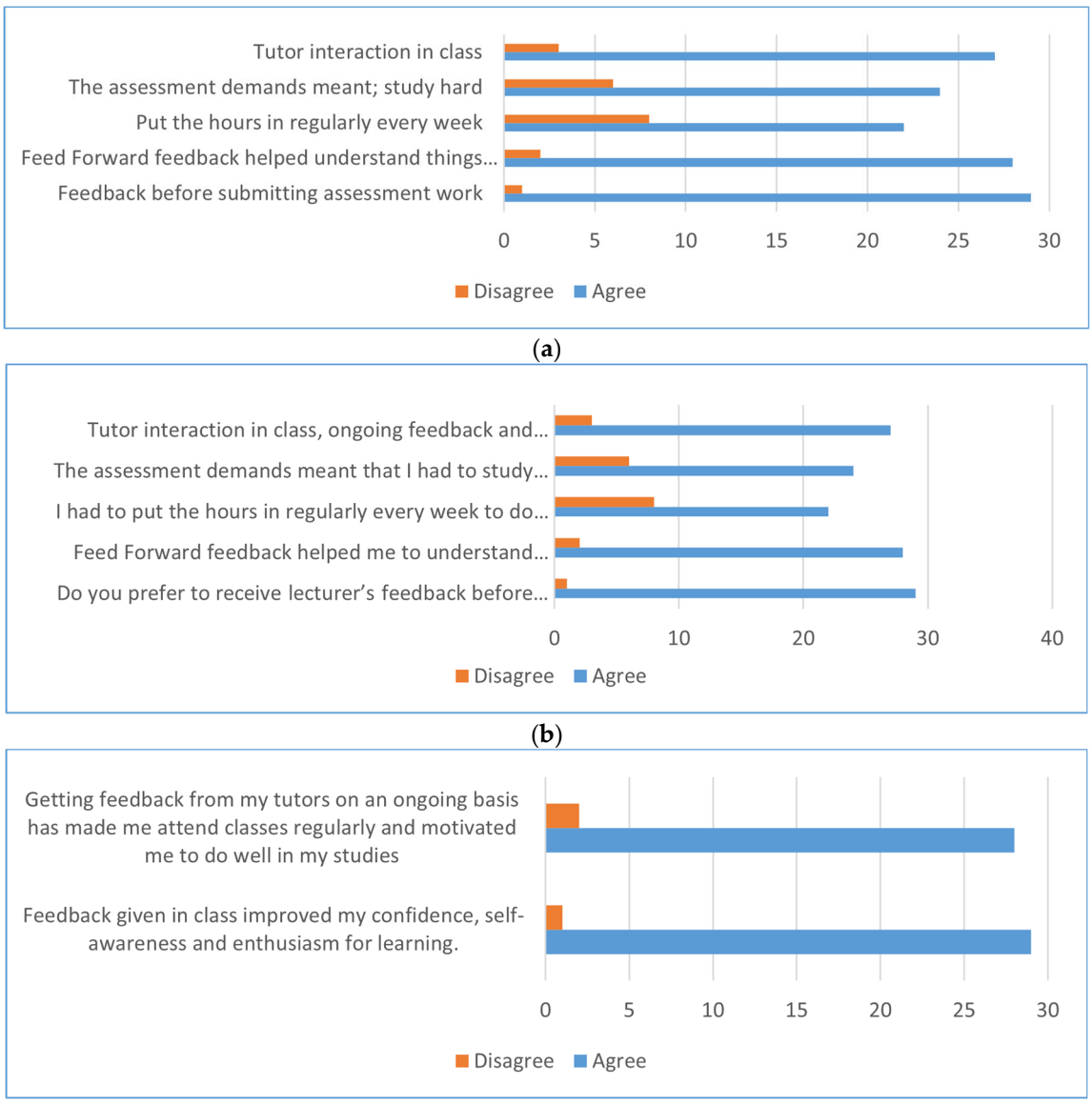


Figure 9. Survey results: (**a**) Performance questions; (**b**) Engagement questions; and (**c**) Retention questions.

As shown in Figure 9, the three categories promote further interest around the themes of performance, engagement, and retention.

The survey illustrates that students drew attention to the fact that feedforward strategies allowed them to apply useful knowledge prior to assessment and, therefore, had a better chance at producing work in line with the lecturer's expectations. In addition, students said that the feedforward approaches equipped them with knowledge regarding the nature of the assignment. They had a better understanding of what was needed in terms of the assignment's requirements. This is evidenced by themes that emerged showing that students not only felt they had achieved better grades but also had gained increased ability and understanding of the task.

5. Discussion

The ongoing feedforward on assessed work to students meant that lecturers needed to have a good understanding of students' strengths and weaknesses. However, student

perception of feedforward is like a stepping stone to the next stage, allowing them to determine what was right and what was wrong and then apply this knowledge. Feedforward should be perceived as allowing these students to overcome fears of tackling challenging tasks. The gradual process of feedforward at a personalised level will eventually prepare students to confidently tackle assessments that involve writing reports, taking exams, and getting ready to work independently in their further studies and final year project.

The findings from the empirical practice study in this research showed the impact of the feedforward model, which improved student performance, engagement, and retention when comparing student performance with other modules, student performance with the previous year, the MEQs, and the surveys. Student performance was evaluated based on pass rate (Figures 4–6), standard deviation (Tables 2 and 3), and mean (Tables 2 and 3). In addition, the student survey also reflected the students' performance (Figure 9a). The performance results (shown in the results section) show a higher pass rate, lower standard deviation, and higher mean. Engagement (Figures 7 and 8b) and retention (Figures 7 and 8c) with lecture-based feedforward were highly recommended by students based on the MEQ and the survey results. Students, in general, made accurate judgments about different types of feedforward support, as shown in Table 4.

The customised feedback proposed and applied in this paper could be considered the main difference between the proposed feedforward research model and other research models. Students may experience a lack of confidence in their approach to the assignments due to an absence of previous educational experience. It is the authors' experience that students often report dissatisfaction when 'traditional' feedback methods are employed for assignments as they feel they have only received helpful advice after submission when it is too late to be acted upon. This research methodology has allowed students the opportunity to practice and test their knowledge and understanding of module content and assessments before the assignment due date, thus, encouraging them to feedforward this experience into their work. Another reason for using this feedforward research model to nurture early starters is to facilitate a strong foundation in understanding the importance of improving academic performance and preparing students to self-evaluate their capabilities and overall performance during their later years.

The findings suggest that students used feedforward to enhance understanding of precisely what aspects they needed to improve. As depicted in Figure 10, students were better engaged with their studies, peers, and tutors, which in turn instilled confidence and demonstrated an overall improvement in retention (based on MEQ and survey findings; Figures 8 and 9, Table 4). From the staff's perspective, feedforward allowed them to facilitate assessment and support according to students' individual needs., which enabled staff to monitor student progress on a regular basis.

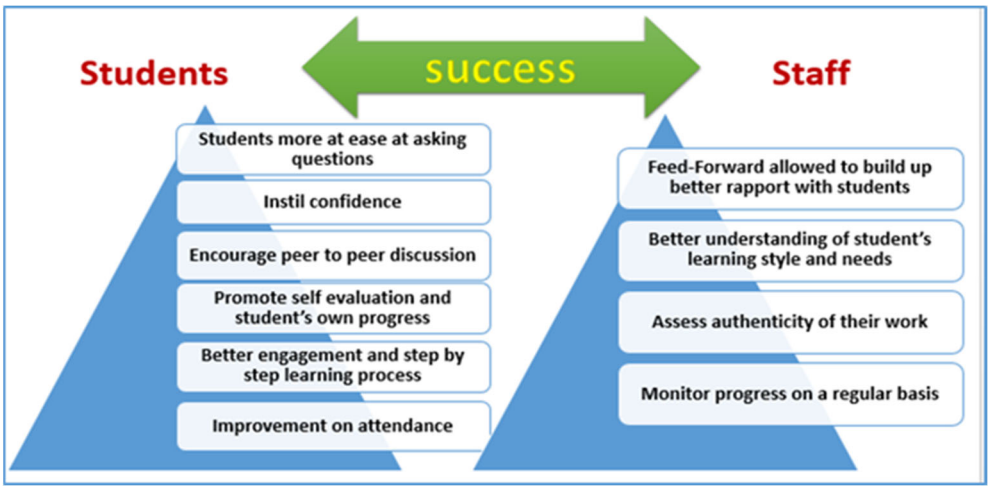


Figure 10. Feedforward impact on students and staff.

6. Conclusions

If assessment lies at the heart of the higher education learning experience, then feedback and feedforward on students' responses to assessments is a critical activity for all universities. It can be conducted face-to-face, in writing, as a group in class, and many other ways. Even casual conversations can be considered feedforward, and it is likely that lecturers provide more feedforward to students than students realise. Feedback received from students is equally important. It plays a vital role in improving the student's learning experience. Responses from students are captured through different ways such as face-to-face, in writing (emails), module evaluation surveys, course committee meetings, National Student Surveys (NSS), and regular, personal tutorial sessions. Hence, lecturers have a vital role in easing the challenges students face and refining the students' future academic work through considering the right curriculum design, providing meaningful guidance, and offering personal coaching. Hereafter, feedforward is a dynamic tool that assists students in refining their future academic work.

This study explored how applying a feedforward strategy increased students' confidence in approaching assessments and overall satisfaction with feedback processes. This paper answered the first research question and introduced feedforward key features (timeliness, regularity, approaches, active learners, engagement, and customised feedforward), which were implemented with the feedforward approaches in the study.

Feedforward was implemented in this study throughout the delivery of two chosen modules at the foundational level from two separate subject areas to measure its impact on student engagement and retention. Next, the final outcomes of the student cohorts' engagement and performance (progress rate and MEQ) were analysed and compared with data obtained the previous year for the same modules, where not much emphasis was given to feedforward approaches. This study has provided evidence from students' progression rates, MEQs, and surveys to address the second research question. It was also found that the pass rate in Computing for the Introduction to Computing Mathematics module increased a noticeable increment of 21%. Whereas within the field of Engineering for the Personalised Learning module, the pass rate increased with an increment of 22%. Additionally, in the academic year 2018–2019, student satisfaction with the quality of feedback for the ICM module increased by 6% and for the PL module by 12%. Feedforward is considered particularly important during the first year of university and can even be viewed as a retention strategy that can help develop student performance, strengthen perceptions of academic support, and reduce anxieties. From the analysis of the evidence gathered, we can conclude that feedforward approaches encourage better student engagement and performance for students starting higher education and, thus, the results answer our research question.

7. Limitations and Future Work

The research in this paper, based on a sample of foundational year students, has shown the benefits of feedforward as a means of enhancing student engagement and performance. Unfortunately, the provision of individualised, timely feedforward can be particularly challenging with cohorts of foundational and first year students because of large class sizes with diverse backgrounds, which impose challenges over time, impact staff workload, and affect other operational logistics.

To take this research forward, further investigation is required to explore the effect of the role of the individual to create a more realistic model and evaluate the impact of the approach on the students involved in this study when they reach a higher level of education.

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