Weekly short assessment and individual feedback: a strategy for deeper learning in blended learning environment

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ABSTRACT

Assessment and feedback methods have important role in motivating students to take deep or surface approaches in their learning. Designing assessments with clear link to the teaching content and intended learning outcomes (ILOs), supports students' approach toward deep learning. This study explored impact of the weekly short assessments with individual feedback in blended classes, on motivating students to take a deep learning approach in their studies. Constructive alignment framework was used to prepare the teaching content, in-class learning activities and assessment tasks. Series of short formative questions prepared with each question evolving around one teaching topic and its ILOs. Students' responses to each question were followed by individual feedback and an opportunity to reflect on the received feedback to improve their work. Students' perception towards the short formative assessment with individual feedback was collected using the Revised Study Process Questionnaire (R-SPQ-2F). Using quantitative methodology responses of the 90 Year 2 chemical and environmental engineering students were analysed. Results showed that there are significantly higher deep approach scores (Mean=2.92, SD=1.14) compared to surface approach (Mean=2.41, SD=1.15), with p-value=0.001. Students' motives and strategies in taking either deep or surface approach is also explored. While factors of "self-satisfaction" and "interest in the course content" were the main motives for students to take deep learning approach, surface strategies such as "learning the examinable content" were remaining high. This research aims to contribute to development of an assessment method in engineering education to foster students' deep learning, by developing their critical thinking and problem-solving skills.

INTRODUCTION

Assessment is one of the key parts in education. It helps educators to design learning activities and to ascertain what the learners know and to support students' approaches to learning (Gibbs, 2006). While the effective assessment methods foster students' learning process, lecturers can use them as a tool to understand the students' learning gap (Vonderwell and Boboc, 2013). Transformation of the nature of teaching and learning from teacher-centred to learner-centred education, raise the requirements to consider innovations in assessment methods including identification and implementation of deep and effective learning strategies (Taras, 2002). Shifting towards the blended classes (combination of face-to-face and online activities), students' engagement remains a concern for educators (Khan et al., 2017). Designing new assessment methods can be considered to enhance students' engagement in such environment (Haugen et al., 2001).

Several studies showed the relation between students' approach to learning and their learning outcome (Bunce et al., 2017, De Clercq et al., 2013, Ellis and Bliuc, 2019). Students' approaches to learning have been conceptualized as deep and surface learning approaches. In deep learning approach, learner is aiming to understand the teaching material while in surface approach, memorising and reproducing of the materials is the main goal (Biggs et al., 2001). Different teaching and learning strategies were developed to adopt deep learning in higher education. This includes the activities to enhance students' skills and knowledge in solving problems (Litzinger et al., 2011). Research studies showed designing activities and assessments to implement problem-based learning can foster students deep learning (Davidson et al., 2009, Rowntree and Fox, 2008, Abraham et al., 2008). In this paper effect of the short formative weekly assessments with individual feedback on motivating students to take deep learning approach through the constructive alignment framework is investigated.

LITERATURE REVIEW

Approaches to learning

Marton and Säljö (1976) initially explained the students' approach to learning by defining the concept of deep and surface learning. Some students may see learning as a process of memorising the information and reproducing them when they questioned on them. This intention to learning is known as the surface learning. In contradict to surface approach,

other students may connect the new information to their prior knowledge by understanding the meaning and through the critical thinking, which is called deep learning (Entwistle, 2000, Biggs et al., 2001).

There are different reasons why students take any of the abovementioned approaches in their learning. The reasons can be related to the learning environment, quality of teaching and students' motivation to learning (Entwistle and Ramsden, 2015). It has been discussed that changes in these factors can influence students' approaches to learning (Gijbels et al., 2013). It is clear that teachers have an important impact on students' approach to learning due to the control they have over the learning environment. Strategies such as the applied teaching method and design of the course can motivate students through the deep learning approach (Biggs, 1999). Effective assessments and feedback methods are the other examples of the teaching strategies, teachers can use to promote deep learning in students (Hall et al., 2004, Warburton, 2003).

Constructive alignment and approaches to learning

Constructive alignment was developed by Biggs (1996). The framework supports deep learning through activities to construct students' knowledge. This stands on two basic pillars: view on students learning, "constructive", and a principle for designing "good" educational activities, "alignment". The first pilar focuses on the students' constructive learning, acknowledges learners as the active knowledge constructors who learn by connecting the new information to the existing knowledge through a sense-making process. The second pillar "alignment" refers to the design of the educational activities, which comprises its intended learning outcomes (ILOs), teaching and assessment methods. The teaching activities and assessment methods should align meaningfully to support the defined ILOs (Malmqvist et al., 2011). The meaningful alignment between these elements, motivates students to take deep learning approach as they perceive a coherence learning experience.

Studies which focused on the assessment element of the constructive alignment, showed the impact of the students' perception towards the assessment process on their approaches to learning. The study conducted by Struyven et.al (2005), showed the importance of the assessment methods and how students adapt learning strategies to succeed in their assessments. This explains the importance of alignment between ILOs, teaching methods and assessment design to motivate students in taking deep approach in their learning (Biggs, 1999). Although the importance of constructive alignment in pedagogical processes is undeniable, its implementation in engineering education is still lacking. Specifically, improvements in assessment methods are mostly overlooked compared to the changes in teaching methods (Parpala and Lindblom-Ylänne, 2007, Boud et al., 2018).

Educators' roles in addressing the challenges with assessment is critical. Designing assessments with clear marking criteria, which are aligned to the teaching content, ILOs and class activities can encourage students to meaningfully engage with the course materials (Malmqvist et al., 2011). Since the constructive alignment is based on the alignment between ILOs, teaching methods and assessment design, by its nature it supports the deep learning in students. By focusing on the assessment and feedback aspect of the constructive alignment, it can be observed the direct influence of the assessment methods on engaging students with the teaching content and their learning process to achieve the ILOs.

Constructive alignment and continuous assessment and feedback to promote deep learning in students

Assessment and feedback can be used as the effective tools to motivate students taking deep learning approach. Brown (2005) discussed the importance of designing assessments in a way to fit-for-purpose. This means along with what and how we are assessing, it is critical to think why any particular assessment is needed. It was discussed by Hall (2004) that the continuous assessment can be used as a method to promote deep learning in students. By designing a continuous assessment and breaking marks into few small activities during the semester, workload will be spread over several weeks. Managing students workload can motivate them to adopt deep learning rather than surface learning (Gow et al., 1994).

Also an assessment which is followed by feedback can promote the effectiveness of that assessment. Askew and Lodge (2000) defined feedback as 'all dialogue to support learning in both formal and informal situations'. This definition shows the role of feedback to build an interaction and conversation between the educator and learner. In blended classes, feedback can increase student-teacher interaction and help to overcome this challenge by building a conversation between them. Consequently the educator-student conversation works as an effective way to motivate students to deep learning approach (Filius et al., 2018, Hattie and Timperley, 2007, Boud and Molloy, 2013, Dennen et al., 2007). Although providing feedback is important, reflecting and responding to it is crucial. Giving students an opportunity to realise their learning gaps and reflecting on them will help them to understand the teaching material deeply and to effectively link them with the new ones in a meaningful way (Filius et al., 2018).

AIM AND OBJECTIVES / RESEARCH QUESTION(S)

The aim of this study is to use the constructive alignment framework to explore the impact of the weekly short assessments with individual feedback on fostering deep learning approach in engineering students in blended learning environment. To achieve this aim, series of short formative assessments, which linked ILOs to a real-world design case followed by individual feedback method, was developed to explore the relation between the prepared activity with deep learning in students. The research question is:

Do continuous short formative assessments with individual feedback promote deep learning approach?

METHODOLOGICAL APPROACH

Activity design

A weekly short assessment and feedback was designed for Year 2 chemical and environmental engineering student at University of Nottingham. All the 182 students who enrolled on materials & sustainable processes module was participated in the activity. The assessment of the module was based on 30% coursework and 70% final examination. To improve students' engagement in the blended sessions and motivate them to take the deep learning approach, a new assessment method was designed. The summative coursework was replaced by the formative activity. A real-world design-based case study with ten short questions was prepared. Each question was designed in a way to link ILOs with the topic delivered in the lecture session and to its application for a real design in industry. Each question, which is linked to the relevant topic was released at the end of the teaching session with a week deadline for students to submit their answers. Students were using Moodle platform to access the information and to submit their answers. After submitting the responses, each student was receiving individual feedback on Moodle. To allow students to think independently and present their ideas based on what they have learned, questions were designed in a way that there was no single, right or wrong answer to them (Gallagher, 1997). Students then could reflect on the given feedback and discuss their ideas and ask their questions in tutorial sessions. At the end of the activity when all the questions were answered, and individual feedback were received, students were asked to write a 2000-word report on the given case study by considering all their answers to the short questions and received feedback.

Survey instrument

Upon completion of the activity, all the 182 Year 2 students were invited to complete a standardized questionnaire survey. The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) used to measure students' approaches to learning (Biggs et al., 2001). The survey was appropriate for quantitative research, and it was aiming to evaluate students' approaches to learning. The questionnaire consists of two main scales, Surface Approach (SA) and Deep Approach (DA), with each of the deep and surface scales shaped around ten items. Each main scale has two variables known as motive and strategy, which makes four subscales Deep Motive (DM), Deep Strategy (DS), Surface Motive (SM), and Surface Strategy (SS). Motives show the reasons a student took deep or surface approach while strategies discuss how those deep or surface learning achieved. The subscale DM shows the intrinsic interest in learning through the application of DS by extracting and understanding the meaning of the learning materials. In contrast the SM, explains the study happens as the student has a "fear of failure" so they take the SS by narrowing their learning to ultimately pass the assessments without constructing deep understanding of learning materials. The respond to the questions is based on a 5-point Likert scale with the range from 'A—this item is never or only rarely true of me' to 'E—this item is always or almost always true of me'. The project was approved by the University of Nottingham ethical committee, and it complied with all the ethical regulations of the university.

Quantitative Data Analysis

Data analysis was performed on the 90 valid responses, completed by students. To process the quantitative data collected from the surveys the open-source software JAMOVI 1.8.1 was used. Raw data from the survey instrument was entered into the software to compute relevant descriptive statistics, including averages and standard deviation.

A reliability analysis was carried out on the student response scales for deep and surface approaches and Cronbach's α values of 0.78 and 0.76 were derived for deep and surface approaches respectively. These values indicate a high level of internal consistency of the survey scales (Bryman and Cramer, 2004).

KEY FINDINGS AND DISCUSSION

Finding 1. Focus on short formative weekly assessments with individual feedback on students' learning approaches

Based on the analysed data on 90 valid responses (n=90), the weekly short assessment and individual feedback fostered students' approach towards the deep learning. While the activity promoted deep learning in 67.8% of students, only 32.2% took the surface approach in their learnings. A significant correlation, at the $p<0.001$ level, was observed between deep learning and surface learning approaches (Table 1). These findings align with Biggs et.al (2022) work, which explains the linkage of the designing teaching and learning activities using constructive alignment with promoting students deep learning approach.

Table 1. Summary of the results derived from the data analysis of the survey responses (n=90)

Approach	**Percentage (%)**	**Overall Mean Value**	**SD**	**Cronbach's alpha**	**P-value**
Deep	67.8	2.92	1.14	0.78	<0.001
Surface	32.2	2.41	1.15	0.76	

To stablish a further understanding about the factors, supported students' deep or surface approaches in learning, percentage of the responses to each question in the survey was calculated (Figure 1). Questions 1, 2, 5, 6, 9, 10, 13, 14, 17, 18, designed to assess deep approach, where questions 1, 5, 9, 13 and 17 evaluated DM and questions 2, 6, 10, 14 and 18 checked DS. To assess surface approach questions 3, 4, 7, 8, 11,12, 15,16, 19 and 20, were designed. SM was assessed by questions 3, 7, 11, 15 and 19 and questions 4, 8, 12, 16 and 20 designed to test SS. Based on the obtained percentages, for the deep learning approach, the questions targeting knowledge reinforcement and personal satisfaction received the highest percentage. For instance, 47% of the responses to question 2 which emphases on reinforcing knowledge was "Frequently true of me". Similarly, for question 1, with focus on personal satisfaction, 39% of responses indicated "Frequently true of me". In contrast, for the surface learning approach, the questions with focus on passing exams with minimum effort, received higher percentage. For example, for question 4, 29% of the responses was "Frequently true of me". Another example is question 19, which 28% of the responses was "True of me about half the time". Entwistle (2000), discussed the possibility of high achievements in study through a clear assessment strategies with rewarding personal understanding which facilitates students to take deep learning approach. To encourage students to actively participate in the blended sessions, the assessment method, feedback strategy and marking criteria were clearly communicated with students and in-class activities designed in a way to link with the weekly assessments. These considerations encouraged students to take deep approach in their learning.

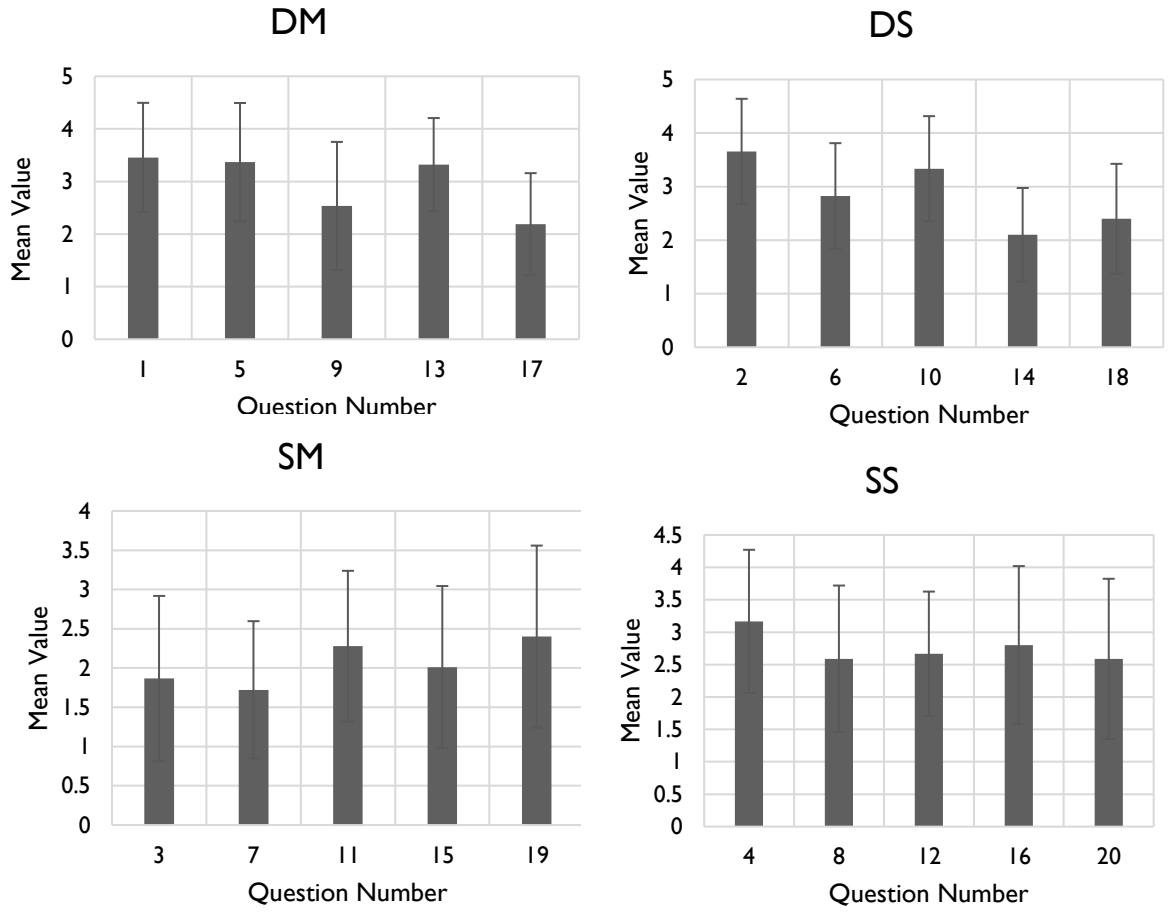
Figure 1. Percentage distribution of responses to the survey questions. The first 10 questions from bottom to top of the graph are designed to evaluate the deep approach and the second 10 questions evaluate the surface approaches in learning

Several studies explored the relation between academic achievement, assessment preparations and deep learning approaches. Michor et.al (2020) explored the relation between deep learning approach and consistency between the class activities and homework with the assessments. The influence of the assessment on motivating or demotivating students to adopt the deep learning is considerable (Asikainen et al., 2013). This can be related to this study by further exploring of the responses on the individual questions. Statements "I do not find my course very interesting, so I keep my work to the minimum" and "My aim is to pass the course while doing as little work as possible." received the highest percentages for the "Never or only rarely true of me" response. These two statements prepared to evaluate students' surface approach to learning. The majority of students did not report they lacked interest in their course and aiming as to only pass their course with minimum effort. This indicates that the students who took the surface approach in their learning mainly had incorrect strategies rather than motivations.

Finding 2. Focus on motives and strategies in learning

The fundamental question to be addressed is why some students took deep approach while the others took surface approach in their learnings. To understand this, the four subscales of DM, DS, SM and SS were investigated. Figure 2 depicts the mean values derived for each of the subscale questions. The overall mean value of DM and SM derived as 2.97±1.17 and 2.05±1.05 respectively with a significant correlation between them (P-value<0.001). For DS and SS, mean values calculated as 2.86±1.13 and 2.76±1.15 respectively, however, no significant relation (P-value=0.14) between these two strategies was observed. While surface motives remaining lower than deep motives, surface strategies were considerably high compared to deep strategies.

Figure 2. Mean values for deep and surface motives and strategies



Focusing on deep approach, students' responses to the survey showed that their DM were slightly higher than their DS. Specifically, questions which measured students' interest in the teaching content and learning materials received higher scores. For DS, questions with the focus on "reinforcing understanding" and consequently "personal satisfaction" received higher scores. This shows students' intrinsic interest in learning (Dolmans et al., 2010). In the research conducted by Joshi et.al (2023) factors such as the relevance of the course to students future career, supportive lecturer and peers have significant impact on motivating students toward deep learning approach. This is in line with the prepared activity. In the given coursework and weekly assessments, teaching content, learning materials and weekly questions were linked with the real-world case study which students could use that as an example to learn an industrial scale design. This supported students' meaningful learning while fostered their analytical and conceptual thinking skills which are the critical requirements for their future industrial career (Hall et al., 2004). Also, the individual feedback with the opportunity to reflect on them supported students learning process by discussing the questions in the tutorial sessions with the other peers and the lecturer to confirm and reinforce their knowledge and to improve their work.

In terms of surface approach, students' strategies toward this approach were stronger than their motives. While the main motive to surface approach was focusing on the examinable materials and not going beyond that (i.e. passing the exams), the strategies taken by students were to solely "learn what is outlined" in the lecture notes and excluding any content which was not questioned in any assessment. In contrast to deep learners, students with surface learning motives are generally extrinsic. This means the main motive for such students are only passing the course with minimum effort. Everaer et.al (2017), explained that learners with surface motive are not aiming to fully understand the teaching material, while investing a significant amount of time and effort to pass the exam by memorising and revising the examinable content.

Survey results showed that deep learning occurs when students perceive that they are engaged in the learning process and their perceived value of the course content is high. Students who perceived the assessment and feedback as a part of class activity and learning process were more likely to report greater use of deep learning approach. In addition, students with positive view on individual feedback and the opportunity to reflect on the feedback to improve their marks, reported greater use of deep learning approach (Ogange et al., 2018, Hailikari et al., 2022).

CONCLUSIONS & RECOMMENDATIONS

Weekly short assessments with individual feedback demonstrated significant impact on supporting students' learning experience and motivating them to take deep learning within the blended learning environment. Findings of this study align with the principles of the constructive alignment framework, wherein meaningful connection of the assessment and feedback methods to teaching content and ILOs, have a key role in fostering students' approaches toward deep learning. Moreover, the research highlighted the main motives and strategies in taking deep or surface approaches. While most responses demonstrated deep motives and consequently deep strategies in students, surface strategies remain notably high.

Future work will focus on the long-term impact of the assessment on students' academic performance and their retention. Also, strategies for making these assessments more inclusive to support diverse learning styles, abilities, and backgrounds should be investigated.

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