

Formative computer-based assessments to enhance teaching and learning

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Abstract

Formative assessment (FA) has the potential to benefit student learning and enhance teaching, as the feedback can assist both students – to assess the quality of their work – and university teachers – to understand students' strengths and weaknesses. This article reports on part of a broader exploratory study, which involved 360 undergraduate law students at a university in South Africa. Weekly formative computer-based assessments (CBAs) were introduced prior to lectures for a period of eight weeks. This intervention could be understood as a variant of FA, which is described by Carless (2007, 171) as 'pre-emptive assessment'. A survey was conducted among students and lecturers at the end of the pre-emptive FA intervention. The study found strong support for the use of FA among students, as well as lecturers, and showed a high participation rate in the FA among students. The study further challenged Biggs' (1989, 7) four-step model of constructive alignment with regard to the role of FA that can precede teaching activities. Hence, it proposes an adaptation of that model.

Keywords: computer-based assessment, enhancement of teaching and learning, constructive alignment, pre-emptive formative assessment

INTRODUCTION

This article focuses on formative assessment (FA) as a means to enhance learning and teaching in the first year of a law course within an accounting programme. The article argues that FA *for* and *of* learning has often been conflated, while the role of FA prior to teaching has been neglected. Conceptual clarity concerning the purpose of FA will help university lecturers to enhance student learning and teaching practices. The current study was conducted at a South African university in a faculty that traditionally teaches large classes of students. Many of the students in the study were academically underprepared for university education, and part of the motivation for the study was to use FA in ways that would contribute to their development, rather than add an extra burden or additional workload onto them. The article reports on part of a broader study of continuous assessment strategies that were embarked upon by lecturers in the course.

LITERATURE REVIEW

The literature review focuses on two main themes: firstly, the tendency of education to conflate FA for learning with FA of learning; and, secondly, the role of FA in classroom-based teaching.

Conflating FA for/of learning

Early theorists advance the notion that the main purpose of FA is to ‘determine the degree of mastery of a given learning task, and to pinpoint the part of the task not mastered’ (Bloom, Hastings and Madaus 1971, 61). This conflation of FA for and of learning has set a trend for others to follow and found its way into policy documents and resource materials, and hence, has limited the development of ‘genuine formative assessment’ (Harlen and James 1997, 365). Wiliam and Black (1996, 537) note that there is no common understanding of FA. Their definition of the concept, does, however, capture something of the dual nature of FA, which they understand as ‘encompassing all those activities undertaken by teachers and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged’ (Black and Wiliam 1998, 7). Sadler (1998, 77) draws on the work of Black and Wiliam when he defines assessment as being ‘specifically intended to provide feedback on performance to improve and accelerate learning’. In a later example, Coll, Rochera, Mayordomo and Naranjo (2007, 786) conclude that there is ‘the need for the use of evaluation for pedagogical ends – without necessarily overlooking or undervaluing the importance of final credentials’.

Joughin (2009, 5) expresses concern over this tendency to define assessment in ways that ‘conflate the construct’. He argues that a simplified definition of assessment will not aid our understanding of assessment and its relationships to ‘other constructs’. Most researchers and theorists do not separate these two aspects of FA, namely FA as part of a learning process and FA as part of the process of preparing for summative, measurement-based assessment. The literature thus conflates assessment *for* learning with assessment *of* learning. This conflation leads to an interpretation that FA, like summative assessment (SA), is ‘limited to the immediate outcomes of the assignment or specific course, instead of enabling students to manage and assess their own learning beyond the end of the course’ (Boud and Falchikov 2005, 2). Therefore, when the effectiveness of an FA is evaluated, an indicator of its success is whether it has influenced student behaviour (Yorke 2003, 484).

FA for the enhancement of teaching

The literature suggests that FA should also provide information to the teacher that can be used to help shape teaching (Nicol and McFarlane-Dick 2006, 199). These authors conclude that FA provides information to teachers about areas which students find challenging, whilst it also allows them to focus their teaching efforts more effectively. Coll et al (2007, 787) rely on the earlier works of Mauri and Rochera

(1997, 48) when they point out that FA is ‘fundamental’ to enable the teacher to ‘regulate his or her teaching activity’, as well as enable the student to similarly ‘regulate his or her own learning process’. Further support for the notion that FA could enhance teaching is found in the work of Yorke (2003, 478) who regards ‘the skill that an assessor brings to bear on the student’s work (as a) critical determinant of the capacity of formative assessment to be emancipatory in nature’. He draws on the earlier findings of Wood (1987, 242) who supports the idea that, during the assessment process, the assessor and the student are in active collaboration in order to ‘produce a best performance’. Yorke finds that the act of assessment has an effect on the assessor, as well as the student, and suggests that the assessor’s disciplinary and/or pedagogic repertoire may be developed after a period of reflection. This period of reflection may be supported by a staff development programme, if necessary, while the ‘revised repertoire’ would then be subsequently available for the next cohort of students. The complex nature of assessments is further emphasised by Carless’ (2007, 171) proposal of ‘pre-emptive formative assessment’, which he describes as ‘teacher actions which attempt to clarify student understandings *before* misconceptions have resulted in ineffective learning or performance’. It would, therefore, appear that FA not only has the potential to benefit student learning, but also the potential to enhance teaching.

The need for conceptual clarity

Biggs (1989, 7–25) points out that learning outcomes are a result of interactions between teaching and learning contexts. Teaching, learning and assessment practices interact to produce various outcomes. Students bring prior knowledge, abilities, values, expectations and ways of learning into the learning system. Biggs identifies these as student ‘presage factors’, which impact on the ways in which they approach and process academic tasks. The teaching context, which encompasses process factors, includes the course structure, curriculum content, methods of teaching and, of course, assessment. Students perceive and interpret assessment (including FA) and adopt a study approach that they think will help them to meet the demands of their teachers and the study programme. Hence, it is important for both teachers and students to be clear on the role and function of FA, which will enable them to ‘short-[circuit] the randomness and inefficiency of trial and error learning’ (Sadler 1989, 120).

THEORETICAL FRAMEWORK

The theoretical framework for this study is adapted from Biggs’ (2008, 1–3) notion of constructive alignment, which is based on the twin principles of constructivism in learning and alignment in teaching. Biggs (2008, 1) points out that a good teaching system should align teaching and assessment methods with learning activities so that all aspects of the system support appropriate student learning. This system is called constructive alignment. Biggs identifies four steps in this process of constructive

alignment. Firstly, the learning outcomes are defined, followed by a selection of teaching and learning activities, as well as FA and SA tasks. Constructive alignment is, therefore, intended to guide the lecturer and student in the planning and execution of teaching and learning activities, which are designed to meet the intended outcomes of the curriculum. Figure 1 is an illustration of that model.



Figure 1: Illustration of Biggs' model of constructive alignment

The linear approach to the teaching and learning process, which is illustrated by Figure 1, is problematic, since it understands the purpose of FA as being limited to serving the immediate outcomes of the assessment task or specific course. This concern is addressed in the research design, which is discussed below.

A holistic assessment strategy

During the broader exploratory study, an assessment strategy was embarked upon, which was designed to be learning-centred, as the student's progress, through continuous assessment, had to constantly inform the student and lecturer of the need for and the nature of the interventions. The aim was to provide opportunities for each student in the diverse population to acquire necessary skills that would meet the specific outcomes of the course, as well as a range of generic outcomes, which are known as critical cross field outcomes (CCFOs). An integrated approach was followed whereby assessment and learning activities were in dynamic interaction with each other. Figure 2 illustrates the process.

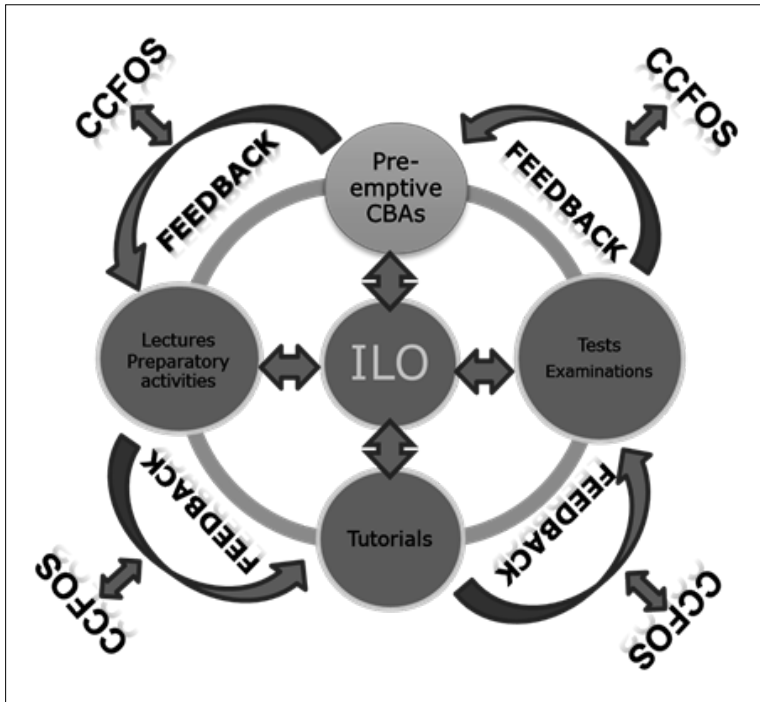


Figure 2: Assessment strategy in a feedback loop

As indicated in Figure 2, the teaching and learning process with its intended learning outcomes (ILOs) which both informed, and was informed by, the assessment strategy, was at the centre of this strategy. Students had to complete weekly tasks on the E-learning system, known as the learner management system (LMS), in preparation for the lectures. The feedbacks from these tasks were intended to inform both lecturers and students about the students' performance, and to help the lecturers decide on appropriate teaching and learning activities (T&LAs). During contact time and beyond, T&LAs would provide an opportunity for students to close the gap between their current performance and the desired performance. Progress during contact time would inform the students and lecturer of the students' readiness to have their learning assessed summatively. Tutorials provided an opportunity for lecturers and students to have that readiness assessed in a more formal setting. Feedback from the tutorials informed lecturers and students about the nature of and the need for further intervention prior to the FAs. Feedback from the final SAs, in turn, would inform the entire teaching and learning process. While the total FA system was comprehensive, the current article focuses on the weekly tasks on the LMS.

Pre-emptive computer-based assessments as a tool for FA

Research has shown that formative computer-based assessments (CBAs) are generally positively accepted by students as a tool to support their learning (Miller

2009, 182) as they allow students to complete assessments at their convenience. Students can 'monitor and adjust their own progress', and actively participate in 'communicating evidence of their own learning to those who need it' (Stiggins 2005, 18). Miller (2009, 182) argues that formative CBA that encourages self-regulated learning provides readily available assessments with immediate feedback that guides students' cognitive development, which in turn allows students to progress at individual rates. Multiple choice questions, in particular, are proposed for their 'usefulness for self-assessment and screening, their high reliability, validity and manageability, as well as their potential to assess a wide range of knowledge quickly' (Brown 2001, 12). The study, therefore, explored the use of CBAs as a pre-emptive FA, intended to enhance students' learning and to inform the teaching.

RESEARCH PROCESS

Ethical considerations

The study was conducted with the consent and under the supervision of the institution's Centre for Higher Education Development. Consent to conduct the study within the programme was obtained from the Head of Department. The informed consent of all the participants in the study was obtained. The FA tasks were made available to the entire student target population, participants and non-participants alike. Participation in the survey was voluntary and confidentiality and anonymity were observed.

Selection of the sample

The student target population of 711 consisted of students who were enrolled for the first year level law course within an accounting programme. This target population embraced two categories, namely: a High Participation Group, consisting of students who had completed more than 50 per cent of the FA tasks; and a Low Participation Group, consisting of students who had completed 50 per cent of the FA tasks or less. The sample of convenience totalling 360 consisted of 328 participants from the High Participation Group and 32 participants from the Low Participation Group. The lecturer target population totalled five, of whom three participated in the study.

Developing a series of FA tasks on the E-learning System

A series of eight weekly FA tasks on the LMS was set at the beginning of eight of the nine study units. These took the form of open book tests, which mainly comprised multiple choice questions. These FA tasks had two main objectives. Firstly, they had to create an opportunity for students to acquire factual knowledge of the subject by encouraging students to read various topics before lectures, and hence prepare for lectures. Secondly, the FA tasks had to assist lecturers to select the most appropriate learning activities for that particular cohort of students. These FA tasks, therefore, assessed whether students could read legal texts with comprehension. Students were further encouraged to do these tasks by the 5 per cent course mark, which was allocated to completion of the FA tasks. Each student was allowed two attempts at

the task so that students who might have found the tasks challenging at first, had an opportunity to engage in further preparation before attempting the FA task again. FA tasks had to be completed before the lecturer dealt with the particular topics in the classroom. The record of student performance in the relevant FA task was drawn on a weekly basis by the subject lecturers when finalising the T&LAs for their lectures. This record was supposed to inform the lecturer as to those T&LAs that would be most suitable for the cohort of students.

Developing a student and lecturer questionnaire

Two sets of questionnaires were designed, namely, one for the students and another for the subject lecturers. The purpose of the questionnaires, on the whole, was to determine whether, in the opinion of the lecturers and students, the FA tasks met the key elements of fairness, validity and reliability, and whether the results informed the teaching and learning strategy in the subject.

The relevant parts of the questionnaires for this discussion contained both structured as well as open-ended items. The purpose of the items was to determine whether the FA tasks were fit for purpose. This meant that the tasks should assist and support the students in preparation for engaging with the lecture content in class, whilst informing the teaching and learning strategy, which was adopted by the lecturer. The closed-ended items in the student questionnaire comprised five quantitative items which required students to indicate the number of FA tasks (maximum 8) that they had completed and to rank the degree of difficulty of the FA tasks on a scale of 1 to 5 (1 being the easiest of all the FA tasks and 5 being the most difficult). The students were also required to indicate whether they had read the relevant content before they attempted the FA tasks, and whether these tasks assisted them in following the lectures better. The last closed-ended item required them to state whether they would recommend the FA tasks to their peers. Two open-ended items were also included, which prompted the students to explain why they chose either to recommend or not recommend the FA tasks, and allowed them to offer any other relevant comment on these tasks.

The relevant closed-ended items in the lecturer questionnaire comprised four quantitative items and three open-ended items. The lecturers had to indicate, on average, the number of FA tasks that a student had completed; rank the degree of difficulty of the tasks on a scale of 1 to 5; and rate the average student performance in the FA tasks. They were further asked whether they thought that the FA tasks were effective; whether they would recommend the tasks as a FA to their peers; while they were also invited to comment on any other aspect of the FA tasks.

Collecting and analysing the data

The questionnaires were self-administered by the participants once they had completed the final SA. The closed-ended items in the questionnaires allowed for the collection of quantitative data, whereas the open-ended items provided qualitative data. Closed-ended items and the complete exported record on the LMS were placed in a matrix and the descriptive analysis simply required the calculation of percentages

and means (averages). Open-ended items from the questionnaires were categorised into common themes and were analysed. Follow-up interviews with participating lecturers were confined to points of clarification.

FINDINGS

The discussion of the findings of the study addresses the results of the student questionnaire, as well as that of the lecturer questionnaire. The results of the two student groups, namely, the High Participation Group (students who had completed more than 50% of the CBAs) and the Low Participation Group (students who had completed 50% of the CBAs or less) are discussed separately. Two broad themes are addressed, namely: pre-emptive formative CBAs enhance learning; and pre-emptive formative CBAs inform teaching. Table 1 contains a summary of the quantitative data collected.

Table 1: Student responses to closed-ended items and record on LMS

Closed-ended Item	High Participation Group	Low Participation Group
	(n = 328)	(n = 32)
	(5–8) CBAs	(0–4) CBAs
	%	%
Number of CBAs completed as per record on LMS (Total = 8)		
7–8	73	
5–6	27	
4		25
3		3
2		3
1		19
0		50
Student recommended CBAs		
Yes	76	59
No	4	3
No response	20	38
Degree of difficulty of CBAs [Scale: 1 (lowest) – 5 (highest)]		
1–3	65	44
4–5	35	12
No response	0	44
Student read text in advance before attempting the CBAs		
Yes	78	31

No	22	3
No response	0	66
CBA's helped to follow lectures better		
Yes	83	25
No	17	9
No response	0	65

Pre-emptive formative CBAs enhance learning

Results from the closed-ended items showed strong support for the weekly FA tasks on the LMS among students as well as subject lecturers. These results were drawn from the record on the LMS as well as the responses to the items that required participants to state the degree of difficulty of the tasks and to indicate whether they would recommend the tasks.

High Participation Group

The record on the LMS showed that 73 per cent of the students in this group completed between seven and eight FA tasks while 27 per cent completed between five and six of the tasks. Furthermore, a total of 76 per cent stated that they would recommend the FA tasks, while 4 per cent stated that they would not, and 20 per cent of this student sample did not respond to the question.

Most students from this group (65%) ranked the degree of difficulty of the tasks at 1 to 3, whereas 35 per cent ranked them at 4 to 5.

The results further showed that 78 per cent claimed to have read the relevant text before attempting the tasks, compared to 22 per cent who claimed that they did not. A total of 83 per cent in this group claimed that the tasks helped them to follow lectures better as opposed to 17 per cent, who disagreed.

Low Participation Group

The record on the LMS further showed sporadic attempts at the FA tasks by this group, with a maximum number of four tasks that were completed. Fifty per cent of the students in this group did not attempt the tasks at all; whereas 19 per cent completed one task; 3 per cent completed two and three tasks, respectively; 25 per cent completed four tasks; and 38 per cent elected not to respond when asked whether they would recommend the tasks to their peers. A total of 59 per cent indicated that they would recommend the FA tasks to their peers, whereas 3 per cent did not recommend the tasks. All the students in this group who completed four FA tasks recommended the tasks.

A total of 44 per cent of participants from this group did not rank the degree of difficulty of the FA tasks. Of the students in this sample who opted to rank the degree of difficulty, 44 per cent ranked them at 1 to 3, and 12 per cent ranked them at 4 to 5.

Students from this group who did not complete any of the tasks were not required to continue with the rest of the questions on this part of the questionnaire. This may account for the ‘no response’ rate among this group. When asked whether they had read the text in advance, 66 per cent showed no response; while 65 per cent did not respond when asked whether the FA tasks helped them to follow the lectures better.

The results further showed that 31 per cent of the students in this sample claimed to have read the text in advance, compared to 3 per cent, who had not. A total of 25 per cent claimed that the FA tasks helped them to follow lectures better, while 9 per cent disagreed.

In addition, strong support for these tasks was found among the students in this group who had completed a maximum of four tasks ($n = 8$). Seven of the eight participants claimed that they had read the text in advance, while they all indicated that it helped them to follow lectures better.

Lecturers

Participating lecturers were unanimous in their support of the FA tasks. They found that the tasks were effective and recommended their use as FAs. All participating lecturers ranked the degree of difficulty of the FA tasks at 3.

The lecturers’ responses to the open-ended items also reflected strong support for the pre-emptive CBAs and suggested that the CBAs enhanced learning. The first of the open-ended items requested students to provide reasons for their choice to either recommend or not recommend the weekly FA tasks. Most students who did not recommend the tasks opted not to provide a reason. Only two responses were recorded. One student claimed that ‘the tasks are not challenging enough’, and another felt that ‘law is not for accounting students’.

High Participation Group

Figure 3 reflects the themes that emerged from the responses of students from the High Participation Group who recommended the tasks. These responses are ranked in order of prevalence.

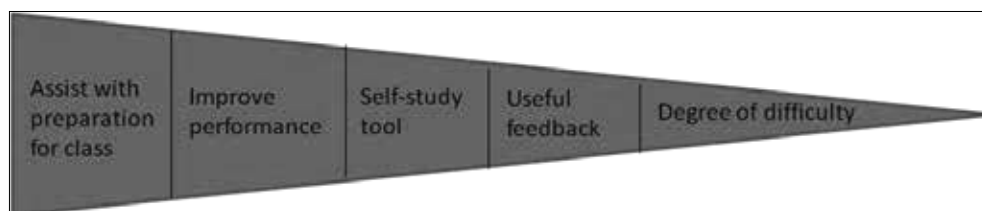


Figure 3: Themes reflecting students’ reasons for recommending the tests

The most prevalent theme that emerged was that the FA tasks appeared to assist with the students’ preparation for class, as students claimed ‘that it helps to prep in advance’. It further allowed them to engage with the content, as students felt that it ‘encouraged/forced (them) to read through the text in advance, helped them through

the text step-by-step', and enabled them to 'overcome the text chapter by chapter'.

The FA tasks seemed to assist with improving students' understanding of the content, and hence improve their performance. Students believed that the tasks 'make work easy to understand before class', as it 'highlights the most important parts'. Others believed that it 'boosted their marks' and 'helped them to pass'.

The FA tasks appeared to be useful tools for self-study, which enhanced independent learning, as students found the tasks to be 'a good self-study method' and that it 'helped (them) to work on (their) own'.

Feedback from the FA tasks seemed to make the tasks useful diagnostic tools as students claimed that they 'showed (them) how much (they) understand'; 'assessed the weakness and strengths in (their) understanding'; 'test(ed) if (they) know (their) work'; and 'tested what (they) learn'.

The degree of difficulty was the least prevalent of all the themes. Some students believed that the degree of difficulty encouraged them to complete the FA tasks, as they found them 'easy'. They claimed that 'once (they've) read through the content, it did not take that long to complete the tasks'.

Students were asked to pass any other relevant comment, and a vast majority opted not to do so. Comments that were made, however, related solely to the themes mentioned above.

Low Participation Group

Students from the Low Participation Group who had recommended the FA tasks passed the following comments, in no particular order of prevalence. They indicated that the tasks 'make clear what to expect', as a result they claimed to have 'learn(ed) more about law', and they seem to 'understand the work better before class'. The FA tasks further helped them to 'prep in advance'; 'encourage(d) (them) to read through the law text'; and 'boosted (their) marks'. Those who did not recommend the FA tasks did not offer reasons and no additional comments were made.

Pre-emptive CBAs inform teaching

It would appear from the responses of the participating lecturers that the pre-emptive CBAs not only enhanced learning but also informed teaching. Lecturers observed that the FA tasks assisted students to prepare for lectures. They found that students 'gained knowledge of the relevant units prior to the formal lecture'; were 'compelled to learn independently'; and could 'pose questions during the ensuing lectures'. These tasks also informed their classroom activities, as they 'enhanced interactive learning', and stimulated critical thinking, as they prepared students for 'Socratic methods of teaching'.

Enquiry into their reasons for recommending the FA tasks elicited the following responses: 'less time is spent on explaining rudimentary concepts'; 'higher levels of Bloom's taxonomy are reached'; 'critical questions become the norm'; 'relevant questions are posed in class'; and FA tasks 'foster class participation'.

DISCUSSION

Upon considering the purpose of FA as a diagnostic and developmental process, which is aimed at enhancing students' learning and informing teaching, the results seem to indicate that the pre-emptive formative CBA serves this purpose.

The strong support for the weekly FA tasks on the LMS confirms the findings of other studies, which found that formative CBAs were positively accepted by students (Miller 2009, 182). A majority of students in the High Participation Group did not seem to find the FA tasks unnecessarily burdensome, as most of them (73%) managed to complete between seven and eight of the tasks. This was further confirmed by a majority of students (65%) in this group who ranked the degree of difficulty of the FA tasks at 3 and below. The degree of difficulty was also the least prevalent of reasons for students who recommended the tasks. This information provides useful feedback to the lecturers concerning the fairness of the FA tasks. Lecturers were now informed that the FA tasks indeed enabled students to engage with the subject content prior to lectures, and were indeed conducive to preparing students for learning.

Moreover, the number of FA tasks that were completed by most participants in this group (7 to 8), combined with a majority of the students (78%) who claimed to have read the relevant content before attempting the tasks, led to the conclusion that the students' behaviour outside of the classroom, had indeed been influenced. Students found that the FA tasks were useful tools for self-study, which means that these enabled them to work independently.

Support for these pre-emptive CBA FA tasks is further reflected in the majority of students in the High Participation Group (76%) who recommended the tasks. Moreover, the emergence of the theme 'preparation for class' as the most prevalent reason for students who recommended these tasks, supports the view that these FA tasks enabled students to become active agents in their own learning. Feedback from the FA tasks seemed to enable them to make judgments about their own performance, and to take corrective steps from an informed position at the earliest possible opportunity, 'before misconceptions result in ineffective learning or performance' (Carless 2007, 171), hence the claim that the tests improved their performance.

The lecturers' unanimous support for the FA tasks on the LMS further emphasises their value as a form of FA. The lecturers believed that their developmental value was reflected in the preparation of students for active participation in an interactive classroom, as well as in the potential of the FA tasks as a means to prepare students for deep learning. This was reflected by the comments that FA tasks 'enhanced interactive learning,' and were 'conducive to Socratic methods of teaching'.

The diagnostic value of FA tasks is confirmed by the fact that they informed the teaching and learning activities. Feedback from the tasks informed the lecturer of the knowledge and capacity of each student before the T&LAs for that unit were implemented. This enabled lecturers to adapt those activities, where necessary. Therefore, lecturers found themselves spending less time on teaching rudimentary concepts, as cognitively demanding tasks were accomplished and critical questions became the norm in class.

The students in the Low Participation Group who did not complete more than four

FA tasks seemed to have insufficient exposure to the tasks to formulate an opinion on most of the items. Support for the pre-emptive formative CBAs was nevertheless found, even among this group, as 59 per cent recommended the tasks. The strong support for the FA tasks, particularly among those who completed four of the eight tasks, seems to confirm their value as an FA.

Therefore, the pre-emptive formative CBAs seemed to have enhanced students' learning and informed the teaching.

CONCLUSION

This investigation has found that pre-emptive FA plays an invaluable role in the constructive alignment of the various activities that comprise the teaching and learning process. Unlike Carless (2007), who proposes that pre-emptive FA takes place during instruction, the current article proposes that it should also take place *prior* to formal instruction. As a consequence, it found the linear approach to constructive alignment inadequate for two reasons. Firstly, it conflates assessment for and of learning, and, secondly, it does not allow for the diagnostic and developmental assessment of the presage factors that influence the constructive alignment of various activities in the teaching and learning process. Hence, the article proposes an adaptation of Biggs' model to allow for pre-emptive FA. Figure 4 is an adaptation of that model, as applied to the assessment strategy in the first-year law course within an accounting programme.

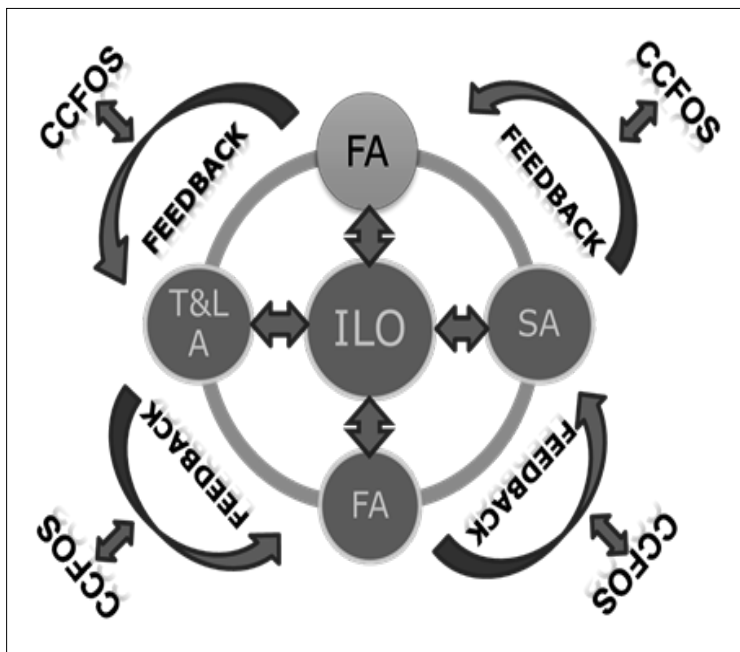


Figure 4: Adaptation of Biggs's model of constructive alignment

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REFERENCES

- Biggs, J. B. 1989. Approaches to the enhancement of tertiary teaching. *Higher Education Research and Development* 8(1): 7–25.
- . 2008. Aligning teaching for constructing learning. *Focus* 16(1): 1–3.
- Black, P. and S. Wiliam. 1998. Assessment and classroom learning. *Assessment in Education: Principles, Policies and Practice* 5(1): 7–74.
- Bloom, B. S., J. T. Hastings and G. F. Madaus. 1971. *Handbook on formative and summative evaluation of student learning*. New York: McGraw-Hill.
- Boud, D. and N. Falchikov. 2005. Redesigning assessment for learning beyond higher education. *Research and Development in Higher Education* 28: 34–41.
- Brown, G. 2001. *Assessment: A guide for lecturers*. Generic Centre Assessment Series No. 3. York: Learning and Teaching Support Network.
- Carless, D. 2007. Conceptualizing pre-emptive formative assessment. *Assessment in Education* 14(2): 171–184.
- Coll, C., M. J. Rochera, R. M. Mayordomo and M. Naranjo. 2007. Continuous assessment and support for learning: An experience in educational innovation with ICY support in higher education. *Electronic Journal of Research in Educational Psychology* 5(3): 783–803.
- Harlen, W. and M. James. 1997. Assessment and learning: Differences and relationships between formative and summative assessment. *Assessment in Education: Principles, Policy and Practice* 4(3): 365–379.
- Joughin, G., ed. 2009. *Assessment, learning and judgment in higher education*. New York: Springer Science and Business Media.
- Mauri, T. and M. J. Rochera. 1997. Learning to regulate one's own learning. *Aula de Innovacion Educativa* 67: 48–52.
- Miller, T. 2009. Formative computer-based assessment in higher education: The effectiveness of feedback in supporting student learning. *Assessment and Evaluation in Higher Education* 34(2): 181–192.
- Nicol, D. J. and D. McFarlane-Dick. 2006. Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education* 31(2): 199–218.
- Sadler, D. R. 1989. Formative assessment and the design of instructional systems. *Instructional Science* 18(2): 119–144.
- . 1998. Formative assessment: Revisiting the territory. *Assessment in Education: Principles, Policy and Practice* 5(1): 77–84.
- Stiggins, R. 2005. From formative assessment to assessment for learning: A path to success in standards-based schools. *Phi Delta Kappan* 87(4): 324–328.
- Wiliam, D. and P. Black. 1996. Meanings and consequences: A basis for distinguishing formative and summative assessment? *British Education Research Journal* 22(5): 537–548.
- Wood, R. 1987. *Measurement and assessment in education and psychology: Collected papers 1967–1989*. London: Falmer Press.
- Yorke, M. 2003. Formative assessment in higher education: Moves towards a theory and the enhancement of pedagogic practice. *Higher Education* 45(4): 477–501.