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Do students benefit from a standardised approach to teaching in post-secondary education?

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This study was to monitor the change in students' approaches to learning over a three-year period and to gain insights into the relationship between students' approaches to learning and students' academic achievements in a standardised PBL environment. Results indicated a significant increase towards 'deep' and 'achieving' with 'deep' having a greater magnitude of change by the end of students' first year of study. This increase in 'deep' and 'achieving' were shown to have a positive effect on students' learning outcomes. As students progressed towards end of second year, the dominant approach to learning for the majority of students has changed from 'achieving' to 'deep'. At the end of third-year study, a significant increase in "Surface" approach to learning was recorded. Although "Deep" approach to learning was still students' dominant learning mode, a significant increase in surface learning motives was detected one year before they completed their final year of study. Further analysis into the strategies and motives elements of SPQ added more insights on the changes in students' approaches to learning. The study concludes that a standardised PBL methodology can have a positive effect students' approach to learning and outcomes. However, the extent of this positive effect depends on various factors such as quality of facilitation and problems, how students perceived the teaching environment and how long a standard methodology is employed.

Keywords: Problem-based learning, approach to learning, study process questionnaire

Introduction

Problem-based learning (PBL) is both a philosophy about learning (Margeston, 2001) and a teaching methodology. The belief is that students when involved in an 'authentic' learning experience assume a more active role in their learning, and become more reflective and self-regulated. Hence, PBL facilitates student learning outcomes through the development of student approaches to learning (Major & Palmer, 2001). Despite the popularity of such beliefs there have been lingering questions about the quality of student learning outcomes (Newman, 2003; Kirschner, Sweller & Clark, 2006). Contributing to this skepticism is the many diver ways in which PBL is understood and practiced (Savin-Baden, 2003). The debate as to whether PBL achieves desired student outcomes is often focused on how well PBL is performed or the environment in which PBL is practiced; i.e. the quality of facilitation, the expertise of the facilitator, the utility of problem triggers and learning scaffolds and the motivation of students. What is often assumed in these studies is that the methodology used in PBL is common across institutions and within academic programmes, however this is not often the case. The methodology used in the practice of PBL can vary dramatically (Barrow

& Tamblyn, 1980; Alavi & Margetson, 1997; Savin-Baden, 2003; Savin-Baden & Wilkie, 2004; Norman & Schmidt, 1993; Schmidt, 2004; Schmidt, Vermeulen, & Van der Molen, 2006) and this may in part attribute to the varying outcomes that are measured in evaluative studies on PBL. This has prompted some institutions to implement a standardised approach to PBL. Prescribing a standardised approach to teaching and learning is uncommon in most tertiary level institutions. Such prescriptions to teaching are seen to be in conflict with notions of academic freedom, or contrary to 'good' principles of teaching and learning wherein the teacher or the disciplinary expert is the best person to decide what instruction is needed for the students. However, there have been persistent calls for some standardisation of teaching (systemic application and measurement) in order to assure a level of quality (Labory & Malgarini, 2000 and Dill, 2001).

The purpose of this paper was to report on a study that looks at the continuing utility of a standardised approach to PBL using empirical evidence from a longitudinal study in an institution. The concepts 'deep' and 'surface' approaches to learning are used to differentiate qualities of learning. The study describes the effect standardised PBL has upon these approaches, and specifically whether a standardised approach to PBL over time cultivates deep learning rather than surface learning.

The second and related objective of the present study was to investigate the general relationship between students' approaches to learning and their academic achievements. In a study done by Gijbels et al. (2005), no relationship was observed between these two components. In this study, the authors examined the relationship between students' approaches to learning and their achievements in a standardised approach to PBL.

The authors adopted a longitudinal investigation in this study that tracked the same batch of students over a three years period from a range of diploma programmes in a learning environment that is totally PBL. The value of this research was that it was sensitive to the incremental changes that happened in learning.

Research context

The institution under study has developed a method for implementing PBL known as the one-day, one-problem approach (O'Grady & Alwis, 2002). This method entails students spending one whole day exclusively working on a single problem. Over the course of one week, students will work on five different problems centering on an idea or a concept. The day is divided into three formal meetings where a class of 25 students meets with a facilitator. There are also two break-out sessions where students work independently in teams of five (Table 1).

Table 1: One-day, one-problem process

Session	Function
First meeting of the day (1 hr)	• Problem presentation by facilitator • Problem analysis by students with guidance from facilitator
1 st breakout (1 hr)	• Self study period
Second meeting of the day (1 hr)	• Students share how they have approached the problem and any learning obstacles with facilitator • Facilitator help students develop learning strategies and formulate/evaluate solution
2 nd breakout (2 hr)	• Self study period • Prepare for presentation
Third meeting of the day (2 hr)	• Each team present their solution • Critiques and evaluation from other teams and facilitator

Methods

A total of 10 classes (250 students) were approached for this study. Students involved were briefed about the research with assurance of anonymity. Of the 250 students surveyed, 66% responded ($N=165$). Subsequently, the SPQ was administered to the same 165 students at the end of their first ($N=125$), second ($N=113$) and third ($N=100$) academic year. Out of 165 students from the initial stage of data collection, 53% responded to all four stages.

The longitudinal study surveyed students in four different stages of their academic life in an institution that employs PBL as the main teaching methodology throughout their diploma education: on the first week of their first year (Stage 0), at the end of their first year (Stage 1) and at the end of their second year (Stage 2) of study; data has been collected at the end of their third year and will be referred as Stage 3 in this study.

Data was obtained from two sources, namely Biggs' (1987) Study Process Questionnaire (SPQ) and academic achievement obtained from daily grades assigned to students based on their classroom performances as well as periodic half hour invigilated written tests

Study Process Questionnaire (SPQ) was developed by Biggs (1987b) to measure students' learning approach in tertiary institutions. Biggs identified three main types of learning approaches, namely surface, deep and achieving, and the two underlying factors that determine students' level of tendency towards each approach are determined by examining their attitudes towards studies (motives) and their usual ways of studying (strategy).

Academic achievement was obtained using two elements: (1) students' classroom performance obtained on a daily basis and (2) several written test administered intermittently during the semester. For students' classroom performance, facilitators assign a daily grade to students based on how well students have engaged in the learning processes (O'Grady, 2004). Written tests are administered to measure students' understanding and reasoning ability on the subject matter. These open book tests apply to all modules and four written tests are conducted for each module. A mean score for classroom performance is determined by taking

the average of the sixteen daily grades for all modules and a mean score for written test is determined by taking the average of four written tests grades for all modules.

Confirmatory factor analysis

To ensure the construct validity of the questionnaire to the sample collected, confirmatory factor analysis (CFA) was carried out using Analysis of Moments Structure (AMOS 7.0) (Arbuckle, 2006). The model construct for each learning approach as proposed by Biggs yielded a reasonably good-fitting model with the observed data shown in Table 3. Reliability analysis was also conducted using Cronbach alpha for each of the approach for all four stages with values exceeding the minimum recommended value of 0.7, indicating adequate internal consistency.

Table 3. Goodness-of-fit and reliability check for the six subscales

Scale	CFI	χ^2/DF	RMSEA	Alpha
Surface	0.92	1.25	0.04	0.73
Deep	0.92	1.47	0.06	0.86
Achieving	0.95	1.26	0.05	0.79

Statistical analysis

Pair-sampled t-test is used to examine any significant changes between each of the approach to learning at different stages.

Pearson Correlation was used to examine the relationship between (1) learning approaches and class performance; and (2) learning approaches and written test. A more in-depth investigation was done using structural equation modeling (SEM) techniques to test the structural relationship between learning approaches with classroom performance and written test.

Results and discussion

In short, the results revealed an increase by 12.5% in number of students adopting 'deep' as their preferred mode of learning as compared to when they first entered the institution. Analysis of the data indicates that there is a significant change towards deep learning over the course of study suggesting that PBL, in the form of a standardised methodology (one day one problem), does have a positive effect on students' learning. Taking into account the effect size of the overall changes, it was found that the magnitude of change towards 'deep' learning (*Cohen's d* = .45) was greater than the change in 'achieving' and 'surface' by the end of students' first year of study. This suggests that a standardised PBL methodology has had a dramatic effect in changing students' approach to learning in their first year of study. One of reasons could be that the learning approach in PBL is very different from their previous education where they are 'mainly engaged in activities focusing on factual or rote learning' (O'Grady & Choy, 2006). Another contributing factor could be the academic structure of a common first year which sees all students taking general modules as opposed to specific disciplinary related modules. The general modules for first year are tightly integrated whereby 'the curriculum is designed top down with institutional objectives informing course objectives, which informs subject objectives which in turn shapes the daily learning

activities' (O'Grady & Alwis, 2002). This builds upon and forms some core capabilities that are transferable.

At the end of third year of study, there was an increase by 2.3% in the number of students having "Surface" as their dominant approach to learning as compared to when they first entered the institution. The significant shift towards surface approach was recorded starting from second year of study in RP ($t = 2.23, p = .028$). Analysis of the subscales revealed that the shift to surface learning from first year to second year can be explained by an increase in adoption of surface strategies ($t = 2.80, p < 0.01$). This could be due to students reasonably responding to the time demands of PBL, in the form of One-Day One-Problem, where they have to produce a solution to the problem within a day. What makes the second year different from the first year of study was that students had to face more disciplinary specific problems. Despite this shift towards surface learning, the dominant approach to learning that most students adopted was still 'deep'. This supports Kember and Gow (1990) who argued students can use surface strategies but with an intention towards deep learning.

Further examination of students' third year of study revealed an increase in the adoption of surface motives ($t = 2.06, p = .04$). It seems unlikely that this unfortunate shift (given the aim of PBL is to foster deep learning) was due to the exposure to disciplinary specific problems, otherwise the shift in surface motives would have appeared in the second year. One explanation could be how long the standardised methodology was employed. The subsequent shift towards a surface approach to learning in their second and more specifically third year suggests that the effect of a standardised approach over an extended period of time may have a negative effect on the quality of learning. This despite the fact that the standardised system, with its inherent assessment scheme, rewards students for taking a deep approach to learning. One of the possible effects of a standardised approach to learning is that what is meaningful to the students initially, can become rote and predictable over time.

However, the authors of this study recognised that the explanations given above were limited since the questionnaire that has been adopted for this study, Study Process Questionnaire (SPQ) developed by Biggs (1987b), does not provide insights on the reasons for students having stronger tendency towards a particular approach to learning. Research by O'Grady, Choy & Lim (2009) lends some light towards what might have influenced students to adopt a surface approach to learning. The paper argued that presage factors (student-based factors and the learning environment), as defined by Biggs (1999), plays an important role in gaining a holistic perspective on how students learns. It was suggested that if the students were unable to understand the PBL process within the first year experience, it was likely for them to have a stronger orientation towards 'surface'. Not understanding the PBL process means students who did not or were unwilling to develop self-directedness in managing learning issues. These students would likely adopt surface approach to learning such as "merely going through the motions of reading the given resources without understanding", "plagiarism—cutting and pasting his answers to knowledge tests" and "consulting with friends who had already gone through the problem recently" (O'Grady et. al., 2009).

Surface approach to learning has a weak inverse correlation with the written test. Positive correlation was found between deep approach to learning and classroom performance at the end of second year ($r = .27, p < .05$) and third year ($r = .24, p < .05$) of study. Achieving approach to learning has a stronger correlation with classroom performance at end of second year ($r = .31, p < .01$) and at end of third year ($r = .29, p < .01$) of study. The SEM analysis also showed that surface learning has a negative effect not only on written tests (end of first

year: B coefficient = -0.32, $p < .001$; end of second year: B coefficient = -0.24, $p = <.001$), but also classroom performance (end of first year: B coefficient = -0.27, $p = .25$; end of third year: B coefficient = -0.34, $p = <.001$). This means the greater a student's tendency towards a surface approach the lower their academic achievement in PBL. In this respect deep learners perform better than surface learners. In examining the relationship between approaches to learning with academic performance, revealed that a 'deep' approach did have a positive effect on classroom performance. At the end of second year, 'achieving' also had a positive effect on classroom. This was highly correlated with a 'deep' approach which suggests that students with an 'achieving' approach also had an orientation towards 'deep' approach. This finding coincides with Biggs' (1987: 16) conclusion that a mixed approach called 'deep-achieving' relates positively with academic performance.

Overall, this study confirmed that a standardised PBL methodology provides a teaching context that will foster a deep approach to learning particularly during the first year of study. Even after the first year there is a continued move towards a deep approach. However, there was a shift in the later years of study towards surface approach to learning. As for what factors might have caused students to lean towards surface approach to learning, the authors do not think that the learning environment is the sole contributing factor. Even Biggs & Tang (2007) indicated that there will be learners who do not adopt deep approaches to learning in an environment that arguably fosters such an approach. Student-based factors need to be examined and addressed to gain a holistic understanding on factors affecting students' quality of learning as well. As in the study done by O'Grady et. al. (2009), students who did not fully grasp the PBL process would tend to resort to surface strategies to overcome the problems in their learning.

In examining the relationship between approaches to learning and academic performance, the conclusion can reasonably be drawn that continuing to foster deep learning in conjunction with achieving will likely lead to further increases in students' academic achievement. It also serves to validate assessment measures that are based on how well students have engaged in the learning processes, collected on a daily basis discourages surface learning, though it is still inconclusive that it is a strong measure of deep learning.

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