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Enhancing the learning performance of passive learners in a Financial Management class using Problem-Based Learning

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Abstract

This study aims to implement a problem-based learning method and investigate how this method enhances students' learning performance, specifically in self-regulated learning and higher-order thinking skills for a Financial Management class, involving highly passive learners. The study adopted mixed methods, quasi-experimentally, by comparing a problem-based learning method with a conventional method, i.e. lecture-based learning. The results indicate that, alongside obtaining positive acceptance from the class, problem-based learning outperforms the conventional method by enhancing both students' self-regulated learning and their higher-order thinking skills, although it lagged behind in maintaining students' lower-order thinking skills. Future research into problem-based learning implementation in a similar learning context to this study should incorporate some adjustments, such as a more efficient curriculum design and a lower level of problem-based learning to ensure as many participants as possible, including slow learners, benefit optimally from learning through problem-based learning methods.

Keywords

problem-based learning, self-regulated learning, higher-order thinking skills, lower-order thinking skills, passive learner

Cover Page Footnote

We would like to show our gratitude to the Dean of Faculty of Economics, Universitas Negeri Malang on his permission to conduct this research completely in Financial management classes.

Introduction

Accounting graduates have been widely scrutinised and shown to be technically capable, but without sufficiently broad skills in areas such as problem-solving and lifelong-learning skills (Hoffelder 2018; Hakim 2016). These skills are necessary for students, as they are part of the professional standards needed to build their ability to adapt critically to the escalating changes in contemporary accounting (Ameen, Bruns & Jackson 2010; Bui & Brenda 2010; Cernusca & Balaciu 2015). However, traditional accounting education has failed to incorporate such skills into both curricula and teaching practice (Oliver, Whelan, Hunt, & Hammer 2011; Van Romburgh & Van der Merwe 2015).

In this study, we apply a problem-based learning (PBL) method to fulfill that purpose for two main reasons: first, through PBL, students are given considerable space to manage their own learning strategies, and thus, this method incorporates self-regulated learning for students to build lifelong learning skills (Herin 2007; Tas & Sungur 2012; Temel 2013); second, the learning activities are centred around an authentic problem-solving process, which demands analytical and critical-thinking skills. Hence, this learning method undoubtedly incorporates the higher-order thinking skills necessary for building students' problem-solving skills (Masek & Yamin 2011; Sendaq & Odabasi 2009; Iwaoka et al. 2010).

Our university, Universitas Negeri Malang, Indonesia, is an example of an institution where accounting is taught to students using traditional teaching and learning approaches. Students' learning in this university is culturally and traditionally characterised by lecturer-dependent learning practices, which are highly textbook-oriented. We use the terms "culturally" and "traditionally" to align with the existing teaching practices in most educational institutions in Indonesia, from primary schooling until higher education, which tend to systematically adopt such formal, conventional teaching approaches, and hence teach the students to become lecturer-dependent, passive learners. Since PBL is an extremely student-centred method and considered a drastic change in our learning environment, we were concerned about the potential for the new method to generate strong resistance from our students, rending this method ineffective.

The effectiveness of PBL as an approach at the foundational level has been well documented, but its technical and practical outcomes remain in dispute (Yew & Goh 2016; Masek & Yamin 2011; Manaf, Ishak & Hussin 2011); this might be a function of the learning contexts into which PBL has been introduced. While many of the previous studies into PBL were conducted in various disciplines (Anderson 2007; Bidokht & Assareh 2011; Catanach, Croll & Grinaker 2000; Chakrabarty & Mohamed 2013; Horton 2014; Temel 2013; Williamson & Gregory 2010), the research was rarely focused on the different learning contexts, in terms of the diversity of the students' prior learning behaviour. In our view, it is not sufficient for empirical examinations of PBL to be conducted within limited contexts across disciplines. Ignorance of broader perspectives, including students' prior learning behaviour, when examining PBL could raise unclear, conflicting results.

Considering our belief that in teaching "*no one size fits all"* (Brennan 2003; Mutumbuka 2014), it is worthwhile revisiting PBL to seek better results under various unique learning contexts, such as that in our university. Therefore, this study will contribute to confirming PBL as a positive teaching method, particularly by highlighting the aspect of prior student learning behaviour. This should help to clarify prior conflicting findings about the practical efficacy of the method. This

study, therefore, aims to explore the extent to which the PBL method enhances students' learning performance in financial-management classes, as part of the accounting-education curriculum. This study focuses on how the method could improve students' learning performance, specifically in terms of students' self-regulated learning and higher-order thinking skills as the ultimate goals of the method.

Literature review

Problem-based learning, self-regulated learning and lifelong learning

Conceptually, PBL is based on the constructivist pedagogy paradigm, which was initially derived from the work of, among others, Bruner (1961), Vygotsky (1962) and Piaget (1980). Constructivism suggests that learning is an active and constructive process within a social context: the learner is a knowledge constructor instead of a passive information receiver. This learning theory implies some key learning practices for PBL. For example, PBL requires learners to engage actively in the process of exploring, retrieving and using new information, either to relate it to prior knowledge, or to construct new knowledge (Schmidt 1993). Furthermore, constructivist principles require learners in PBL contexts to function as self-motivated, self-directed and collaborative participants in their learning experiences (Tam 2000; Von Glasersfeld 1995). With this method, students are given much freedom to manage their own learning strategies (Tas & Sungur 2012; Temel 2013).

As a student-driven learning method (Bell 2010), PBL has also been reported to be powerful in enhancing students' self-regulatory learning skills and, at the same time, increasing students' awareness of their own learning responsibilities (Laal & Laal 2012; Tas & Sungur 2012; Temel 2013). PBL, accordingly, is well-known as a prominent self-regulated learning strategy that turns students from *passive* information recipients to active acquirers and developers of knowledge through their own learning experiences, derived from authentic problem-solving processes (Coombs & Elden 2004; Hendry, Frommer & Walker 2006; Loyens, Rikers & Schmid 2006). Self-regulated learning is represented throughout the problem-solving stages that follow a scientific procedure: identifying a problem to solve; selecting, exploring, analysing, and critically evaluating data and information, or learning content, relevant to the problem solution; formulating a solution; concluding the overall solution; and presenting the result to others. As a student-driven learning system, PBL offers teachers a central role as facilitators, instead of simply transferring information or knowledge to students, as in conventional lecture-based teaching approaches. This central role is to ensure that both the intended learning process and the students' motivation are maintained throughout the learning process (Bell 2010; Tas & Sungur 2012; Temel 2013).

Characterised by self-regulated learning, the PBL method has been widely accepted as enhancing students' lifelong-learning skills (Perry, Phillips and Dowler 2004). Some previous studies have reported that students who have successfully engaged in a reasonably self-regulated learning process also demonstrate positive characteristics such as being autonomous learners and having the high metacognitive and motivational skills necessary for lifelong learning (Wolters 2003; Bidokht & Assareh 2011; Laal & Laal 2012). Lifelong learning is defined as a continuous effort to explore and independently apply knowledge and skills throughout a learner's lifetime. The basic idea of lifelong learning is that the knowledge and skills obtained from formal education are not sufficient to equip people to deal with the changes and continuous developments in their careers during their lifetime (Sharples 2000). Since lifelong-learning skills are in high demand for dealing with escalating rates of change, education should change its focus from knowledge acquisition to

empowering people to manage their own learning in a variety of contexts, throughout their lifetime (Bentley 1998). PBL facilitates this process (Hung, Jonassen & Liu 2008).

As an active-learning method, PBL shares general characteristics with other active-learning methods. These characteristics include a number of learning principles: learning is aligned with constructivist strategies through the integration of students' prior and new knowledge; the learning approach promotes students' leadership skills through self-regulated learning activities; the learning atmosphere supports students' collaborative learning through learning communities; and the learning process cultivates a dynamic environment through interdisciplinary learning and promotes research-based learning through investigation by giving students a realistic, practical sense of the subject matter (Grabinger & Dunlap 1995).

Problem-based learning and higher-order thinking skills

Besides being a method that provides considerable space for self-regulated learning, PBL is also argued to be a powerful learning method to enhance students' higher-order thinking skills. In PBL, problem-solving becomes the centre of the students' learning activities, as it demands the use of analytical, creative and critical thinking processes. Furthermore, the problems best suited to this learning method are those that are complicated, ill-structured, open-ended and authentic (Butler 1998; Gallagher, Stepien, Sher & Workman 1995; Hmelo-Silver & Eberbach 2012).

Barrows (1985) describes some features of a problem that satisfies these criteria. First, sufficient information is needed to understand the problem, and this should go beyond the information provided in the problem description. However, some features of the problem are not provided so that the problem definition is not clear (ill-structured). Second, there is no definitive, single solution for the problem: different perspectives and strategies are necessary to solve the problem (open-ended). Third, the problem reflects the complexity of the real-life environment the students will later encounter (authentic and complicated). Therefore, students working with PBL seem to adopt the higher-order thinking skills needed to scientifically solve the complex problem; this will, in turn, lead them to engage in an in-depth learning process. In-depth learning occurs when students engage in a learning process that requires them to explore and investigate a great depth of knowledge, or a topic that enables them to apply the skills and knowledge obtained to solving unknown or unseen problems in a wider context (Lowndes & Berry 2003).

In the light of these conceptual features, much empirical evidence has been generated (Orozco & Yangco 2016; Tilchin & Raiyn 2015; Vidergor & Gottlieb 2015), suggesting that PBL is a powerful method for strengthening students' problem-solving skills, including higher-order thinking skills. Bloom's cognitive taxonomy suggests that higher-order thinking skills mainly consist of the last three levels of the taxonomy: analyse, evaluate and create new knowledge or synthesise; the first three levels – remember, understand and apply – are characterised as lower-order thinking skills. Other authors suggest that analytical, critical and creative thinking skills are the main components of higher-order thinking skills (Jianzeng, Yanbao & Wenxian 1997; Hmelo-Silver 2004; Ennis, Millman & Tomko 2005).

Since PBL incorporates significant higher-order thinking skills into students' learning processes – in contrast to conventional lecture-based teaching, which is built heavily on lower-order thinking skills – it is hypothesised that students learning through a BPL method will demonstrate greater higher-order thinking skills than those learning through a conventional lecture-based teaching method.

Method

To achieve the aims of this study, we used a mixed-methods approach with convergent parallel design, as suggested by Creswell and Plano Clark (2011). This method was used to develop the best and deepest understanding of the research problem by collecting and analysing two strands of quantitative and qualitative data in a single phase, then combining the results to achieve an overall interpretation. We used a quasi-experimental design, which involved an experimental class being taught through PBL and a control class being taught using routine, conventional, lecture-based learning. The involvement of experimental and control classes was intended to examine both higher- and lower-order thinking skills by comparing the two groups' achievement of such skills. The impact of PBL on students' self-regulated learning was also assessed based on feedback (perceptions) from those students involved in PBL (the experimental group). Both groups were taught in parallel by the same lecturer to minimise instructor bias.

Participants

The study was conducted with two parallel classes in financial management: one class was treated as the experimental class and the another as the control class. The students involved in this study were in their fourth semester (in their second year) of their study program. We selected these two classes because the average cumulative grades achieved by students in both classes before the experiment were statistically alike. Also, there was no participant in either class who had already participated in other financial-management classes prior to this experiment. Thus, the sample participants for this study were chosen from classes that seemed to follow a convenient sampling technique. Financial-management courses mainly address issues surrounding the creation of sound managerial decision-making processes in corporate finance that, ideally, should be based on analytical and critical evaluation of any decision-relevant information. Accordingly, the PBL method seemed to be an ideal teaching and learning method for this subject matter.

Procedures

Experimental class

We taught the experimental class using the PBL method for four course topics, constituting approximately 70% of the course. In general, PBL procedures followed the normal procedures conducted in previous studies. Following the integrated teaching principles in PBL, as suggested in Dunnill and Davies (2006), these topics were integrated into a thematic problem that the students were asked to solve: investment decision-making. Therefore, these course topics were taught holistically by means of complex problem-solving learning mechanisms, so that there were no longer clear boundaries between the individual topics. Overall, the PBL unit took 12 out of the 16 classroom meetings available across the semester.

The problem was constructed based on the criteria suggested by Butler (1998), Gallagher et al. (1995), Hmelo-Silver and Eberbach (2012) and Savery and Duffy (1995): it should be complex, authentic, contextual, ill-structured and open-ended. To create an authentic atmosphere for the problem-solving process, the PBL content was designed using a role-play (Catanach, Croll & Grinaker 2000; Kiger & Kirch 2003; Tick 2007). In this scenario, students served as consultants who were expected to provide investment-consultancy services for clients, while the lecturer, besides serving as coach/model-facilitator as suggested by Hmelo-Silver and Barrows (2003), also acted in the role-play as a client. The client planned to invest his available funds into several types of small and medium-sized businesses. As consultants, the students were required to provide sound investment analysis and suggestions as to whether the investments in the businesses that

the client proposed were likely to be economically profitable. Thus, the lecturer and student communication resembled a client-consultant relationship.

The PBL process was designed using a closed-loop problem-based system, one of the approaches in the PBL taxonomy, according to Barrows (1986). This approach suggests that PBL is a sequential process. Conceptually, it starts with students scrutinising the authentic problem presented by the lecturer; then the students identify and explore the concepts, principles, procedures and any other relevant information from various learning sources needed to address and solve the problem. The students perform an evaluation of what knowledge has been obtained. Next, they return to the problem and reflect on the process as a whole. The process culminates in the presentation of the results. All of these learning measures were conducted under students' self-regulated learning.

In addition to the scenario, before entering the PBL stages, we provided an orientation to the students to introduce this method, so that the students had a reasonable understanding about the learning objectives and requirements, and the PBL learning process (Catanach et al. 2000; Kiger & Kirch 2003). The students were also provided with a supporting assignment, also under a self-regulated learning framework, to write a short essay on issues related to the underlying subject content needed to solve the problem (Catanach et al. 2000). The lecturer did not inform the students that the essay assigned to them was part of the learning content or knowledge needed to solve the problem. This measure was intended to minimise lecturer intervention into their learning, and thus to optimise the students' independent thinking processes. At the end of the self-regulated learning phase, we held a debriefing session with the students, which was intended to correct any misconceptions found during the process and to evaluate the entire PBL program.

The PBL class was divided into 12 groups of four students each, as recommended by Johnson et al. (2006) and Heller and Hollabaugh (1992), as related in Brame and Biel (2015). This small group size was designed to avoid free-riding behaviour in group learning (Brooks & Ammons 2003). To minimise mimicking behaviour amongst the groups, the problem to be solved was not a single issue, but consisted of six different types of investment targets. These schemes proposed six investment alternatives in small and medium-sized businesses covering, for example, three types of franchises in retail and culinary businesses, a travel-service business, a laundry-service business and a photocopying-service business. As consultants, the students' task was to provide sound investment analysis and consideration to assist the client in making rational investment decisions for each type of business proposed.

Since the PBL method involves a large portion of the student learning activities being outside the classroom, to monitor these activities, we asked each group to organise a diary to record what the group did outside the classroom. We also applied an online application, "Edmodo", as a support system to facilitate interaction between the students and lecturers outside the classroom, including the administration of supporting assignments (Tick 2007). The students presented their work on investment analysis and suggestions for their client and wrote it up in a final report to be submitted to the lecturer. This final report also served as valuable supporting evidence to gauge the students' learning performance in PBL. We assessed the students' reports using a rubric that examined the impact of the students' higher-order thinking and self-regulated learning skills as shown in their reports. The rubric embraced aspects such as the work's originality, criticality and creativity in addressing the problem.

Control class

We taught a control class using conventional lecture-based learning methods, as per the routine teaching practice in our university, especially in the Accounting Department. While the course topics in the PBL (experimental) class were integrated into an holistic and complex problem for students to solve, in the control class, under conventional lecture-based methods, each topic was taught separately. Learning stages in the control class were predominantly determined by the lecturer and were mechanistic in nature. With the lecture-based method, initially the lecturer explained the conceptual content of the topic, followed by giving examples to the students to show how the concept actually works. Next, the lecturer gave the students a textbook-based exercise to enable them to apply the concept to a case problem that was used for every topic. At this step, several students were asked to present their work to the class, followed by all students submitting their work to the lecturer as a report. Following the completion of certain topics, this teaching cycle was then repeated.

Data collection and analysis

The data needed in this study was the students' learning-performance evidence, which showed the impact of the new pedagogy. The data was collected using questionnaires, tests and semi-systematic observation. The questionnaire, consisting of both closed and open-ended questions, was distributed to the PBL participants to capture their feedback and perceptions as to how PBL affected their self-regulated learning and thinking skills. To generate the students' feedback on these two dimensions of PBL, the closed question items were constructed using a Likert scale. The open-ended items were used to ask the students to describe the reasons for their responses about whether PBL was *enjoyable* as well as *challenging*.

The test instrument was used to measure the students' cognitive (thinking) skills, which were arranged according to Bloom's cognitive taxonomy. Although this study was only intended to test the higher-order thinking skills, as proposed in the literature review, we also collected and analysed data about the students' lower-order thinking skills, to address the previous conflicting findings on these skills. Accordingly, the test instrument was composed of two parts. The first consisted of several test items used to measure the students' achievements in lower-order thinking skills, covering Bloom's cognitive levels of *remembering* and *understanding*. The question items in this part focused on students' understanding of the concepts. The second part measured learning achievement in higher-order thinking skills, covering Bloom's cognitive levels of *application*, *analysis, evaluation* and *creation* (or *synthesis*) (Ennis 1985; Miller 1990). The questions in this part focused on how students selected the relevant concepts and information critically, then analysed and synthesised them to solve open-ended problems.

The result of the statistical analysis of the internal consistency (reliability) of the questionnaire and test items showed acceptable Cronbach alpha indices of 0.851 and 0.732, respectively. We also invited two senior colleagues to judge the construction validity of these two instruments, and neither had any objection on this matter. We also conducted an anecdotal record based on unsystematic observation of the students' PBL performance (McFarland 2008). This instrument was used to record some important events found in the students' learning processes that were also considered as part of the impact of the learning method, but were not captured in the questionnaire and test.

Statistical analysis was applied to the quantitative data. First, an independent-sample t-test was applied to examine the hypothesis about the students' thinking skills, based on test scores elicited from the test instruments. Second, simple descriptive analysis with percentages was used to

examine the students' responses to the closed-ended questionnaire. Meanwhile, the qualitative data derived from the open-ended questionnaire was analysed using *conventional content analysis*. Following Kondracki and Wellman (2002), we used open coding to elicit meaning from the raw qualitative data. Using this methodology, we enabled the themes (codes) to flow from the data, instead of working with predetermined codes.

Results

Students' perceptions of problem-based learning

For nearly three months in the PBL class, students were involved in the problem-solving process both inside and outside of the classroom. Students' perceptions of how PBL processes influenced their learning were reflected in their responses to some of the closed questions (Table 1).

Table 1. Quantitative data: student responses about their experiences with PBL

No	Questionnaire statement	Student response (%)	
		Agree / Strongly agree	Disagree/ Strongly disagree
1	PBL enhances self-regulatory (independent) learning	95	5
2	PBL drives the student to be active in the learning process	92.5	7.5
3	PBL strengthens problem-solving and critical-thinking skills	90	10
4	PBL leads students to be creative and innovative in their learning		
5	PBL improves student cooperation and communication skills	95	5
6	PBL strengthens student self-confidence in learning		
7	PBL is an enjoyable learning process	97.5	2.5
8	PBL is a challenging learning process	75	25
		72.5	27.5
		95	5

As generally predicted in the PBL conceptual literature, almost all the PBL participants in this study felt that working with this method enhanced their ability to learn independently; to solve problems; to think analytically and critically; and to be creative and innovative in the learning process. In addition, they felt that through PBL they had had meaningful experiences, which would help them to improve their cooperation and communication skills and, at the same time, strengthen their confidence in learning. Alongside these results, we intentionally added the last two statements (statements 7 and 8) in the questionnaire, which were intended to examine the students' acceptance of this method. The responses of students to these statements were quite surprising to us, as most students perceived PBL as an enjoyable (72.5%) and simultaneously challenging (95%) learning process. Qualitative data showing the reasons why this method was perceived as enjoyable and challenging were indicated in their responses to the respective open-ended questions (Table 2).

Table 2. Qualitative data: the reason themes why the PBL process was perceived as enjoyable and challenging

Themes	Reasons indicated in the students' response
PBL is enjoyable	Learning is not only in the classroom but also directly in a real-life context; learning is not only from textbooks but mostly directly from everyday life; students could develop their own ideas as they think; intensively learning to communicate and work together; playing the role of consultant; theories and concepts being studied are directly applied; students become more intimately engaged in their learning; students become more aware of the problems that exist in real life.
PBL is challenging	Students must explore the learning content by themselves; learning is determined by our own motivation and willingness to learn; PBL requires students to find active learning initiatives, think critically and creatively, be innovative in order to solve complex problems; learning time must be managed carefully; students must be smart in their communication with others in a real workplace to obtain data.

Learning outcomes in terms of thinking skills

Students' positive feedback and their perceptions of some the features of PBL (Table 1) seem to parallel their learning outcomes in terms of thinking (cognitive) skills. As measured using the test items, Table 3 summarises the students' learning achievements in terms of their thinking skills in both the experimental and the control classes.

Table 3. Statistical test of students' learning outcomes in terms of thinking skills

No.	Level of cognitive thinking skills	Mean score		Mean difference	Sig.
		Experiment	Control		
1	Lower-order thinking (cognitive) skills (LOTS)	54.39	64.31	9.92	.029 (significant)
2	Higher-order thinking (cognitive) skills (HOTS)	72.17	43.33	28.84	.000 (significant)

The results in Table 3 show significant differences in the learning outcomes between the two classes. The PBL class obtained significantly higher mean test scores for higher-order thinking skills (72.17) than the control class (43.33), based on a 0-100 scale. This result confirms the hypothesis we proposed that students learning through PBL will demonstrate considerably greater higher-order thinking skills than those learning through the conventional, lecture-based method.

However, the class taught using the conventional method (the control class) had significantly better results in lower-order thinking skills than those in the PBL class. Since we did not propose any hypothesis on the performance of the PBL method on students' lower-order thinking skills; this result was used to confirm previous conflicting findings on such matters.

Observations on student learning performance

The anecdotal records obtained from unsystematic observation of students' learning performance through PBL are also worth noting, particularly as they provided a surprising result. For example, some groups, when presenting their results in front of the class, behaved as if they were real consultants providing investment advice to the client. It was quite convincing to us that they had incorporated a significant amount of their own creative and original ideas into their work.

As indicated in the students' learning diaries, their work on problem-solving was in general supported by real data obtained from field observations, including interviews with relevant business agents in the workplace. Students' critical thinking was noticeable during the PBL process. We also observed that students worked with data and information obtained from multiple learning sources, involving more internet browsing, and they were seen to engage in in-depth analysis. This was intended to produce reasonable suggestions for the client, based on which the client would make a sound investment decision. When involved in an in-depth analysis process, for example, the students appeared to be engaged in group discussion to confirm and calibrate the knowledge they explored. The knowledge was then analysed and synthesised to solve the problem, rather than the students just memorising the related concepts and terms or the knowledge they had obtained.

The work produced by the groups to find a solution to the problem went considerably further than the same work generated by students in the control class, which was based on fictitious and structured cases available in the textbook. Hence, in the conventional class, students' written reports, derived from long-term investment analysis (capital budgeting) exercises, resembled textbook-based formats much more and, on average, covered only about two to four pages. The content structure of their work and the way they presented it to the class were also characterised as highly textbook-based. They seemed to just copy the structure of the content of the book or other assigned sources in their PowerPoints and written reports. There is insufficient evidence that they explored reasonable critical- and creative-thinking skills to manipulate and organise the work content for presentation. This evidence indicated that the learning process in the control class occurs more at the surface rather than being an in-depth and creative learning process, such as that found in the experimental class.

By contrast, in the PBL class, the same report, resulting from an authentic problem-solving process, could cover 15 to 26 pages, with content that was structured in a far richer and more creative format. This report reflected a relatively comprehensive analysis of long-term investment plans and decision-making that principally conformed to the conceptual principles of capital budgeting (long-term investment analysis) suggested in the literature. The report also provided authentic evidence representing the results of the students' learning process in collecting, analysing, synthesising and interpreting relevant data and information to construct a comprehensive conclusion to the problem solution. Students in this process were critically and creatively challenged, as they were responsible for creating a written report with their own creative formats so that it could communicate their investment analysis and evaluation soundly and accessibly to the client.

Some constraints

Besides having significant pedagogical advantages, PBL may incorporate some other common constraints and limitations that educators need to manage to improve its effectiveness. In our study context, these constraints were mainly indicated in the students' responses to open-ended questions, which included negative themes such as learning overload, learning irregularity and

learning time management. For example, we identified that about 46% of the PBL participants perceived that this method resulted in learning overload and learning irregularity. They also criticised the fact that working with PBL took a lot of learning time, causing them to perform less well in other courses they were taking in the same semester. Students at our university commonly have quite a high study load, mainly in the first through sixth semesters. During this time, students have an average of eight courses each semester. The following are examples of the responses from two PBL participants:

> *...with a semester load of 24 credits, I feel the PBL method is burdening me. I find it hard to manage my available learning time to accomplish assignments for other classes I take in this semester because the PBL problem-solving task requires me to learn complex course content and to think critically.*

> *...because students are required to be active both inside and outside the classroom or during the group discussions. Although the PBL method is quite good, the students seem to focus only on one course with PBL. This is because the problem-solving process takes a lot of learning time, causing other courses to become neglected.*

About 30% of the students responded that the class size – 46, according to the regular class capacity at our university – was too large in the PBL class became an obstacle to the effectiveness of the method. They recommended that the class size should be reduced to improve the lecturer's ability to pay attention to monitoring each student's performance and to give more time to each group for the class presentations. Indeed, to manage such a large number of PBL class participants and to maintain the small number of group members to avoid free-riding learning behaviour (Johnson et al. 2006 and Heller & Hollabaugh 1992 as cited in Brame & Biel 2015; Brooks & Ammons 2003), it was necessary to create a large number of groups within the class. The following are examples of responses from participants on this matter:

> *Since the number of students in the class is too large, the presentation of group work becomes less effective due to the limitations on presentation time available for each group.*

> *In this PBL, according to my observation, because of a large number of participants, it becomes unclear for the lecturer, which students work effectively in a group and which ones are only behaving as a free rider.*

On the other hand, as reported by Chakrabarty and Mohamed (2013), Horton (2014) and Sindelar (2002), some students in this study perceived that PBL resulted in learning irregularity, which was also problematic. This matter was reflected in the following student response:

> *In my opinion, the process of problem-based learning can actually improve students' ability in learning but it requires students to study independently, which in turn results in learning confusion for me.*

> *Some students in the PBL class encountered learning confusion during the initial phase of PBL, though this was later successfully overcome as they became familiar with PBL. In contrast, other students seemed to find it hard to adjust and others failed to deal with the learning irregularity and confusion they experienced.*

Discussion of findings

Students' self-regulated learning

The results of this study show how students perceived the PBL method in terms of building up their skills in managing their own learning strategies, as well as in adopting higher-order thinking skills. Importantly, these results suggest that the PBL method seems to work effectively to enhance students' skills in self-regulated learning, even when conducted in the context of a learning culture and environment characterised by highly lecturer-dependent learners. The evidence that the majority of participants perceived PBL be enjoyable and challenging indicates that those participants in this study who were traditionally highly passive learners became positive about this method, even though the method is known to be focused on student self-directed learning. To some extent, this result indicates that the PBL method has considerable acceptance, even from those students who had previously shown unfamiliarity with the learning habits it requires.

Several interesting conclusions can be drawn from our students' perceptions, which seem to confirm the theoretical and conceptual foundation of the PBL method. First, presenting authentic, everyday problems to students to solve (Hmelo-Silver & Eberbach 2012; Savery & Duffy 1995) makes PBL interesting and enjoyable. The students in this study learned not only from books but also directly from everyday life in context. They could learn to become more flexible and to construct their own knowledge and ideas independently, which fostered their self-confidence in learning (Hmelo-Silver 2004). Second, by providing students with a complex and ill-structured (open-ended) problem to solve, the PBL method strongly challenged students in terms of managing their own learning, exploring relevant subject content and thinking critically. Third, when exploring data involving an interview with some business agents in the workplace, working in groups for problem-solving and presenting the results of group work to the class, the PBL students were involved in a learning process that would enhance their professional skills in oral communication. Importantly, in this process students also learned to encourage, examine and comprehend the viewpoints of others. When engaging in writing the report in various formats of their own, students were involved in a very valuable learning process, as this fostered their creative professional communication skills, particularly their writing skills.

Overall, this learning process may result in an increase in students taking responsibility for their own learning or self-regulated learning, high-level cognitive engagement and communication, which, in turn, should strengthen their lifelong-learning skills (Perry, Phillips & Dowler 2004; Wolters 2003; Bidokht & Assareh 2011; Laal & Laal 2012). The results are also generally consistent with some previous findings (Orozco & Yangco 2016; Tilchin & Raiyn 2015; Vidergor & Gottlieb 2015), indicating that this method is very beneficial for accelerating students' creative learning. Nevertheless, we were clear that all these results were achieved partly due to the presence of excellent support from a highly committed lecturer, who consistently played the role of a coach or learning facilitator and motivator as suggested by Hmelo-Silver and Barrows (2003). In our view, this role was crucial in creating a bridge between the students' prior passive-learning habits and the motivated, active learning required by PBL. It seems to us that the stronger the students' prior passive **[?]** learning habit, the more crucial is the lecturer's role as a facilitator for PBL.

Students' thinking skills

The results in Table 3 indicate that, as implemented in our specific study context, the performance of PBL in enhancing students' higher-order thinking skills is consistent with results reported by most earlier studies conducted in different learning contexts: for instance in those studies by Brodie and Porter (2009); Kek and Huijser (2011); Sendaq and Odabasi (2009); and Yuan, Kunaviktikul, Klunklin and Williams (2008). These results confirm the conceptual features of the PBL method as a student-centred learning method that emphasises the high-cognitive processes of students through in-depth learning (Butler 1998; Gallagher et al. 1995; Hmelo-Silver & Eberbach 2012; Savery & Duffy 1995).

However, the results in Table 3 seem also to support (although not to prove definitively) several previous findings indicating underachievement under PBL for low-level thinking skills, which are characterised by knowledge acquisition and rote memory, compared to the conventional methods (Anderson 2007; Sendaq & Odabasi 2009; Wijnen, Loyens & Schaap 2016). This may be because PBL stresses learning mechanisms that focus on the adoption of higher-order thinking skills in a complex problem-solving framework, rather than on lower-order thinking skills. As a result, it minimises, or even tends to ignore, the learning processes that support students' lower-order thinking skills. In contrast, conventional lecture-based methods gave students considerably greater space for surface-learning processes that required them to work only with low-level cognitive or thinking processes (Dolmans, Loyens, Marcq & Gijbels 2016).

The surface learning that characterises much lecture-based learning invites students to memorise and absorb learning content purely to pass the exam. Students in these contexts view learning tasks as externally enforced and tend to play the role of passive learners who work in isolation (Marton & Saljö, 1976). In contrast, under an in-depth learning approach such as the PBL approach, students are intrinsically motivated to explore and deeply understand the true meaning of the learning content and relate it to their daily life. Their learning tasks are built on their own intrinsic motivation and curiosity. In-depth learning involves the critical analysis of new ideas, so that they can be used for problem-solving in unfamiliar contexts (Houghton 2004). Therefore, the nature of the method seems to partly contribute to the explanation as to why, compared with a conventional class, the PBL participants showed the same, or even lower, low-level thinking skills, but convincingly superior high-level thinking skills. Some empirical literature has documented that PBL participants' knowledge-retention rates are much greater than those of learning through traditional methods. Such achievements are claimed to be a direct outcome of the students' involvement in the in-depth learning processes within PBL (Anderson 2007; Dods 1997; Herman & Knobloch 2004; Shaer & Gaber 2014).

The smaller improvement in lower-order thinking skills, as found in this and some previous studies, also leads us to question common assumptions about PBL methods. Such assumptions suggest that the application of higher-order thinking skills automatically involve a learning process or cognitive phase that requires students to work with lower-order thinking skills. As a result, in PBL, students' learning achievement in lower-order thinking skills should not be neglected in favour of encouraging their achievements in higher-order thinking skills. Teachers are challenged to develop a PBL design that not only enhances higher-order thinking, but at the same time maintains and strengthens students' lower-order thinking skills. Presumably, this contradiction, also noted by Ribeiro (2011), might imply that more thorough future empirical studies are needed to find a PBL design that is effective for both kinds of thinking skills.

Learning constraints in problem-based learning

This study also provides important evidence that introducing PBL to participants who are commonly unfamiliar with active-learning mechanisms could find the challenge problematic: even, as found in this study, resulting in learning confusion or frustration for some students during the entire process. Presumably, this fact could become part of the contextual constraints of PBL implementation. Students at our university are accustomed to well-defined lectures, organised by lecturers. In such teaching schemes, lecturers predominantly organise the students to learn what, when, in what way and from what source of learning, so that learning is uniformly structured for each student. However, with PBL, where the problem to be solved is unstructured in nature, students are exposed to greater learning uncertainty. In such a learning environment, they must be creative in determining their own learning strategy: what they should learn, to what extent and from what kind of learning sources. The chosen learning strategy may well be different from student to student and from group to group. That is why, initially, all the PBL students in this study tended to feel shocked and look confused. However, after some time, as they became familiar with the method, they adapted to it. Interestingly, most of the PBL students found that this irregularity of learning became enjoyable, as well as challenging (Table 1), with several reasons for this indicated in their responses (Table 2). Those students who found it difficult to adapt to this method seemed to experience what is called "cognitive overload" (Horton 2014), which can lead to learning confusion and even frustration. In a PBL context, cognitive overload would seem to be the result of the required content complexity (intrinsic cognitive load), which can result in an excessive cognitive load (Meacham 2017). The term "cognitive load" describes the total amount of mental activity imposed on a student's working memory at any given time (Cooper 1998).

From this study's context, we have learned some lessons on how to mitigate the confusion and frustration of passive learners in dealing with learning irregularity and uncertainty in PBL. First, the orientation of the PBL program needs strengthening. Such an orientation should be more detailed and comprehensive to ensure that each participant understands how to work soundly using this method. Students should also clearly internalise crucial learning objectives to be achieved by this method (Chakrabarty & Mohamed 2013). A good orientation would prepare the students' mindsets to work with the PBL method and gradually shift their lecture-based learning attitudes towards self-regulated and in-depth learning habits. Second, it is very important for the lecturer to work as a motivator and facilitator, as in this study, to keep the participants strongly motivated during the learning process. This motivating process, at the level of either the group or the individual student, should be a continuous and consistent task for the lecturer (Manaf, Ishak & Hussin 2011). Third, as indicated in the students' responses in this study, providing a greater portion of direct lectures or lecturer guidance as part of a PBL program, is vital. As also noted by Dubs (2004), though hands-on and self-directed learning play a central role in PBL, this learning approach still requires a certain amount of explicit teaching. Hence, in some situations, it might be beneficial to downgrade to some extent the level of learning complexity and irregularity by offering students a more structured PBL mechanism. It seems that a moderated form PBL would be more acceptable than exclusively self-managed PBL. Therefore, it is important that all these measures should be adjustable to each class's unique conditions, as found in this study.

The constraints found in this study also indicate the need to control other environmental factors to ensure this method will succeed. The first relates to students' learning overload, as also reported elsewhere (Catanach et al. 2000; Mohamad 2017; Moralee & Sweeney 2012). Commitment to the implementation of this method requires curriculum rearrangements to give equitable space to students when adopting a self-regulated and in-depth learning process that is basically more time-consuming than conventional learning methods. As an illustration, in our university, the average

student can take up to 24 units of semester credit, equivalent to eight courses per semester. Several of this study's findings indicate that the demands of the content-based curriculum became one of the constraints in the implementation of PBL. Next, as also suggested by Johnson et al. (2006) and Heller and Hollabaugh (1992), as cited in Brame and Biel (2015), PBL requires more limited class sizes, so that the class is more manageable throughout the learning process. Although large PBL classes, as reported by Woods (1996), are not actually a crucial constraint, as PBL can be adjusted for the number of participants, this was not the case in our university context. Students in our classes are, in general, highly passive learners and obviously not familiar with self-regulated learning. As they became participants in PBL, some students felt that they still needed more lecturer interventions, and thus that the lecturer's attention to each individual student had decreased. This class condition prompted students to recommend some reductions in the number of PBL participants in the class. Another alternative to deal with this problem is to have a teaching team to help students build their PBL skills.

Conclusion

Overall, what we found in this study reassures us that PBL is an equitable and accessible learning method, despite our students' normally more passive dependence on their lecturers. The introduction of this method in the financial-management class generated positive responses from our students. In general, the results of this study indicate that, although implemented in an unfamiliar learning environment, results from PBL actually exceeded those from the conventional method commonly practiced in our university, characterised by structured, lecture-based teaching. This, therefore, confirms the underlying conceptual and theoretical literature of PBL.

The results of the quantitative data analysis provided two main findings. First, students undoubtedly perceived that the PBL method authentically enhanced some skill dimensions that increased their self-regulated learning and higher-order thinking skills. Second, the method was proven to raise students' higher-order thinking skills more effectively than conventional teaching, although, conversely, it was found to fail to maintain lower-order thinking skills. The qualitative data analysis mainly showed that the students' reasons as to why they perceived PBL as enjoyable and challenging centred on some of their learning experiences in working with the method, which basically increased their self-regulated learning and higher-order thinking skills.

Strong commitment from the lecturer in effectively playing the role of learning facilitator and motivator could have served as a bridge between students' prior passive learning behaviour and PBL. However, considering some of the constraints found in this study, future implementation of PBL in relatively the same learning environment as in this study needs some adjustment to achieve the highest success. This includes more-efficient curriculum design and lower complexity of PBL itself to ensure that as many participants as possible, including slow learners, benefit optimally from learning through PBL. The complexity of PBL design should be fully in line with the phase of the students' learning experience; specifically in terms of whether they are at an initial or mature phase.

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