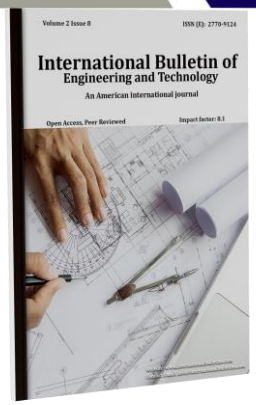

THE SIGNIFICANCE OF PBL IN TEACHING STUDENTS IN THE SPHERE OF TAX AND TAXATION!

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Abstract: This study compared the effectiveness of problembased learning (PBL) and traditional instructional approaches in developing highschool students' macroeconomics knowledge and examined whether PBL was differentially effective with students demonstrating different levels of four aptitudes: verbal ability, interest in economics, preference for group work, and problem-solving efficacy. Over all, PBL was found to be a more effective instructional approach for teaching macroeconomics than traditional lecturediscussion (p=.05). Additional analyses provided evidence that PBL was more effective than traditional instruction with students of average verbal ability and below, students who were more interested in learning economics, and students who were most and least confident in their ability to solve problems.

Key words: *tax, budget, economy, export.*

Introduction

Problem-based learning (PBL) is an appealing instructional strategy. Rather than reading or hearing about the facts and concepts that define an academic field of study, students solve realistic (albeit, simulated) problems that reflect the decisions and dilemmas people face every day. Many argue that PBL is a powerful and engaging learning strategy that leads to sustained and transferable learning (Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990; Hiebert et al., 1996; Jones, Rasmussen, & Moffitt, 1996; Stepien & Gallagher, 1993; Stepien, Gallagher, & Workman, 1993). PBL, it is argued, fosters the development of self-directed learning strategies and makes it easier for students to retain and applyknowledge and solution strategies to new and unfamiliar situations (Blumberg, 2000; Cognition and Technology Group at Vanderbilt [CTGV], 1997; Maxwell, Bellisimo, & Mergendoller, 2001).

PBL deviates from more conventional instructional strategies by restructuring traditional teacher–student interactions toward active, selfdirected learning by the student (Barrows, 1988; Birch, 1986; Savery & Duffy, 1994; Stepien & Gallagher, 1993; Torp & Sage, 1998). In PBL, teachers coach students with suggestions for further study or inquiry but do not assign predetermined learning activities. Instead, students pursue their own problem solutions by clarifying a problem, posing necessary questions, researching these questions, and producing a product that displays their thinking. These activities are generally conducted in collaborative learning groups that often solve the same problem in different ways and arrive at different answers.

The design of the PBL instructional approach used in the current study (Maxwell et. al., 2001) is instantiated in a series of curricular units focused on the knowledge, concepts, and principles that comprise the American highschool economics curriculum (Buck Institute for Education, n.d.). These units can take from one day to three weeks to complete, scaffold, and, to some degree, constrain teacher and student behavior. Each unit contains seven interrelated phases: entry,

problem framing, knowledge inventory, problem research and resources, problem twist, problem log, problem exit, and problemdebriefing.Student groups generally move through the phases in the order indicated but may return to a previous phase or linger in a phase as they consider a particularly difficult part of the problem. The teacher takes a facilitative role, answering questions, moving groups along, monitoring positive and negative behavior, and watching for opportunities to direct students to specific resources or to provide clarifying explanations. In this version of PBL, students do not learn entirely on their own; teachers still "teach,"but the timing and extent of their instructional interventions differ from those used in traditional approaches. PBL teachers wait for teachable moments before intervening or providing needed contentexplanations, such as when students want to understand specific content or recognizethat they must learn something.

Although the theoretical basis for the PBL argument is compelling (Norman & Schmidt, 1992; Regehr & Norman, 1990), little research has been conducted on the impact of PBL at the high-school level because most studies have occurred in medical schools (Pross, 2005), where curriculum reform is frequently based on the PBL instruc- tional model (Armstrong, 1997; Kaufman, 1985). Reviewers who have examined PBL medical school research have reached contradictory conclusions. For example, Albanese and Mitchell (1993) concluded that problem-based instructional approaches are less effective in teaching basic science content (as measured by Part I of the National Board of Medical Examiners exam), whereas Vernon and Blake (1993) report- ed that PBL approaches were more effective in generating student interest, sustaining motivation, and preparing students for clinical interactions with patients. Berkson (1993) found that "the graduate of PBL is not distinguishable from his or her tradition- al counterpart" (p. 85).This conclusion is consistent with a number of studies that have shown no statistically significant differences in learner performance compared to stu- dents receiving lecture-based instruction (Albano et al., 1996; Blake, Hosokawa, & Riley, 2000; Farquhar, Haf, & Kotabe, 1986; Kaufman & Mann, 1988). Culver (2000) conducted ameta-analysis of studies comparing the impact of PBL and lecture–discussion instruc- tion and concluded that there was "no convincing evidence that PBL improves knowl- edge base and clinical performance"(p. 259). Culver argued that the effects reported in the literature were either too small to be of consequence (generally less than .2 *SD*), or resulted from selection bias and other methodological defects. In response to Culver, Norman (2001) disputed the general approach of using high-stakes examinations, such as the National Board of Medical Examiners exam, as a comparative outcome measure. He pointed out that many medical students cram or take special preparation courses to prepare for this exam. As a result, the impact of a curricular design may well make a minor contribution to exam results.

Problems abound in generalizing results from research conducted on students in medical schools to a high-school population (Maxwell et al., 2001). Medical students are an elite group with superior verbal and quantitative skills.They are older than high-school students, and their intellectual development has progressed further. They are, presum- ably, more experienced with and accomplished in the use of hypothetical-deductive rea- soning.They have *chosen* to attend medical school, and they view their training as instru- mental to future occupational success. Given these differences in student characteristics and learning contexts, it is dubious that findings based on research with medical students can be applied directly to high-school courses structured around a PBL format andenrolling a diverse group of students.

Little research has been conducted within high schools comparing the effectiveness of PBL and traditional instructional approaches. Mergendoller, Maxwell, and Bellisimo (2000) compared the learning and attitudes of high-school students studying economics using problem-based and lecture

discussion methods. They found no statistically signifi- cant pre–post differences in learning for individual units, but there was a statistically sig- nificant pre–post difference in general economics knowledge from the beginning to the end of the semester, with the lecture–discussion classes learning more. Visser (2002) compared the effects of problem-based and lecture-based instruction on student prob- lem solving and attitudes in a high-school genetics class. She found statistically signif- icant differences ($p < .05$) in learning outcomes and motivation for students in the PBL and lecture–discussion treatments, with the PBL students reporting less motivation and learning yet recounting more confidence in their learning. Gallagher, Stepien, and Rosenthal (1992) compared the spontaneous problem solving of two groups of gifted highschool students: a problem-based science and society course and a comparison group not enrolled in the problem-based course.They found that students enrolled in the problem-based course were more proficient in "problem finding" and engaged in problem solving more successfully and spontaneously than the comparison students (who had not been taught a specific problem-solving process). Given the lack of decisive evidence that a PBL instructional approach is more effective than a traditional lecture– discussion approach, we hypothesized that in the current study there would be no difference in learning gains between students in PBL and traditional instructional envi- ronments.

In addition to incomplete knowledge regarding the effectiveness of PBL instruc- tional approaches with highschool students, we know little about how individual dif- ferences *among* high-school students might make PBL a more or less effective learning environment. In a review of the implications of cognitive theory for problem-solving instruction, Frederiksen (1984) noted, "there is considerable evidence that aptitudetreatment interactions exist" (p. 397). (Note: Aptitude-treatment interactions occur when certain treatments such as PBL have differential effects on students with differ- ent aptitudes.)

The first aptitude, which generally accounts for between one-third and one-half of the variance in academic achievement (Bartsch, Barton, & Cattell, 1973), is verbal ability. This relatively stable student characteristic is of interest because some authors have argued that lower ability students, who often do not thrive in traditional learning situations, are more likely to succeed in content rich, socially collaborative, contextually meaningful learning environments, such as those established in wellimplemented PBL(Delisle, 1997; Glasgow, 1977; Jones et al., 1996). Our review of the PBL research literature, however, revealed no empirical studies suggesting that PBL is an effective instructional approach for lower ability highschool students. In fact, the opposite may be true. One of the best known American high schools incorporating a PBL approach is the Illinois Mathematics and Science Academy (IMSA). IMSA students, however, are chosen through a highly selective admission process and demonstrate superior ability in mathematics and science (Connolly, Szczesniak, & Nayak, 2003). A previous study by the current authors (Mergendoller et al., 2000) found that verbal ability was positively associated with successful learning in *both* PBL and traditional highschool courses. Given the scant research on problembased instruction in high school, it is evident that more research is needed before claims of PBL's superior efficacy with lower-achieving students can be accepted.

In addition to academic ability, there is a question of whether other aptitudes might increase students' learning in PBL classes. The first is interest in learning economics. Throughout a PBL experience, students take an active role in their learning as they discuss and decide on problemsolving strategies, divide research and other responsibilities among group members, communicate the results of their research back to the group, and finally craft a problem solution, which is often presented to an external audience.Such active intel- lectual and social engagement is generally more demanding than

listening to a lecture or participating in a class discussion (Blumenfeld, Mergendoller, & Swarthout, 1987; Doyle,1983). We expected that students who wanted to learn about economics would be more willing to engage in the complex cognitive and interactional tasks required by PBL and thuswould learn more in this instructional condition than less interested students.

Other aptitudes include those that are more directly related to the task and interactional demands of the PBL learning environment. Meyer, Turner, and Spencer (1997) reported that individual differences in motivation and selfperception influenced mathematics attainment in investigative, activity-based group learning, an instructional approach with many characteristics in common with PBL. Ethnographic research by Anderson, Holland, and Palincsar (1997) documented how interpersonal dynamics and perceptions ofthe capability of other group members can alter the task demands and participatory behavior and can limit the learning opportunities available to less academically talented group members. Given this research and our own observations of PBL learning environments, we wanted to explore whether students who preferred to learn in groups and who perceived themselves to be competent problem solvers would learn more in PBL learning environments than students who did not like to complete group work and who wereunsure of their problem-solving ability.

To summarize,this research tested the following three hypotheses:

There is no difference in achievement, as measured via pretest–posttest changes in macroeconomics knowledge, between students in PBL and traditionalinstructional environments.

There is no difference in achievement, as measured via pretest–posttest changes in macroeconomics knowledge, between students with different levels of verbal ability in PBL and traditional classes.

There is no difference in achievement, as measured via pretest–posttest changes in macroeconomics knowledge, among students with different levels of interest in learning economics, preference for group work, or problemsolving efficacy.

Five veteran teachers at four different high schools participated in this study conducted during spring semester of the 1999–2000 academic year. All of the high schools were located in a large metropolitan area in northern California. Two of the high schools were suburban and two were urban. To control for teacher effects, all teachers taught the same macroeconomics content using a PBL approach with one or more classes and a traditional lecture–discussion approach with one class. Teachers were allowed to select which class they would instruct using a lecture–discussion approach, but this choice wasmade before the school year began and before teachers had received their class lists. Consequently, teachers had no advance indication of the student composition of eachclass. PBL and traditional classes were distributed throughout the school day, with four of the five teachers teaching the PBL and traditional classes within two periods of each other. The remaining teacher's PBL and traditional classes were within three periods of each other. A total of 346 twelfth-grade students in 11 classes completed one or more of the instruments used in the study.The following data analysis is based on data collected fromthe 246 students who completed the pre- and post-macroeconomics knowledge instrument and the verbal ability measure described below. These students make up 71% of students enrolled in the classes. Some of these students did not complete one or more of the aptitude assessments. When this occurred, we substituted the population mean forthe missing score. The high amount of student attrition is testament to the elevated absence rates common among graduating seniors during the second semester of the senior year (when grades do not count for college admission). Similar absence rates were found in other subjects.

Finally, we conducted independentsamples t-tests within tertiles comparing mean pretest–posttest change scores in macroeconomics knowledge for students in the PBLand lecture–discussion classes. Table 3 displays the data used in this analysis, the t-tests results, and the effect size for each comparison. Except for students whose scores on the interestin-learning-economics aptitude measure placed them in the high tertile,there were no statistically significant differences at the .05 level. These analyses allowed us to accept our second hypothesis of no differences in pretest–posttest change in macro-economics knowledge between students with different levels of verbal ability in PBL and traditional classes, and to reject our third hypothesis, indicating a difference in pretest–posttest change in macroeconomics knowledge among students with different Our results leave many important questions unanswered. A key limitation of the cur-rent study is the lack of in-depth information about what, exactly, teachers were doing inthe PBL classes that distinguished them from the lecture–discussion classes and how these differences were associated with increased student learning.Future research should include observational studies of PBL instructional environments, document the essential compo- nents of problem-based learning,and assess the extra-content outcomes theoretically asso-ciated with problem-based instructional approaches and espoused by PBL advocates.

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