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The purpose of this quasi-experimental research study was to determine the effects of a problem based learning (PBL) curriculum on students' perceptions about self directed learning (SDL). Seventy-three students enrolled in a School of Pharmacy, with a one-year PBL curriculum, completed the Self Directed Learning Readiness Scale-Version A (SDLRS-A) questionnaire on three occasions over the course of a 16-week semester.

The analysis of the data indicated a statistically significant decline in mean scores of the SDLRS-A for students from the pretest to posttest 1 that occurred within the first eight weeks. Additionally, students experienced a statistically significant decline in mean scores from the pretest to posttest 2 which represented 16 weeks.

All subjects experienced a significant decline in their perceptions of their ability and their perceived importance of SDL as a result of a PBL curriculum. The majority of subjects (94%) were young adult learners, between 18 and 25 years of age. The study supports the need for additional research regarding age and the effect of a PBL curriculum. The data also supports the need for an induction phase and orientation period for students entering a PBL curriculum for at least 16 weeks in order to promote student readiness for self directed learning.

Background

Self directed learning (SDL) has been heralded as a theoretical approach to learning based on the andragological perspective that individuals should be able to make logical and significant choices in learning. Numerous authors support the premise that the conceptual principles of self directed learning give the adult learner control and autonomy over his/her education at any given point in time (Boekarts, 1999; Hughes, 1999; Lowery, 1989). This autonomy and control further enhance the learner's intrinsic being, as well as the life and well-being of others and the society at large (Hughes, 1999).

Brockett and Heimstra (1991) also support that andragological perspective and present a broad view of the theoretical approach of SDL. The authors believe that SDL processes involve higher order critical thinking awareness along with social action on the part of the learner. They relate that the process of SDL provides for a more liberating perspective for the learner, melding both the intellectual and social learning environment into the learner's critical awareness and social interactions.

In order to promote the andragological perspective of SDL in higher education, academicians have studied various teaching methodologies in an effort to empirically validate learning outcomes of SDL. Of these various teaching methodologies, Problem Based Learning (PBL) has emerged as a significant method of enacting the theoretical principles of SDL (Wilcox, 1996; Barrows, 1994; Boud & Feletti, 1997).

Boud and Feletti (1997) state that Problem Based Learning (PBL) has been one of the most powerful teaching methodologies to encourage students to take responsibility for their own learning. The authors state that the PBL approach provides the student the motivation to actively pursue concepts and principles that they need for life. The authors also believe that students, using a PBL approach, learn to develop knowledge acquisition skills, flexibility, and deeply rooted theoretical concepts, that better equips them for life long learning. (Boud & Feletti, 1997).

There has been a growing body of PBL research, with significant studies focused on student and faculty performance and levels of competence. The growing body of empirical data supports PBL as a valuable teaching methodology and supports the concept of PBL as a method of operationialising SDL theory (Albanese & Mitchell, 1993; Norman & Schmidt, 1992; Boud & Feletti, 1997).

The current study explores students' perceptions about their capacity to be self directed learners. This quasi-experimental research study seeks to examine the effect of a PBL curriculum on students' perceptions about self directed learning. The study explores changes in student ratings regarding the importance of self directed learning and their ability to conduct self directed learning as they progress through a PBL curriculum. Specifically, changes in student perceptions are measured by the Self Directed Learning Readiness Scale (SDLRS-A). The

results of the SDLRS-A have been measured at intervals throughout the course of a 16 week semester of a PBL curriculum.

Theoretical framework

There has been a continuing debate surrounding a cohesive theory of self directed learning (SDL). Various authors conclude that the elements for a SDL theory do not truly exist, but are more of a dichotomy of processes versus theory (Brookfield, 1988; Field, 1989). Candy (1991) discusses the need for a new epistemological framework that interprets the phenomena of SDL, rather than practical application of SDL. The author states that the "preponderance of research has emerged from the psychological perspective and from the positivistic view of knowledge" (Candy, 1991, p. 436). He concludes that self directed learning is distinguished as a process rather than a personality construct. He has taken the distinction further and designated the SDL processes within and outside of the individual and the institutional setting.

Another supportive theoretical model has emerged in the past decade that mirrors the concepts of SDL. The construct of Self-regulated learning (SRL) promotes the concept of processes that occur within in the individual learner.

Boekaerts (1999) describes three domains of SRL. The first domain includes the metacognitive realm where the learner's cognitive strategies drive the selection, coordination, and organisation for learning. The second domain involves individual learning styles and interactions, both "reciprocal and recurrent", that foster individual learning. The third domain is inclusive of the learner's goals for learning that involve emotional capacity, intrinsic motivation, and volition (Boekaerts, 1999).

Boekaerts (1999) also identifies that SRL is a complex construct that blends cognitive and affective processes for the individual learner. These processes, as a part of the individual, are enmeshed in the "information processing system" that represents Self-regulated learning (p. 449).

Brockett and Heimstra (1991) share similar conceptual thinking and developed a theoretical model in support of SDL with internal and external factors. The model is the first to incorporate a learning method, or teaching methodology, along with learner characteristics.

The "Personal Responsibility Orientation" Model (PRO) developed by Brocket t and Heimstra (1991) substantiates the theory proposed by Candy (1991) and Knowles (1975) that self direction in learning comes from internal and external influences. The authors believe that an individual's personality characteristics are just one element that influences the processes of SDL. These personality characteristics serve as starting points for understanding self direction in learning and coupled with autonomy and personal choice, serve as the catalyst for SDL to

occur.

The first concept of the PRO Model involves personal responsibility for learning. The "personal responsibility" concept encompasses the individual owning his/her behavior for learning and being solely responsible for personal thoughts and actions toward learning. The personal responsibility concept includes how the learner responds in a learning situation. The individual is then inherently responsible for the consequences of that learning and for his/her self direction in learning. Personal responsibility is also considered as a measure of the individual's willingness to seek his/her potential. The personal responsibility concepts are derived from the basic philosophical ideology that human nature is basically good and that humans have the potential for unlimited growth. Several authors suggest that the influence of humanistic philosophy yields greater determinants on a learner's self direction than any other philosophy (Boud & Feletti, 1997; Brockett & Heimstra, 1991; Elias & Merriam, 1980; Houle, 1961; Tough, 1979; and Candy, 1991). Such influences drive the personality and character of an individual toward self-actualisation, which is often referred to as the highest potential for human growth. The learner's self directedness emerges from significant levels of self-understanding, intuitiveness, and insightfulness. The self actualised individual consistently seeks to utilise resources to the maximum and are creative and not fearful of the unstructured learning environment. Numerous authors support that the learner's self direction is manifested by responsibility for his/her behavior and also the consequences of that behavior (Boekaerts, 1999; Brockett & Hiemstra, 1991; Candy, 1991; Elias & Merriam, 1980; Houle, 1961).

Autonomy also serves as an essential element of the personal orientation of the PRO Model. The autonomous individual is considered as separate and independent from outside influences, regulations, and limits. The element of autonomy implies that an individual decides what they value and make decisions regarding learning experiences that will enrich his/her life and move the individual toward self actualisation.

The intrinsic elements of personality characteristics, internal motivation, responsibility, and autonomy come together to direct the learner towards self realisation and self actualisation. The intrinsic elements blend together to represent the personal responsibility concept of the PRO Model.

The second concept in the PRO Model is inclusive of a "process orientation". The "process orientation" includes instructional methodology that revolves around planning, implementing, and evaluating learning. The essential element of the process orientation includes the interactions between teaching and learning. These interactions are external to the individual and are manifested by processes such as needs assessments, evaluations, learning resources, facilitator roles and skills, and independent study (Brockett & Heimstra, 1991).

The focus of the process orientation is on teaching and learning elements of the

teaching/learning interaction. This concept allows for assessing learner's strengths within the learning method and allows for variances in teaching methodologies. The process orientation supports opportunities to match teaching methodology with learning styles of individuals.

The PRO Model also provides the foundation for inclusion of the social context. The "personal responsibility" concept and the "process orientation" concept can not occur independently and will always occur within the umbrella of the social context.

According to the PRO Model, the social context provides the surrounding framework for SDL to occur. Brockett and Heimstra (1991) refer to the social context phenomena as the "Umbrella Effect" (p.24). The potential for the individual, within the personal orientation and the process orientation, is expanded or limited, by the social context in which learning occurs. The social context encompasses the cultural, political, social, and environmental norms for society and for the individual. It provides an avenue for individual gains that benefit society as a whole. The surrounding societal context expands the individual's growth through SDL to reflect and enhance societal growth.

The PRO model supports the idea that the individual and the social context cannot exist without one another. The model also suggests that no dichotomy exists between the individual and society at large, but they are blended and enmeshed. Furthermore, the PRO model suggests that the self actualised individual acts on behalf of society at large. The individual self learner is only a part of the greater whole and contributes to the well-being of all. The self learner is the "starting point for educational process and practice to occur" (Brockett & Heimstra, 1991, p. 131).

The theoretical framework proposed by Brockett and Heimstra (1991) supports the individual as the emphasis for adult education. The individual is part of the greater social context that shares equal importance in the conceptual analysis. The individual experiences SDL as a personal orientation and, as a learner (self directed), experiences PBL as a process orientation. The theoretical principles provided by the PRO Model have been the framework for the current study and provides the context for theoretically based research regarding PBL as a learning method. The ultimate goal of this study has been to provide empirical evidence to validate PBL as a credible learning method supported by a sound theoretical framework.

Literature review

The literature pertinent to the study includes an overview of research studies, as well as anecdotal writings, related to the field of SDL. A review of current research literature regarding PBL in higher education and curriculum outcomes are also included.

The majority of SDL literature supports the need for empirical testing of a theory and extensive theory development (Wilcox, 1996; Garrison, 1997; Ramsey & Couch, 1994). Much of the SDL literature has been directed toward identifying personal characteristics of the self directed learner (Taylor & Burgess, 1995; Kreber, 1998; Pedley & Arbor, 1997). The results have been inconclusive regarding specific personal character traits that enhance SDL.

In one study, Kreber (1998) analysed the relationships between self directed learning, critical thinking, and psychological type. Three instruments were used in the study. The first tool, the Self Directed Learning Readiness Scale (SDLRS) developed by Lucy. M. Guglielmino (1977), which is the same instrument used in the current study, was administered. The second tool was the Watson-Glaser Critical Thinking Appraisal instrument that tested students' abilities to enhance critical thinking. The third instrument used was the Psychological Types and the PET Type Check that is based on theoretical applications by Jung and measures people's preferences regarding intuition and psychological typing (Kreber, 1998).

One hundred forty-two undergraduate students from a Canadian university were the subjects for the study and they were to complete all three questionnaires. Limitations for the study were cited as controversy over the content and construct validity of all three instruments used and the fact that different disciplines were not represented in the study. No data were provided regarding the age of the subjects (Kreber, 1998).

Kreber's (1998) results indicate a strong, positive correlation between extraverted intuition and positive scores for the SDLRS $r = 0.61$, ($p < 0.001$). A smaller, yet significant finding also exists between extraverted thinkers and positive scores on the SDLRS. Extraverted intuition proves to be a strong indicator for willingness and perceived capacity to engage in self directed learning. No significant correlation was found between introverted intuition and lower SDLRS scores. The conclusion is that psychological type did not appear to be a predicator of critical thinking ability or ability to perform SDL. The study results indicate that there is a relationship between a student's willingness and perceived capacity to engage in self directed learning and that these are related to the personality type of extraverted intuition (Kreber, 1998).

Pedley and Arber (1997) also conducted a study to examine students' perceptions of SDL abilities. The authors sought to evaluate student learning processes according to the Jarvis' experiential framework. The Jarvis framework is a decision-making grid that allows students to make clinical decisions within a structural guide. The grid supports three thought processes of planning, monitoring and reflecting. In the study, 135 nursing students were asked to complete a semi-structured questionnaire regarding their ability to perform self directed learning in the confines of a class project module. The module was a four-week-long project that required students to research and examine factors that influenced their clients' health care needs.

The only statistical analyses provided by the authors were simple descriptive statistics and content analysis. The authors stated they searched for broad themes in the open-ended questionnaires for results and no data was reported regarding the age of the subjects (Pedley & Arber, 1997).

The results of the Pedley & Arber (1997) study indicate an overwhelming majority (97%) of the subjects found the SDL module to be a positive learning experience. Twenty percent of the students responded that they found the autonomy and freedom of choice, for both content and format, a positive learning experience. Overall, comments indicated students identified choice and autonomy as important but the authors failed to provide statistical measures. Nineteen percent of the students considered the opportunity to manage their time, and their motivation and assessment skills as essential to the SDL process. Ten percent of the subjects indicated they learned significant information acquisition, summarising and evaluating skills as a result of the SDL module.

The authors conclude that the Jarvis framework is instrumental in allowing subjects to plan, implement and evaluate their SDL performance. They further conclude that there is a great need to continue development of student-centered educational methodology in higher education (Pedley & Arber, 1997).

Jacobus, Grol, Crebolder, Rethans and Vleuten (1998) also conducted a study in the Netherlands regarding self-assessment of self directed learning. They noted that little empirical data supported the validity of previous self-assessment ratings and thus was the impetus for the study. Sixty physicians were asked to complete a 60-item multiple choice test to ascertain baseline content knowledge after completing a continuing education course for medical skills. The subjects were randomly divided into control and treatment groups. The treatment group received additional skills training and consistent feedback over the course of three and six months. A 22-item, self assessment questionnaire was given at three and six month intervals to both groups. All participants received a detailed written account of their scores, including comparison to the other participants and corrective actions for items missed.

The results of the study indicate that there are no significant differences in the personal characteristics of both groups, knowledge or self-assessment skills. Correlations between the two groups for self assessment and knowledge were low initially (0.24) and later increased to moderate levels (0.20) toward the six month mark. The data suggests that over time there are moderate improvements for self assessment skills and knowledge for the treatment group (Jacobus, et al., 1998).

The study limitations include the small sample size of volunteer physicians and the significant missing scores from several questionnaires. The authors report that pre- and post-intervention self assessments were subject to bias due to the internal motivation of the subjects. No data were reported regarding the age of the subject, however, it was noted that they were all experienced physicians (Jacobus

et al, 1998)

The study concludes that self-assessment scores may be useful in obtaining measures of perceived competence. The authors also conclude that providing regular feedback did not significantly improve any level of skill, knowledge acquisition, or self assessment for the subjects (Jacobus et al., 1998).

Some of the research literature regarding student perceptions of ability for SDL and related topics has been presented. The following section addresses the anecdotal literature pertinent to the study regarding SDL and students' ability and performance outcomes in higher education.

Anecdotal literature related to self directed learning

Significant amounts of anecdotal literature exist regarding SDL in higher education. Ramsey and Couch (1994) propose a model for implementing SDL that enhances the partnership between teachers and students. The authors developed three major dimensions for the model.

The first dimension regards who controls choices in learning situations. The authors believe that this is a continuum and that the ultimate goal is to have a mutual sharing of choices in the learning situation. The second dimension regards the different types of learning situations that emerge from different data sources or within the learning content. The authors believe that learning occurs from multiple and varied sources and are driven by the learner within a certain situation. As the learning situation evolves, so does the resource pool from which the learner draws knowledge. The third and final dimension of the model regards two different learning strategies. The first strategy suggests that the individual determines specific goals to acquire certain knowledge and is called "planned knowledge". The second strategy involves learning after the fact. The individual experiences events and becomes aware of learning after the event when evaluations and resources can be used to explain what has occurred. Synthesis and connection of knowledge acquisition occur and unrelated events then take on a connection. The strategy is referred to as "post-hoc learning" (Ramsey & Couch, 1994, p. 12).

Ramsey & Couch (1994) developed a six cell matrix that involves three dimensions of learning: (1) controlled choices in learning, (2) different types of learning situations, and (3) a choice of two learning strategies. These dimensions are cross-referenced with teacher-centered learning attributes and student-centered learning attributes to determine the basis for the model.

The authors conclude that SDL is a necessary component of the model and must be developed in partnerships with learners, peers, society and teachers. The authors championed the cause to create learning societies where SDL is a valued and accepted theory as evidenced by practice (Ramsey & Couch, 1994).

Hughes (1999) presents an alternative view to SDL theory through depiction of the negative connotations associated with SDL. By placing hyphens into certain words, the author supports the concept of "Dire" in Self-DIRE-ected learning. The argument is made that SDL assumes the learner is capable and able to make rationale and logical choices for learning. The author believes that educators do not take into account the varied linguistic, cultural, social, and political implications for the individual in a SDL curriculum. Hughes (1999) believes that by emphasising the individual's learning needs that collaborative or cooperative learning is diminished by making the individual extremely competitive and "me" focused.

Taylor and Burgess (1 995) write about the critical need for orientation of students to the process of SDL. They believe that there is a great disparity between inductions of students into SDL processes versus orientation. The authors believe that educators have failed to provide adequate orientation to prepare students to engage in SDL. They state that little research has been done to establish the stages of readiness for students to engage in SDL. They also believe that an ethical battle has been waged in academia by forcing student orientation to SDL when students do not choose to participate. The authors cite that most of the SDL theorists negate the influence or need of any orientation to prepare students for SDL. The authors conclude that student orientation to SDL principles is imperative if students' are to succeed (Taylor & Burgess, 1995).

The authors conducted a study based on a social work course that included a student orientation to the process of SDL. Forty students were assigned to small groups that were facilitated by a teacher. These small group sessions met three times a week for 15 weeks. The average age of the students was 35 (Taylor & Burgess, 1995).

The learning resources to support the 40 students SDL activities were provided for them. Students had a wide variety of content areas in which to choose their learning interests. They were also able to choose their method of evaluation after completing a content brief or paper. The orientation process for these students began during the selection process. On initial interview they were informed about the SDL process and allowed to choose a continuation in the SDL or the traditional curriculum. On interview day the students watched an SDL educational video and were given written guidelines about expectations and roles of students and faculty. When classes started, time was allotted to induct or assist the students in the processes of SDL. Throughout the semester, students were provided weekly opportunities to ask questions and seek guidance regarding their development of SDL skills and ability (Taylor & Burgess, 1995). When the semester concluded, students were asked to evaluate the orientation period for SDL processes as well as the entire course. Students identified four essential areas to include in student orientation for SDL: (a) the role of the facilitator, (b) the expectations of lecturers, (c) the expectations of learning in groups, and (d) time-management strategies. The majority of students responded that they did not

obtain competence with SDL activities until mid-way through the semester (Taylor & Burgess, 1995).

The authors conclude that it was helpful to view orientation to the process as part of the paradigm in the interactional conceptual design of SDL. They believe a theoretical paradox regarding the very nature of SDL was generated. They suggest that the need for orientation to SDL presents a juxtaposition to the nature of individual learners seeking self directing in learning (Taylor & Burgess, 1995).

The research literature regarding SDL is abundant. The studies in the review of the literature are relevant to the current study and provide a sound background for the uniqueness of this study. Likewise, the research literature regarding the teaching methodology of PBL has been prolific. The research in the review of the literature is pertinent to the study regarding students' perceptions of PBL.

Research in problem based learning in higher education

The impetus for the current study arose from the work of Ryan (1993), who conducted a study to investigate students' perceptions about SDL in a professional course implementing PBL. The author used four items from the Malcolm Knowles' Self Rating Instrument for Competencies for SDL. Thirty-five subjects in a graduate nursing program were asked to rate the value of importance of SDL and perceptions of ability to conduct SDL as they progressed through one course of a nursing program designed as PBL. The subjects were in the adult age-range, with 90% over the age of 25.

Ryan (1993) administered the four-item questionnaire at three intervals over the semester. Correlation coefficients, one-tail T tests for correlated means were the only statistical measures given. The results indicated that on three separate occasions during the semester, students consistently rated the importance of SDL as highly important and the results were considered to be significant at the 0.01 level. The students also rated perceived ability to conduct SDL as highly significant and the rating increased over the course of the semester to the 0.001 level of significance.

Ryan (1993) concludes that students perceived SDL as important from the onset of the study. The students' perceived ability to perform SDL increased with the use of PBL. The author concluded that several factors influenced the results. One factor may have been that asking students to evaluate their performance and systematically rate value and ability to conduct SDL may have produced the positive effects. It was also a conclusion that merely fostering a highly supportive learning environment was a major factor in the significant results (Ryan, 1993).

In another study regarding student perceptions, Patel (1998) investigated student perceptions and performance in a medical undergraduate pediatric clerkship. Twenty-seven, fourth year medical students, were randomly assigned to two

groups located at two different hospital sites. One group of 10 students was assigned to the PBL group and the other 17 students were assigned the traditional curriculum. The pediatric clerkship consisted of eight weeks and provided the identical clinical experiences as the traditional group received. The difference between the two groups was the method of knowledge acquisition. One group received lecture while the PBL was divided into small groups. The PBL group had 12 tutorials during the course of the clerkship and met for two-hour sessions twice a week. The other group was provided 16 hours of lecture over the course of a week. Both the PBL and the traditional groups were asked to keep journals of their clinical experiences. The journals and clinical observations by faculty were the evaluation methods for the study. The clinical evaluations were based on the objective structured clinical examination (OSCE) tool. The tool was developed to measure clinical competencies for medical students regarding medical diagnosis, treatment interventions, laboratory implications and follow-up care. The students' perceptions were assessed by a questionnaire.

Patel (1998) did not indicate statistical measures used for the data. Means and standard deviations were occasionally cited in the data. The content validity of the instruments was not discussed and no data were reported regarding the age of the subjects (Patel, 1998).

The results of the study indicated that students expressed increased positive statements for PBL over the course of the semester. The PBL students expressed overall satisfaction with their theoretical knowledge acquisition and learning synthesis. "New" learning was rated greater for the PBL students than the traditional students. PBL students indicated they felt better prepared to interview parents and care-takers than did the traditional students. However, both groups of students indicated they did not feel prepared to examine children or work with the anxieties of children or their families (Patel, 1998).

The students' performance on the OSCE did not indicate significant relationships in clinical performance between the two groups. Both groups held a 6.9 standard deviation (SD) with regard to the questionnaire, the satisfaction with the clerkship, and knowledge acquisition. Some of the limitations included lack of supervision for students acquiring clinical skills and the small number of subjects for the study (Patel, 1998).

The author concluded there was no evidence that PBL was more powerful or enhanced medical knowledge any more than the traditional methods of teaching. However, he suggested additional research to study student preparedness for SDL and faculty preparedness in their role for PBL (Patel, 1998).

In another study, Miller and Schwartz (2000) addressed implementing multi-disciplinary teaching with a modular curriculum that represented the best components of PBL. In the study, 188 medical students were divided into four small groups of 12, with an assigned tutor or facilitator.

Systems-based modules were developed that included the musculoskeletal, cardiovascular, respiratory, gastrointestinal, and kidney systems of the normal body physiology. The modules were utilised over two clinical years to incorporate learning across areas of human anatomy, biochemistry, physiology, pathology, pharmacology and microbiology. The students were asked to complete a 19-item questionnaire with a five point Likert scale, (1= yes or strong agreement to 5=poor or little agreement), evaluating the effectiveness of each module and the overall evaluation of the course. The results of these data were reported in means and standard deviations. Other statistical analyses for these data were not reported. The age of the subjects was not reported (Miller & Schwartz, 2000).

The results indicated that students were relatively satisfied with course objectives (2.6 SD), their skills gained (2.3 SD), their ability to problem solve in the fields (2.3 SD), and the module (mean 57%). The conclusion was made that the module format in conjunction with PBL principles offered an alternative to a pure PBL curriculum. These modifications could offer the benefits of PBL without radically changing the curriculum and causing faculty and student resistance to the change (Miller & Schwartz, 2000).

In another study identifying student perceptions, Natis, Follet, Menard and Des Marchais (1999), studied medical students at Rouen, France. Ninety students in their second year of medical school and 87 students in their third year were asked to complete a 30-item questionnaire with a few open-ended questions to investigate the difficulties and advantages of the PBL curriculum. Response rates for the questionnaire were 54% for the second year students and 74% for the third year students. Statistical measures were not given for the data. Only percentages and standard deviations were reported. No data were reported regarding the age of the subjects.

The results of the data indicated students from both classes were influenced by small group process and were supportive of the logical reasoning processes. Students reported they were not satisfied with faculty help to find resource data and reference books. The students concluded that they did not want PBL carried over into their clinical clerkships. The students were asked to rate the easiest and the most difficult points of PBL.

Natis et al. (1999) concluded that the second year students were more supportive of PBL than the third year students. They attributed this to the fact that major efforts to revive PBL in practice had occurred at this medical school over the previous year. They also found that students had great difficulty with the transition from a more traditional curriculum to the PBL curriculum. The authors supported involving students in an on-going evaluation of the PBL process and curriculum in order to fully meet their needs (Natis et al., 1999).

In another study that evaluated a traditional versus PBL curricula, Derectchin and Contant (1999) looked at learning behaviors of medical students. The Cognitive

Behavior Survey, a self-reporting instrument, was given to 540 medical students in three successive classes. The 1995 class had 150 students enrolled in the traditional curriculum. The 1996 class had 165 students enrolled in the traditional curriculum. The 1997 class had 165 students enrolled in a mixed PBL/traditional curriculum. Mean Medical College Admission (MCAT) test scores and GPA scores were obtained as cross over references. The Cognitive Behavior Survey asks students to rate their perceived use and value of conceptualising medical knowledge acquisition.

Analysis of the variance (ANOVAS), descriptive statistics and contingency tables were cited as the statistical measures applied in the study. The Alpha was set at 0.05 and reflected all of the student responses rather than those of a specific class. The MCAT and GPA scores were reported by class. No data were reported regarding the age of the subjects (Derectchin & Contant, 1999) .

The results of the study indicated that there was little difference in the mean GPA (3.7) across all classes. The MCAT scores were relatively the same (10.7 on a 15 scale) for all classes with the 1997 mixed curriculum class having slightly higher mean scores (Derectchin & Contant, 1999).

All classes reported significant importance on self directed learning formats. Interestingly, the 1997 mixed curricula class indicated a desire for more traditional lecture formats than any other class. The 1997 mixed curriculum class also significantly rated SDL lower than the other two classes (Derectchin & Contant, 1999).

There were no significant differences between the classes regarding resources of knowledge. Textbooks, syllabi, course outlines, and lectures remained the primary resources used by all students with no significant differences noted in the variety of resource used in the classes (Derectchin & Contant, 1999).

The authors concluded that the results of the study were controversial and non-conclusive. The mixed curriculum students rated concepts of SDL higher, yet their rating for active forms of learning were decidedly lower than the other participants. The authors noted that extensive changes and growth of the PBL curriculum may have influenced the study results, but concluded that there was a positive trend toward students embracing PBL as a method for life long learning (Derectchin & Contant, 1999).

In another study that addressed student perceptions, Warburton & Whitehouse (1998) studied 118 medical students' perceptions of how well a PBL approach improved their integration of knowledge. Ninety-two percent of the students completed the structured questionnaire at the half-way point of a year's PBL curriculum.

No statistical measures were given for the study. The data were reported in terms

of percentages and no data were reported regarding the age of the subjects (Warburton & Whitehouse, 1998).

The results indicated that 45% of the students indicated satisfactory understanding of the course objectives and 65% indicated enjoyment of the course. Thirty-nine percent indicated the same amount of understanding as a traditional course and 27% reported the same level of enjoyment. Forty-eight percent reported experiencing the same amount of work with 30% reporting greater amount of work for the PBL course (Warburton & Whitehouse, 1998).

The authors concluded that while PBL groups were being enjoyed and course objectives were being meet, that the PBL process was not meeting the students' personal goals. They recommended additional research to consider differences in learning wants and needs (Warburton & Whitehouse, 1998).

Research into PBL curriculum in the discipline of accounting was noted. Breton (1996) conducted a study which analysed two different teaching methods in an accounting theory class. Two classes of students, one traditional and one PBL, were compared to determine differences in knowledge acquisition and aptitude for problem solving. Students were randomly assigned to a morning and afternoon accounting theory class without knowing the instructor or the teaching methodology.

The experimental PBL work groups were assigned an eight page paper to develop the theories of accounting and provide a theoretical answer to the case question. The control group was given a detailed assignment including a company's annual report and long term financial report. They were asked to make determinations about this company based on the information. The group was also given a mid-term exam (Breton, 1996).

At the completion of the course both groups were given the same examination derived from a test bank. No statistical measures were given for the study. The data were reported in percentages, standard deviations, and significance levels were given. The mean age for the PBL group was 25.3 years of age. The mean age of the control group was 24.3 years of age (Breton, 1996).

The students in the PBL experimental group scored significantly higher (0.294) on two of the four questions. These data suggested that the PBL students had greater recall and applicability of the knowledge gained than the traditional students. The experimental PBL students indicated having a larger workload but noted equal utility of the information for longer term use than the traditional students ($p = 0.05$) (Breton, 1996).

The author concluded that the study findings were in support of PBL as a more effective teaching methodology than a traditional lecture, teacher-focused curriculum. The author further concluded that the study indicated students

acknowledged a greater consciousness of long-term acquired knowledge and life-long learning ability as a result of participation in a PBL curriculum (Breton, 1996). In another study that addressed comparisons of PBL versus traditional curriculum, Antepohl and Herzig (1999) conducted a randomised, controlled experimental trial in a German medical school. The study included 123 medical students in their fifth year of medical school who enrolled in the basic Pharmacology course. The students were allowed to choose between a Tuesday or Thursday class and were informed that there would be two different teaching methods used. Staff were blinded to the enrollment procedure and the teaching methods to be used.

Sixty-three students were assigned to the PBL group and were further divided into eight small groups. These groups were to have two hours of PBL with one hour of lecture per week. Two tutors, or facilitators, were assigned to cover all the groups at different time intervals. Sixty students were assigned to the control group or traditional lecture method (TLM) (Antepohl & Herzig, 1999).

Three different evaluation methods were selected. These included a written final exam that both groups were to take, a questionnaire seeking student's preference for teaching methodology and a second questionnaire addressing satisfaction with the PBL course alone (Antepohl & Herzig, 1999).

Descriptive statistics were used in data analysis. The Welch t-test was used to compare groups. The test was selected due to the significant variation in group standard deviations. The mean age of the PBL study group was 24 years of age. The mean age of the control group was 24.7 years of age (Antepohl & Herzig, 1999).

The results of the study indicated no significant differences between the PBL group scores and the TLM groups' scores across all parameters. Only on the short essay component of the examination did the PBL group have higher scores ($p = 0.07$). Comparing the groups, the PBL students obtained nearly identical scores for the short answer and multiple choice questions. Students in the TLM scored significantly lower ($p < 0.001$) on short answer and multiple-choice answers. The overall results between the eight PBL groups did not significantly differ from one another (Antepohl & Herzig, 1999).

The students indicated an overall level of satisfaction with the PBL course and considered it to be an effective learning method. Students indicated a positive relationship to synthesising information from multiple areas such as physiology and biochemistry because of the PBL format (Antepohl & Herzig, 1999).

The authors concluded that the study supported PBL as an equal, if not more effective method of learning and teaching than traditional lecture formats. The study also supported higher levels of students' satisfaction with learning after a PBL experience (Antepohl & Herzig, 1999).

A similar study was conducted in Australia by Miflin, Campbell and Price (1999). The study included 234 medical students in a PBL curriculum and focused on the impact of an orientation program on the PBL process for faculty and students. The study sought to promote the concept of self directed learning to guide student and faculty for successful PBL outcomes.

Instruments used in the study included a questionnaire for tutors before and after the 10-week course, observations of the PBL sessions, weekly debriefing sessions, weekly questionnaire to the students, and weekly consultations to the group process. No statistical analysis was provided for the study. The average age of the subjects was 26.5 years of age (Miflin, Campbell & Price, 1999).

The results of the study indicated four essential items that positively influenced the PBL process. First, an orientation program that provided clear instructions and introduction into the SDL principles faculty and students. Secondly, there was a need for more focused briefings of students and faculty regarding resources. Thirdly, the introduction of a weekly lecture to review the basic principles addressed during the week enhanced the process. Finally, regular formative evaluations for students and faculty need to be conducted (Miflin et. Al, 1999).

Boud and Feletti (1997) contributed to the body of knowledge significantly with their book titled *"The Challenge of Problem Based Learning"*. The authors discussed that there are several practical issues that impede PBL's efficiency and effectiveness. These issues are student evaluation, age and experience of students, content to be learned, and resources available. The authors describe another significant barrier to PBL effectiveness in the education and support of faculty in the role of facilitator or tutor. The authors describe the need for an extensive student induction into the processes of PBL (Boud & Feletti, 1997)

Several PBL studies indicate a need for induction or orientation to SDL in order for students to be academically successful (Boud & Feletti, 1997; Kreber, 1998; Albanese & Mitchell, 1993; Miflin et al., 1999). Most authors agree that students have a difficult time with the transition from lecture-based learning to PBL and needed a period of induction and orientation to the processes of how to become a self directed learner (Boud & Feletti, 1997; Miller, 2000: Patel, 1998, Ramsey & Couch, 1994; Hughes, 1999).

Extensive research has been done in order to compare PBL with traditional lecture-based curricula (Miller & Schwartz, 2000; Deretchin & Contant, 1999; Breton, 1999; Antepohl & Herzig, 1999). The research findings regarding academic outcomes are mixed and inconclusive. There are no clear implications for superior knowledge acquisition or recall for either PBL or traditional teaching methodologies. Therefore, the research findings have made little impact on clarifying the academic outcomes of a PBL program versus traditional methodology in terms of students' ability to adopt self directed learning strategies.

Numerous studies in PBL research have evaluated students for their perceptions of the PBL programs' organisation, view on faculty/tutors, process, and overall satisfaction (Steel et al., 2000; Miflin et al., 1999; Warburton & Whitehouse, 1998; Albanese & Mitchell, 1993). The current study seeks to provide data in the area of impact of a PBL curriculum on students' perceptions about SDL.

Furthermore, the vast majority of PBL research has centered on the 25 year old and older age group student. No study has targeted the young adult learner, ages 18 to 25, regarding SDL in conjunction with PBL. The current study has provided valuable data regarding student age in relationship to the PBL teaching methodology.

Definitions

The operational terms and definitions utilised for the purpose of this study have been developed to describe background information, relate the significance of the research, and identify concepts under investigation. The terminology definitions provide the necessary consistency for collecting, developing, and analysing data.

Setting

The setting for the study is a School of Pharmacy located in the United States of America in a southern state. The curriculum structure in the setting has been developed and implemented according to the definitions and prescribed structure as noted by Dr. Howard Barrows (Barrows, 1985 and 1994; Sweeney, 1999). The School of Pharmacy's academic reputation for the utilisation of a PBL curriculum served as the impetus for using this setting in the current study.

Procedures

The design for the study is a pretest, posttest, and posttest measures for one group of 73 students enrolled in a PBL curriculum in a School of Pharmacy. The required university Institutional Review Board approvals were sought and granted. At the beginning of the study the convenience sample of 73 subjects received the pretest five days before beginning the PBL curriculum. The pretest was administered by the researcher during student orientation to the PBL curriculum. All 73 subjects returned the pre-test questionnaire.

Posttest 1 was administered to the same group of 73 subjects after eight weeks of experience in a PBL curriculum. Sixty-eight subjects returned posttest 1 for a return rate of 93 percent.

Posttest 2 was again administered to the same 73 subjects at the end of 16 weeks of a PBL curriculum. Sixty-eight subjects returned posttest 2 for a return rate of 93 percent.

Posttest 1 and 2 administrations of the questionnaire were distributed with a cover letter through the internal routing system within the school and returned in the same manner. Potential subjects were informed in the cover letter that completing the questionnaire and mailing it to the investigator in the self-addressed return envelope constituted an implied consent to participate in the study.

Subjects

The subjects included all students entering the fifth year class of the School of Pharmacy that was totally PBL in the curriculum design. The average age of the participants was 23.5 years old with the median age being 22 years old. The age range of subjects was from 21 to 51 years old. The sample was predominately female (78%) with sixteen males (22%). The dominate race for the sample was Caucasian, with 59 subjects (80%), seven African American subjects (10%), and seven Asian subjects (10%).

Methods of measurement

Data were collected using the Self-Directed Learning Readiness Scale (SDLRS-A) developed by Lucy M. Guglielmino (1977) at the University of Georgia through her dissertation research. The SDLRS-A is a 58-item, five point Likert scale instrument that measures a total score for self directed learning readiness. The instrument has been used to explore relationships between an individual's characteristics and SDL readiness as well as to determine an individual's perceptions of importance regarding readiness and ability to conduct SDL.

The instrument was selected due to extensive empirical testing and the nature of the design. Guglielmino's (2000) most recent report stated that the SDLRS-A has been used in over 70 dissertations and was the most widely used instrument for the assessment of readiness for SDL. There are four versions of the scale: (a) SDLRS-A, the adult version of the scale that has been translated into over 12 foreign languages and has been used for general adult populations, (b) SDLRS-ABE, for adults with low reading levels or non-narrative English speakers with 34 items on the questionnaire, (c) SDLRS-E, for children under the age of 18 with 58 items on the questionnaire, and (d) SDLRS-S, the learning preference assessment which is a self-scoring, immediate feedback version for the general adult population. The SDLRS-A Adult Version was selected for the study due to the age appropriateness of the sample and the extensive reliability and validity testing of that particular version.

Guglielmino's (1977) dissertation research found the reliability coefficient for the SDLRS-A of 0.87. Guglielmino and Murdick (1997) used the instrument in business research and reported that revised reliability estimates are now at .91 using a Spearman-Brown correction for the Pearson product moment correlation.

Construct validity has been established empirically as well. Item-to-item correlations have been tested for all 58 items by Long (1998), and Brockett & Hiemstra (1991).

However, the SDLRS-A has endured controversy regarding validity and reliability. Field (1989) identified three items on the questionnaire that had internal consistency problems and failed to obtain a 0.3 correlation coefficient. Guglielmino (1989) responded to Field's criticism with additional empirical evidence of a 0.30 or higher internal consistency for each item. Brockett (1991) also supported the difference in reliability estimates as significant and called for a revision of the instrument. The results of the controversy have yielded conclusions from various authors to use the instrument on a case by case method and to continue to use discretion with scientific interpretations (Brockett & Heimstra, 1991; Candy, 1991).

The 58-item SDLRS-A asks subjects to rate how important or relevant to their current learning did they perceive each item to be. Subjects were asked to rate each item on a five item scale (1 = almost never true of me; 2 = not often true of me; 3 = sometimes true of me, 4 = usually true of me; 5 = almost always true of me).

The first rating occurred within the first week of orientation to the PBL program and immediately prior to the beginning of Block I of the PBL curriculum. The second rating occurred at the end of the first eight week block. The final rating occurred at the end of the second eight week block which represented 16 weeks of the PBL curriculum.

Statistical analysis

Descriptive summary statistical measures including frequency counts, percentages, and measures of central tendency appropriate to the type of data collected were used to analyse the demographic attributes. Specific statistical tests applied include the t-test for independent groups. The SDLRS-A score was identified for each subject during each administration of the instrument. The score served as the covariant in the statistical procedures. SPSS for Windows (1999) computer software system was used for computing all indices.

Research hypothesis

There is a significant change in student perceptions about self directed learning as a result of 16 weeks in a Problem Based Learning curriculum

Null hypothesis

H_0: There is no significant change in student perceptions about self directed

learning as a result of 16 weeks in a Problem Based Learning curriculum.

Findings

Each of the three administrations of the instrument have been analysed independently. The data from each administration was then compared with subsequent administrations. Descriptive summary measures regarding the paired samples are reported in Table 1.

Table 1: Paired samples statistics

	Mean	N	Std. Deviation
Pair SDLPRE 1 SDLPOST1	223.55 214.4247	73 73	21.60 28.08
Pair SDLPRE 2 SDLPOST2	223.22 212.54	68 68	22.28 31.52
Pair SDLPOST1 3 SDLPOST2	216.11 212.54	68 68	27.82 31.52

Descriptive summary measures and Paired Samples Test analysis indicate a statistically significant nine-point decline in the mean scores for all subjects from the pretest to posttest 1 ($p < .018$). An 11-point statistically significant decline in the mean scores also occurred from the pretest to posttest 2 ($p < .007$) (Table 2). Thus, the null hypothesis was rejected.

Table 2: Summary paired samples test

SDLPRE-SDLPOST1

Source	t	df	Sig. (2-tailed)
2.421	72	.018*	
SDLPRE-SDLPOST2	2.791	67	.007*
SDLPOST1-SDLPOST2	.772	67	.443
*p<.05			

The data indicate a statistically significant decrease in SDLRS-A scores for all subjects from the pretest to posttest 1 ($p < .018$). There was an observable difference in mean scores of nine points (+/- sd 32) with confidence intervals ranging from two to 17. There was also a statistically significant decrease ($p <.007$) of 11 points (+/- sd 32) in mean scores with confidence intervals ranging from

three to 18, from the pretest to posttest 2.

The data indicate no significant difference in mean scores from posttest 1 to posttest 2 with $p < .443$ (+/- sd 38). Although there continued to be a three-point decline in mean scores, it was not determined to be statistically significant.

Limitations

The following limitations apply to the study:

1. Only a specific group of students, who met the admission criteria and completed the plan of study to be a fifth year Pharmacy student (P-5), were included. A student obtained the P-5 status after satisfactory completion of two years of prerequisites at any institution of higher learning and two years of pre-pharmacy courses at the university campus. The P-5 year is a two semester, four block, PBL curriculum, and is the only course taken during this academic year. The successful completion of each of the four blocks is required before a student moves to the sixth Pharmacy year (P-6) of clinical pharmacy. The terminal degree awarded is a Doctor of Pharmacy.

2. The study was further limited due to the use of a convenience sample of students who agreed to participate.

3. A self-report reflects only what the subject is willing to disclose to the questions being asked on the SDLRS-A.

4. Students who were absent or withdrew from the study or program on the day of the posttest administrations were excluded from the study. Six percent of the sample was excluded from the study as a result of withdrawal from the program.

Discussion

The findings in the study reflect that students have difficulty maintaining their perceived ability to perform SDL and their perceived importance of SDL in a PBL curriculum. The results of the study indicate that the teaching methodology of PBL initially diminishes students' perception in their confidence and ability of students to perform SDL. The first eight weeks are the most critical in terms of students' decline in their perceived ability to perform SDL. The study supports that diminished student confidence levels continue for up to 16 weeks in a PBL curriculum.

Therefore, if it is known that the introduction to a PBL curriculum will initially dramatically diminish students' perception about their ability to perform SDL, then it is essential to determine why that occurs and how to assist students to overcome the potentially incapacitating effect.

In order to determine why diminished student confidence occurs with PBL, it was imperative to look to the literature. According to the research literature, two elements may be most responsible for the diminished, perceived capacity of students to perform and value SDL in a PBL curriculum . These elements include evaluation methods, and student preparedness or readiness for SDL (Lowery, 1989, Ryan, 1993, & Taylor & Burgess, 1995; Warburton & Whitehouse, 1998; Boud & Feletti, 1997).

According to Lowery (1989), the motivation for self directed learning is dependent upon the individual learner being in control of the methods, resources, and evaluation for learning. He stated that 90% of all learning is derived from the individual's self direction in learning and only if the individual is in charge of the resources and evaluations can SDL take place (Lowery, 1989).

Boud and Feletti (1997) state that the typical student evaluation methods in PBL curricula are tutor, peer and self-ratings. The authors also state that computer-based exams, essay exams, and short-answer exams are commonly used as methods of evaluating student learning. Each type of evaluation method has barriers in terms of measuring knowledge acquired by the student. The authors also note that the type and timing of exams greatly influence students' outcomes and success (Boud & Feletti, 1997). The PBL curriculum in the present study has rigorous evaluation criteria in place that remains outside the control of the student. Each eight week block has a mid-block content exam that is given during the fourth week. At the end of each block, students are given another content exam, a case exam and an in-group performance grade to comprise quality points for the grade point average for the semester. Each exam is developed by the facilitators for that block and are designed to mirror the unfolding case scenarios presented during the block. The facilitators outline specific criteria for each question and assign points for correct answers.

A mid-block content examination was given on week four which was three weeks prior to the administration of posttest 1. At that time, nineteen students were placed in academic jeopardy due to failure of this exam. Five students eventually withdrew from the program as a result.

Students had experienced two blocks of PBL by the time posttest 2 was administered. At the end of 16 weeks, several students were once again in academic jeopardy and experiencing anxiety due to potential failure of the program.

The failure to meet the established evaluation criteria impacted the students' perception of their ability to perform self directed learning within the context of PBL. The rigorous evaluation criteria and numerous student failures had significant impact on the students' perceptions of their ability to perform self directed learning and therefore impacted the current study. One other element potentially responsible for the difficulty with students maintaining their

perceived ability to perform SDL involves student readiness or preparedness for SDL.

The majority of subjects (96%) are considered young adult learner between the ages of 18 to 25. Age may be a factor in students' perceived ability and value of self directed learning in a PBL curriculum because they may not be prepared to master the principles and processes of SDL expected in a PBL curriculum.

Ryan (1993) conducted a study where 90% of the subjects in a graduate nursing program were over the age of 25. Based on that study Ryan (1993) concluded that PBL, as a teaching methodology, enhanced graduate student performance in SDL. Ryan (1993) further concluded that PBL provided a highly supportive learning environment and students' perceived ability to perform SDL improved over the course of a semester. Students in Ryan's study perceived SDL to be important and that perception of importance increased over the course of a semester for one course designed as PBL. The data from the present study did not support Ryan's (1993) findings.

The data from the present study indicate that students experience a statistically significant decline in their perceived ability to perform SDL and their perception of the importance of SDL in a PBL curriculum. In comparison to Ryan's (1993) study, this study indicated that the subjects may not be as prepared for SDL within the context of a PBL curriculum as the over 25 year old student. In addition, Ryan's (1993) study did not include the evaluation measures that may have impacted the results.

SDL readiness continues to be an essential component for a study by Patel (1998). Patel (1998) concludes that there is no evidence that supports PBL as more powerful teaching methodology than traditional methods of learning. Patel (1998) states that PBL assists students to acquire knowledge that is relevant and can be recalled readily in the performance of clinical skills. Students' perceptions, measured by way of an open-ended questionnaire, indicate that st udents in the PBL group scored as low as the traditional group regarding their knowledge acquisition and clinical reasoning ability (Patel, 1998). Based on the findings, Patel recommended additional research to determine students' readiness for SDL.

The present study provides data regarding student readiness for SDL as measured by the SDLRS-A questionnaire. In addressing student readiness, the element of questionnaire bias was considered. Students in the current study may have responded to the pretest with higher scores because they were responding to what they perceived to be important or expected, since they were enrolled at a University. Students may have experienced the "Hawthorne Effect" and have higher pretest scores because they are being asked about SDL. They may have also respond with higher scores on the pretest based on their perceptions regarding traditional teaching methodologies with which they are more familiar. The higher pretest scores may have been misleading in terms of assessing student

preparedness or readiness for performing SDL because students have an inflated view of their abilities.

Students in the current study came from a traditional teaching methodology background and presented on the pretest with a high level of perceived ability to perform SDL. However, the results of the current study indicates that a PBL curriculum diminishes students' perceptions of their ability to perform SDL and their perceived importance of SDL within a 16-week period.

Another potential questionnaire bias may have resulted from repeated administrations of the same questionnaire. Increased familiarity with the questions may have altered students' responses regarding their perceived ability to perform SDL and their perceived value of SDL.

The findings from the present study reflect that the initial eight weeks of a PBL curriculum are the most critical in terms of formulating and supporting student perceptions regarding SDL. As a method of supporting student readiness and preparedness for SDL, Taylor and Burgess (1995) identified four essential areas for student orientation to the processes of SDL. The areas are the lecturer's expectations toward SDL, the role of the facilitator, how to learn in groups, and how to manage time. The current study indicates that a significant decline in student perceptions regarding their ability to perform SDL and their perceived importance of SDL occur within the first eight weeks and continued to decline at the end of 16 weeks. It may be that this decline in student perceptions is from inadequate orientation to the processes of SDL that results in decreased student readiness or preparedness to perform SDL within the confines of a PBL teaching methodology.

Implications

Academicians need to consider strategies to support students' induction into the processes of PBL to enhance student readiness for SDL. Based upon the findings from this experimental research, the following recommendations are provided.

First, it is recommended that critical analysis of the internal structures of the PBL curriculum be evaluated to determine what impact the evaluation methods may have on students_ confidence levels. Including students in the development of the evaluation methods and evaluation outcomes would be invaluable to support students in the SDL processes.

Secondly, it is recommended that academic administrators seek methods of supporting students, particularly in the first eight weeks, with extensive orientation and induction to the processes of SDL within the PBL curriculum. According to Taylor and Burgess (1995) there are essential elements that enhance the induction process. These elements include: expectations of the broad content areas from experts in the field; clearly defined roles of students and faculty;

expertise of the facilitator; direction for how to learn in a group; group management skills; personal time management strategies (Taylor & Burgess, 1995). These identified strategies will serve to foster successful student orientation and induction into preparedness for SDL within a PBL curriculum.

PBL is a highly acclaimed, efficient, and effective teaching methodology that places the student in control of his or her own learning. With the changing infrastructure of institutions of higher learning, PBL will become an even more valuable and efficient method of teaching. Based on the current study, implementing the recommendations to a PBL curriculum could make a significant difference for student success as well as the educational environment.

Further study

The present study was conducted over the course of 16 weeks of one academic semester. In order to determine the long range effect of the PBL curriculum on students' perceptions of SDL it may be beneficial to continue to measure the effects over the remaining year of the PBL curriculum and again at the end of the clinical year. The students' perceptions regarding ability to perform SDL may change over extended time and may change once the knowledge gained through PBL has been applied to clinical practice.

The current study should be repeated in terms of assessing students' ability to problem solve. Instruments that identify students' perceptions regarding problem solving ability and clinical competency measures should be developed and empirically tested.

The current study should be repeated with qualitative data incorporated to determine specific attributes of students' perceptions regarding the initial PBL experience and what specific needs or problems students identify.

In order to determine if particular nuances exist regarding the PBL curriculum in the current study, the study should be replicated at another institution with a PBL curriculum. Comparison data may provide more insight into the internal structures of the PBL curriculum that may have impacted the current study.

It is also recommended that future study be directed toward comparing the young adult learner (ages 18-25) to the older adult learner (ages 26 and above) in terms of the SDLRS-A scores in a PBL curriculum. Determination of whether PBL is a suitable and appropriate teaching methodology for the young adult learner is essential for students, the learning environment, and institutes of Higher Learning.

Summary

The implications of this study must be viewed with caution since the sample was

one of convenience, and the results can only be generalised to students in a particular PBL curriculum. The findings indicate that students have great difficulty maintaining their perceived ability to perform SDL and their perceived value of SDL in the context of a PBL curriculum. Academicians need to enact strategies to support students' induction into the processes of SDL in order to enhance student success in a PBL curriculum.

This study is one of the first to explore the effects of PBL as a teaching methodology in relationship to self directed learning. The current study provides groundwork for additional research to enhance SDL for students and to provide valuable insight and guidance for academicians in developing PBL curricula.

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Print version errata: Delete references to Appendix A and Appendix B on page 88. Appendix A and Appendix B were not required for the published version of this article.