Self-directed learning during problem-based learning sessions

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Abstract

Purpose: The study aimed to obtain student perceptions about the influence of problem-based learning on self-directed learning skills among undergraduate basic science medical students.

Methods: A cross-sectional study was conducted among first to sixth-semester undergraduate medical students during the last week of July 2016. A previously used instrument was used after obtaining written permission from the developers. The data was analyzed using statistical package for social sciences version 20. The free text comments were tabulated.

Results: Fifty-two of the 90 students (58%) participated. The majority of respondents were between 20 to 30 years of age, and of either American or Canadian nationality. The gender distribution was nearly equal. The mean self-management of learning, independent pursuit of learning, learner control of instruction and personal autonomy scores were 2.95, 2.94, 2.98 and 2.87 (maximum possible score being 4). There were no significant differences in the mean domain scores according to age group, gender, and nationality of respondents.

Conclusion: Respondents in the present study showed good scores on most statements related to the four dimensions of self-directed learning. Due to the hybrid nature of the curriculum and due to lectures being the dominant teaching-learning strategy, students may have devoted less effort and time to the PBL topics.

Keywords: Caribbean region; medical students; problem-based learning; self-directed learning

Introduction

There are only a few studies in the literature about problem-based learning (PBL) sessions at Caribbean medical schools. Most articles report a hybrid version of PBL with the sessions being used to supplement and strengthen student learning with didactic lectures continuing to be the major teaching-learning strategy (Vuma & Sa, 2015;
Shankar et al., 2014a, Shankar et al., 2014b; Alleyne et al., 2022). Through PBL students assume increasing responsibility for their own learning and strengthen their self-directed learning (SDL) skills. SDL is becoming increasingly important in medical education considering the information explosion in medicine and the constant need to stay abreast of new developments. SDL was described by Malcolm Knowles, one of the pioneers of adult learning as the process in which individuals take the initiative to identify their learning needs, formulate learning objectives, choose appropriate learning strategies and evaluate learning outcomes with or without the help of others (Knowles, 1975). Previous studies have shown that PBL students have better SDL skills and adopt a deep approach to learning compared to their counterparts in traditional curricula [Distlehorst et al., 2005; Loyens et al., 2008; Abraham et al., 2008).

During the brainstorming phase of PBL students are engaged in SDL as they understand the case, and identify and refine their learning objectives and during the self-study phase students actually decide what to learn, to what depth, and how to learn. The tutorial (small) group discussion and the individual learning process has an important role in structuring student learning (van den Hurk et al., 2001). The self-directed learning readiness scale (SDLRS) originally developed for use among nursing students was validated among medical students (Hendry & Ginns, 2009). A study conducted in a medical school in Nepal which follows a partly problem-based curriculum showed that certain aspects of SDL increased at the end of the first year (Shankar et al., 2011). Candy defined four dimensions of SDL which are personal autonomy, self-management in learning, independent pursuit of learning and learner control of instruction (Candy, 1991). Personal autonomy (PA) is concerned with freedom of choice and the ability of students to realistically appraise their shortcomings as a learner. Self-management in learning (SML) refers to the willingness and ability of students to manage their own learning while learner control of instruction (LI) refers to students' control over aspects of the instructional situation. Independent pursuit of learning (IPL) is concerned with learning occurring outside formal educational settings. Recently the extent to which PBL influences the attributes of SDL using the four dimensions described by Candy was studied in a medical school in India (Abraham et al., 2016).

Xavier University School of Medicine (XUSOM) is a private medical school located in Aruba, Dutch Caribbean admitting students from the United States (US), Canada and other countries to the undergraduate medical (MD) course. Though most students are US or Canadian citizens the majority are of Asian descent. There are three student intakes a year in January, May, and September. Students complete the first two years of the course in Aruba and then do their clinical rotations in affiliated hospitals in the US and Canada. The school has been following an integrated organ system-based curriculum with early clinical exposure from January 2014 [2]. The school follows a hybrid curriculum and interactive lectures are the major teaching-learning strategy. PBL sessions are conducted during each organ system except during the first system of fundamental concepts during which the newly admitted students are introduced to PBL. Like in most other institutions, there is a brainstorming session followed by a presentation/discussion session. These sessions are separated by a week. The process of PBL in the institution has been described previously (Shankar et al., 2014). As PBL is only one of the learning strategies we were not sure to what extent SDL is facilitated during PBL among students. Hence the present study was carried out using an instrument which had been validated in a previous study [12]. The scores along the four dimensions of SDL were compared among respondents according to their age group, gender, and nationality.

**Methods**

**Study design:** Students' perception regarding SDL during the PBL sessions was studied during the last week of July 2016 using an instrument developed by Abraham and coworkers (Abraham et al., 2016) after obtaining written permission from the developers. The study was conducted among the basic science undergraduate medical students from the first to the sixth semester. All students willing to participate in the study after providing written informed
consent were included.

**Materials and/or Subjects:** Respondents' perception regarding SDL during PBL sessions was studied using a questionnaire developed by Abraham et al as mentioned previously. The questionnaire had eighteen items based on the SDL model developed by Candy. The dimensions of SDL considered were self-management of learning (SML), personal autonomy (PA), independent pursuit of learning (IPL) and learner control of instruction (LI). The questionnaires were distributed among the respondents and the class representative was given the responsibility of collecting the completed responses from the students. For each statement respondents were asked to indicate their degree of agreement using a four-point Likert scale ranging from 1= strongly disagree to 4= strongly agree with the statement. For the first four statements, respondents were also requested to provide the reasons for their choice.

**Statistics:** Age, gender, nationality and semester of study of the respondents were noted. The frequency of different subgroups of respondents was noted. Statistical Package for Social Sciences version 20 for windows was used for the data analysis. The scores along the four dimensions of SDL were compared according to the age group, gender, and nationality. A p value of less than 0.05 was taken as statistically significant. The statements were grouped into the four dimensions of SDL mentioned previously. Mean and standard deviation were calculated for the individual statements and for the four SDL domains. The normality of distribution of the mean scores for the four SDL domains was compared using one-sample Kolmogorov-Smirnov test. The free text responses were grouped together into themes and the number of respondents mentioning each theme was noted.

**Ethical approval:** Students were explained the aims and objectives of the study and invited to participate. It was emphasized that participation in the study was voluntary and respondents were free not to participate. Written informed consent was obtained from all the study participants. The study was approved by the institutional review board of the institution vide notification XUSOM/IRB/2016/03.

**Results**

Fifty-two of the total of 90 students (58%) participated. Table 1 shows the demographic characteristics of the respondents. Table 2 shows the mean scores for various items in the questionnaire and also the mean score for the four SDL domains. The mean scores for the four SDL domains were noted to be normal on carrying out the one sample KS test. The mean scores for the following statements were greater than 3: ‘I take more responsibility in learning a PBL topic compared to a lecture topic’, ‘I effectively manage my time while studying for a PBL topic in order to be optimally prepared for the presentation session when compared to a lecture topic’, ‘In a PBL session, I get immediate feedback from the facilitator. So I can monitor whether my preparation was sufficient enough or not. In this way I can manage my learning more effectively’, ‘After the presentation session, I evaluate myself whether the preparation was sufficient enough to get a better understanding of the topic.’, ‘I feel that compared to my earlier PBL sessions s, now I am more self-reliant’, ‘I have control over my learning in PBL, as I myself plan, monitor and evaluate my learning’, ‘During the study period in PBL (one week between brainstorming and presentation sessions), I indulge in collaborative learning with my peers’, ‘In PBL, I utilize my freedom to learn beyond the learning objectives by referring learning resources (websites, books) other than those recommended by the facilitator’, and ‘While learning a PBL topic, I try to correlate the content with the content of other subjects’.

Table 3 shows the most common reasons mentioned by the respondents for the statement numbers 1 to 4. There was no significant differences in the mean SML, IPL, LI and PA scores among different subgroups of respondents according to age group, gender, and nationality. As some of the semesters had a low response rate we did not
compare mean scores along the four dimensions of SDL according to the semester of study.

**Discussion**

This manuscript examines the indirect influence of PBL on SDL skills of medical students using the same instrument like in a previous study (Abraham et al., 2016). Like in the previous study Candy's SDL model was used. Studies have shown that context has an important influence on learning. The medical school learning environment and its impact on student learning was studied at a US medical school (Shochet et al., 2013). Most students rated the learning environment as exceptional, good or fair and students rated positive events as having the highest impact. Student learning strategies are influenced by instructional context and the use of various learning strategies by students do change over time (Delva et al., 2000). PBL as a learning context may foster the development of SDL skills which can support students’ lifelong learning and their ability to adapt to the changing circumstances of medical practice (Barrows & Tamblyn, 1980).

Like in the study conducted at the medical school in India, students in the present study seem to possess skills in all four aspects of SDL. Our score in the domain of SML was higher than that reported in the Indian study. Our students reported lower scores for the statement about learning a PBL topic being more stressful than learning a lecture topic and about spending more time preparing for PBL sessions. In a hybrid curriculum sometimes students use lecture power point slides of faculty members either from the present or previous semesters to guide their PBL presentation and discussion. This may however have the undesired effect of reducing literature search and interpretation by students and may impact the SDL occurring during PBL. There were also differences in the scores of individual statements under this dimension.

The scores in the present study were also higher in the IPL dimension. In the Indian medical school the authors did mention shortcomings with regard to discussion within the PBL group (Abraham et al., 2016) Small group effectiveness during PBL sessions was studied at XUSOM, Aruba during September 2013 during the early days of PBL at the institution (Shankar et al., 2014b). Students’ perception about small group effectiveness was positive with good cognitive and motivation scores and low de-motivational scores. However, problems were sometimes noted in group functioning and dynamics with some individuals not getting along and some students had the perception that their team members were not contributing adequately to the group functioning. During informal discussions with students and based on our observations we found that group members are increasingly using social media to stay in touch and coordinate group activities during the time between brainstorming and presentation. Also students get the opportunity to interact during class hours and even after school.

The score in the LI dimension was higher than that reported in the Indian study (Abraham et al., 2016). Student involvement in learning and in design and implementation of the curriculum is one of the criteria assessed by different accreditation agencies in the Caribbean and we obtain student feedback about different systems covered during different semesters and during this process also obtain feedback about PBL. Some students are members of the curriculum committee of the institution. During the last three years we are actively trying to promote SDL among students and during training sessions for faculty it is emphasized that group facilitators should not act as information providers and should concentrate on the group dynamics and processes.

However, the PA scores were higher in the Indian study. The scores were lower for statements dealing with time and effort spend on preparing for a PBL topic. The scores in the present study for statements dealing with reflection and for correlating the content with the content of other subjects was higher. The process of reflection is important for structuring SDL during PBL (Silen & Uhlin, 2008). They mention that the process of reflection helps students...
acquire new ‘informed eyes’ and obtain a better understanding of the problem. Metacognitive analysis of the learning process is important for creating a sense of ownership of learning.

The study had limitations. Only 52 of the total of 90 students (58%) participated. Student perceptions was studied only by using a questionnaire. The questionnaire was used in a previous study (Abraham et al., 2016). The questionnaire was developed after a thorough literature review and was validated by faculty members of the Indian institution. The questionnaire was however, not pretested.

**Take Home Messages**

The present study shows good scores on most statements related to the four dimensions of SDL put forward by Candy. Due to the hybrid nature of the curriculum and due to lectures being the dominant teaching-learning strategy, students may have devoted less effort and time to the PBL topics. The process of reflection and of correlating various subjects seems to be occurring satisfactorily.

**Notes On Contributors**

Dr. Pathiyil Ravi Shankar is Assistant Dean for Medical Education and Chair of the Curriculum Committee at the institution. His areas of research interest include small group learning, active learning strategies, and self-directed learning.

Dr. Atanu Nandy is Assistant Dean for Student Affairs and a member of the Curriculum Committee at the institution. He is the Chair of problem-based learning. His areas of research included problem-based learning and self-directed learning.

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**Bibliography/References**

Abraham, R.R., Pallath, V., Kamath, G., Kamath, A., & Ramnarayan, K. (2008). Learning approaches of undergraduate medical students to physiology in a non-PBL- and partially PBL-oriented curriculum. Advances in Physiology Education, 32:35–37.

[http://dx.doi.org/10.1152/advan.00063.2007](http://dx.doi.org/10.1152/advan.00063.2007)

Abraham, R.R., Hassan, S., Damanhuri, M.U.A., & Salehuddin, N.R. (2016). Exploring students' self-directed learning in problem-based learning. Education in Medicine Journal, 8:15-23.
Alleyne, T., Shirley, A., Bennett, C., Addae, J., Walrond, E., West, S., & Pinto Pereira, L. (2002). Problem-based compared with traditional methods at the Faculty of Medical Sciences, University of the West Indies: a model study. Medical Teacher, 24:273-9.

http://dx.doi.org/10.1080/01421590220125286

Barrows, H.S., & Tamblyn, R. (1980). Problem-based learning: an approach to medical education. New York (NY): Springer. Publishing company, 205 p.

Candy, P.C. (1991). Self-direction for lifelong learning: a comprehensive guide to theory and practice. San Francisco (CA): John Wiley & sons; 587 p.

Delva, M.D., Woodhouse, R.A., Hains, S., Birthwhistle, R.V., Knappe, r C., & Kirby, J.R. Does PBL matter? Relations between instructional context, learning strategies, and learning outcomes. Advances in Health Sciences Education: Theory and Practice, 5:167-177.

Distlehorst, L.H., Dawson, E., Robbs, R.S., & Barrows, H.S. (2005). Problem-based learning outcomes: the glass half-full. Academic Medicine, 80:294–299.

http://dx.doi.org/10.1097/00001888-200503000-00020

Hendry, G.D., & Ginns, P. (2009). Readiness for self-directed learning: Validation of a new scale with medical students. Medical Teacher, 31:918-920.

http://dx.doi.org/10.3109/01421590802520899

Knowles M. (1975). Self-directed learning: a guide for teachers and learners. Chicago (IL): Follett publishing company; 135 p.

Loyens, S.M.M., Magda, J., & Rikers, R.M.J.P. (2008). Self-directed learning in problem-based learning and its relationships with self-regulated learning. Educational Psychology Reviews, 20:411– 427.

http://dx.doi.org/10.1007/s10648-008-9082-7

Shankar, P.R., Bajracharya, O., Jha, N., Gurung, S.B., Ansari, S.R., & Thapa, H.S. (2011). Change in medical students' readiness for self-directed learning after a partially problem-based learning first year curriculum at the KIST Medical College in Lalitpur, Nepal. Education for Health, 11:552.

Shankar, P.R., Balasubramanium, R., Dwivedi, N.R., & Nuguri, V. (2014a) Student feedback about the integrated curriculum in a Caribbean medical school. Journal of Educational Evaluation for Health Professions, 11:23. doi: 10.3352/jeehp.2014.11.23. eCollection 2014.

http://dx.doi.org/10.3352/jeehp.2014.11.23

Shankar, P.R., Nandy, A., Balasubramanium, R., & Chakravarty, S. (2014b). Small group effectiveness in a Caribbean medical school's problem-based learning sessions. Journal of Educational Evaluation for Health Professions, 11:5.

http://dx.doi.org/10.3352/jeehp.2014.11.5
Shochet, R.B., Colbert-Getz, J.M., Levine, R.B., & Wright, S.M. (2013). Gauging events that influence students' perceptions of the medical school learning environment: findings from one institution. Academic Medicine, 88:246-52.

http://dx.doi.org/10.1097/ACM.0b013e31827bfa14

Silen, C., & Uhlin, L. (2008). Self-directed learning – a learning issue for students and faculty! Teaching in Higher Education, 13:461–475.

http://dx.doi.org/10.1080/13562510802169756

Van Den Hurk, M.M., Dolmans, D.H.J.M., Wolfhagen, I.H.A.P., & Van Der Vleuten, C.P.M. (2001). Testing a causal model for learning in a problem-based curriculum. Advances in Health Science Education Theory and Practice, 6:141–149.

http://dx.doi.org/10.1023/A:1011402507476

Vuma, S. & Sa, B. (2015). Evaluation of the effectiveness of progressive disclosure questions as an assessment tool for knowledge and skills in a problem-based learning setting among third-year medical students at The University of The West Indies, Trinidad and Tobago BMC Research Notes, 8:673.

http://dx.doi.org/10.1186/s13104-015-1603-0

Appendices

Table 1: Respondents' demographic characteristics

| Characteristic     | Number (percentage) |
|-------------------|---------------------|
| Age (in years)    |                     |
| Less than 20      | 3 (5.8)             |
| 20-30             | 43 (82.7)           |
| Greater than 30   | 5 (9.6)             |
| Gender            |                     |
| Male              | 26 (50.0)           |
| Female            | 24 (46.2)           |
| Nationality       |                     |
| American          | 23 (44.2)           |
| Canadian          | 15 (28.8)           |
| Others            | 10 (19.2)           |

* The numbers may not add to 52 and the percentage to 100 as some respondents did not complete all demographic information

Table 2: Mean scores for individual statements and the mean domain scores
### Domains and Items

| Domains and items                                      | Mean scores |
|--------------------------------------------------------|-------------|
| **Self-management of learning (SML)**                  |             |
| Learning a PBL topic is more stressful than learning a lecture topic. | 2.67        |
| I spend more time in studying a PBL topic compared to a lecture topic. | 2.79        |
| I put more effort to study a PBL topic compared to a lecture topic. | 2.83        |
| I take more responsibility in learning a PBL topic compared to a lecture topic. | 3.20        |
| In a lecture class, I feel I don't have much freedom to express my ideas. But in a PBL session, I have more freedom. So in this way, I feel I have control over my learning in a PBL environment compared to that of a lecture class. | 2.80        |
| In a PBL session, doubts are clarified at once. But in a lecture class, sometimes I have to meet the teacher later and get my doubts clarified. So I can manage my learning more easily in PBL compared to a lecture. | 2.61        |
| I effectively manage my time while studying for a PBL topic in order to be optimally prepared for the presentation session when compared to a lecture topic. | 3.09        |
| In a PBL session, I get immediate feedback from the facilitator. So I can monitor whether my preparation was sufficient enough or not. In this way I can manage my learning more effectively. | 3.31        |
| For learning a PBL topic, I refer *recommended books* and therefore I manage my learning during the study period of PBL. | 2.90        |
| For learning a PBL topic, I refer *books other than recommended books* and therefore I manage my learning during the study period of PBL. | 2.65        |
| After the presentation session, I evaluate myself whether the preparation was sufficient enough to get a better understanding of the topic. | 3.08        |
| In PBL, I am the initiator of the learning task. That means I know what needs to be learned. | 2.94        |
| *I feel that compared to my earlier PBL sessions s, now I am more self-reliant* | 3.25        |
| I have control over my learning in PBL, as I myself plan, monitor and evaluate my learning. | 3.31        |
| During the study period in PBL (one week between brainstorming and presentation sessions), I indulge in collaborative learning with my peers. | 3.06        |
| **Independent pursuit of learning (IPL)**               |             |
| For learning a PBL topic, I refer *recommended books* and therefore I manage my learning during the study period of PBL. | 2.90        |
| For learning a PBL topic, I refer *books other than recommended books* and therefore I manage my learning during the study period of PBL. | 2.65        |
| In PBL, I utilize my freedom to learn beyond the learning objectives by referring learning resources (websites, books) other than those recommended by the facilitator. | 3.02        |
During the study period in PBL (one week between brainstorming and presentation sessions), I indulge in collaborative learning with my peers. 3.06

While learning a PBL topic, I try to correlate the content with the content of other subjects. 3.06

| Learner control of instruction | 2.98 |
|-------------------------------|------|
| In a lecture class, I feel I don’t have much freedom to express my ideas. But in a PBL session, I have more freedom. So in this way, I feel I have control over my learning in a PBL environment compared to that of a lecture class. | 2.80 |
| In a PBL session, doubts are clarified at once. But in a lecture class, sometimes I have to meet the teacher later and get my doubts clarified. So I can manage my learning more easily in PBL compared to a lecture. | 2.61 |
| In a PBL session, I get immediate feedback from the facilitator. So I can monitor whether my preparation was sufficient enough or not. In this way I can manage my learning more effectively. | 3.31 |
| For learning a PBL topic, I refer *recommended books* and therefore I manage my learning during the study period of PBL. | 2.90 |
| For learning a PBL topic, I refer *books other than recommended books* and therefore I manage my learning during the study period of PBL. | 2.65 |
| After the presentation session, I evaluate myself whether the preparation was sufficient enough to get a better understanding of the topic. | 3.08 |
| In PBL, I am the initiator of the learning task. That means I know what needs to be learned. | 2.94 |
| *I feel that compared to my earlier PBL sessions, now I am more self-reliant.* | 3.25 |
| I have control over my learning in PBL, as I myself plan, monitor and evaluate my learning. | 3.31 |

| Personal autonomy | 2.87 |
|-------------------|------|
| I spend more time in studying a PBL topic compared to a lecture topic. | 2.79 |
| I put more effort to study a PBL topic compared to a lecture topic. | 2.83 |
| I take more responsibility in learning a PBL topic compared to a lecture topic. | 3.20 |
| I effectively manage my time while studying for a PBL topic in order to be optimally prepared for the presentation session when compared to a lecture topic. | 3.09 |
| In PBL, I utilize my freedom to learn *beyond the learning objectives* by referring learning resources (websites, books) other than those recommended by the facilitator. | 3.02 |
| *In PBL, my intention is only to have a superficial understanding of the topic, so I just memorize content for the learning objectives.* | 2.08 |
| After the presentation session, I evaluate myself whether the preparation was sufficient enough to get a better understanding of the topic. | 3.08 |
| While learning a PBL topic, I try to correlate the content with the content of other subjects. | 3.06 |
Table 3: Most common reasons indicted by the respondents for items number 1 to 4

| Item                                                                 | Number of respondents |
|----------------------------------------------------------------------|-----------------------|
| **Learning a PBL topic is more stressful than learning a lecture topic.** |                       |
| You have to lean by yourself and do your own research               | 5                     |
| PBLs are more time and energy consuming                             | 4                     |
| Depends on the topic                                                | 3                     |
| Stressful as some of the other students are childish and not mature enough and do not put in the requisite effort | 3                     |
| Other members of the group are also depending on you to learn       | 3                     |
| **I spend more time in studying a PBL topic compared to a lecture topic.** |                       |
| Presentations are especially stressful                             | 5                     |
| Studying for PBL helps to understand the subject matter             | 4                     |
| To understand the topic and to be able to explain it well to peers. | 3                     |
| Less effort as depending on the assigned section of PBL not more than 4 hours are put into the preparation | 3                     |
| **I put more effort to study a PBL topic compared to a lecture topic.** |                       |
| PBL presentations/discussions require that you know the topic inside out | 5                     |
| No. Again a lecture has more information                            | 5                     |
| Yes I spend time studying the topic and making sure my group mates understand when I explain/present the same | 4                     |
| Good presentation/discussion is required for a good grade.          | 3                     |

**Declarations**

The author has declared that there are no conflicts of interest.

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