

Differentiating case-based learning from problem-based learning after a two-day introductory workshop on case-based learning

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RESEARCH

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ABSTRACT

Background

Considerable overlap exists between case-based learning (CBL) and problem-based learning (PBL) and differentiating between the two can be difficult for a lot of the academicians.

Aims

This study gauged the ability of members of medical school, familiar with a problem-based learning (PBL) curriculum, to differentiate between case-based learning (CBL) and PBL after a two-day workshop on CBL.

Methods

A questionnaire was distributed to all participants, attending the introductory course on CBL. It was designed to document the basic characteristics of the respondents, their preference for either CBL or PBL, their ability to

recognize differences between CBL and PBL, and their overall perception of the course.

Results

Of the total workshop participants, 80.5 per cent returned the completed questionnaire. The mean age of the respondents was 44.12±12.31 years and women made up a slight majority. Majority favoured CBL over PBL and felt it was more clinical, emphasizes on self-directed learning, provides more opportunities for learning, permits in-depth exploration of cases, has structured environment and encourages the use of all learning resources. On the respondents' ability to discriminate CBL from PBL, a weighted score of 39.9 per cent indicated a failure on the part of the respondents to correctly identify differences between CBL and PBL. Less than half opined that CBL was a worthwhile progression from PBL and about third would recommend CBL over PBL.

Conclusion

It seems that majority of the respondents failed to adequately differentiate between CBL and PBL and didn't favour CBL over PBL.

Key Words

Problem-based, case-based, differences, instructional design, medical education

What this study adds:

1. What is known about this subject?

There is a rapid evolution in the curriculum design and teaching strategies in medical education institutes. Understanding of these strategies is important for the success of any curriculum design. Considerable variation

exists in the understanding of CBL and PBL among academicians.

2. What new information is offered in this study?

- Faculty members Failed to recognize the differences between CBL and PBL.
- Faculty members didn't recommend CBL over PBL.

3. What are the implications for research, policy, or practice?

Full understanding of the teaching paradigm is required before implementation.

Background

The medical curriculum has witnessed a significant transition in its design, scope of teaching and in the method of its implementation over the years. The first transition was a move from the typical subject-based to a problem-based learning (PBL) curriculum, particularly in the pre-clinical years. McMaster University was credited for the introduction of PBL into the medical curriculum in 1969 and it has since spread to numerous medical schools throughout the world.¹ In general, PBL consists of purposefully designed problems that act as triggers to student learning. It has been suggested to have advantages over the typical subject-based curriculum in terms of making the relevance of basic sciences in clinical practice more obvious; greater teaching exploration and student participation; and better knowledge application while at the same time providing a vehicle for integration of different medical disciplines.² PBL is believed to have the potential to prepare students more effectively for future learning with its emphasis on learning as being "constructive, self-directed, collaborative and contextual".³

The implementation of PBL, however, seems to vary from one institute to another, depending on the philosophy of the faculty and the available resources,⁴ and it is therefore uncertain if all the four major domains are achieved equally at all medical schools.

CBL is a more recent innovation in the medical curriculum. It is designed to engage students in discussion of specific scenarios that resemble or are real clinical examples. It is also student-centred; permitting intense interaction between the learners as they build their knowledge and work together as a group to examine the clinical case. Although differences between CBL and PBL have been documented, considerable overlap nevertheless exists between the processes used in these two teaching modes, creating some confusion in the minds of many

academicians. Srinivasan et al.⁵ demonstrated a comparison between PBL and CBL in clinical case teaching. The similarities lie in students' approach in eliciting presenting problem, use of same case for subsequent session and the ability to ask, interact and discuss among the group. The differences however could be summarised in the following Table 1.

Table 1: Comparison between PBL and CBL in clinical case teaching

| N | Domain | PBL | CBL |
|---|---------------------------|-------------------------------|-------------------------------|
| 1 | Initial topic | Not known | Known |
| 2 | Beforehand Preparation | No | Some preparation |
| 3 | Facilitator's role | Provide limited direction | Provide direction |
| 4 | Data-seeking | Allowed | Not allowed |
| 5 | After session preparation | Applicable | Not applicable |
| 6 | Learning objectives | Identified during the session | Identified before the session |

In general, the basic elements of CBL are not different from those of PBL but the main divergence perhaps lies in the domain of exploration from the students' perspective. In PBL, the students explore the problem through purposefully designed triggers from which they acquire the skills to identify the problem(s) and consequently identify gaps in their knowledge and then map out their learning objectives. The tutor's role is generally passive; primarily to ensure that students remain on track. However, this process demands greater analytic abilities, rationalization, and synthesis of knowledge, and good communication skills from the students.⁶ In contrast, in the CBL, the learning objectives are identified early and the students prepare according to these objectives. The tutor guides the group through focused questions to drive them along the learning objectives and arrive at a diagnosis.^{5,7,8}

Whilst the similarities and differences between these two teaching paradigms have been documented in the literature there is no gold standard or bench mark to gauge the precise effectiveness of these two approaches to teaching and learning. Despite this, there remains a view in some medical schools of the necessity to evolve to a better model that embraces the required competencies of future medical graduates.

The Faculty of Medicine at Universiti Teknologi MARA (UiTM), is a 12-year-old medical school. Its medical curriculum is system-based and hybrid incorporating the conventional didactic mode of teaching with some PBL sessions that are introduced from as early as year 1 and continue through to year 2. Each PBL package consists of a scenario or vignette with triggers to be discussed in two 2-hour sessions, over two weeks. Students usually start the session with no prior knowledge about the case. Lecturers act as facilitators during these sessions to guide the students, wherever necessary, so that they attain appropriate learning objectives of the curriculum.

In line with vision of Malaysian qualification agency of continuous quality improvement and in its endeavour to improve its teaching learning methods, the Faculty of Medicine UiTM, recently planned to replace the PBL with CBL. It is felt that CBL might be more appealing to the learners as it requires lesser effort of preparation and more clinically oriented. To prepare the faculty members to this new approach to learning, a two-day CBL introductory workshop was held. It also aimed to feel the views of the faculty about the new paradigm of teaching. Topics covered during the workshop were, overview and definition of CBL, how it is prepared, how it is implemented and an overview of its divergence from PBL.

Most of the staff members had varying teaching experiences and exposure to PBL but no previous experience in CBL. Given the diverse background of the staff and their varied teaching experiences and exposure to PBL, we hypothesized that this might affect their ability to clearly recognize the differences between CBL and PBL even after the workshop. This study therefore aimed at assessing the faculty's ability to differentiate between PBL and CBL, overall perception of CBL and its preference of PBL or CBL after a two-day introductory workshop on CBL.

Method

Procedure

Academic staff of the Faculty of Medicine, UiTM, who were involved in the facilitation of PBL and attended the two-day workshop on CBL, were recruited into this study. A verified questionnaire was distributed to the participants immediately upon completion of the workshop and the completed questionnaire was collected on the spot.

The questionnaire was developed earlier, based on the available literature to identify areas related to both PBL and CBL with special emphasis on the differences that are cited in the literature and could be captured by a trainer.^{5,8,9} It

consisted of four sections; the basic characteristics of the respondents, questions about their preferences for CBL or PBL, discriminatory questions highlighting differences between CBL and PBL and respondent's overall perception of the CBL.

Statistical analysis

Data were entered and analysed using statistical tests in SPSS version 20. Descriptive statistics were calculated for all variables. Numerical variables were summarized by mean \pm SD, and categorical variables were summarized by frequency and percentage. Answers regarding preference were scored as 'no', 'yes' and 'not sure'. Answers to questions about the main differences were also scored as 'no', 'yes' and 'not sure'. Score of correct answers for each respondent was computed by summing up the correct answers to obtain a score from 0–9 for each participant. The correct answers score was then weighted to 100. We tested the hypothesis that the correct answer score is different from 50 (that favours the ability to discriminate or otherwise) using one sample t test. Internal consistency of the questionnaire was assessed with Cronbach's alpha.

Results

Of the 72 staff members who participated in the workshop, 80.5 per cent returned the completed questionnaire. There was a slight female majority in the respondents. The age of the respondents ranged from 28–80 years and their teaching experiences ranged from six months to over forty years. The average duration of teaching PBL for the whole group was just under six years. More than half were PhD holders and a small fraction were non-medical doctors. About two thirds were regular facilitators of PBL sessions (Table 2). In terms of internal consistency, questions about preference reached 0.86, questions about differences had 0.73 while those about overall perception had 0.91 level of consistency.

Table 3 presents the responses to statements comparing CBL to PBL. Majority favoured CBL over PBL as they considered it being more clinical, emphasizing self-directed learning, providing more opportunities of learning, permitting in-depth exploration of cases, having structured environment and encouraging the use of all learning resources. Less than half thought of CBL as being better at improving diagnostic skills, efficiency in the use of time, assessment of students, emphasis on concept and skills, and promotion of professional attitude. With regard to whether CBL provides greater emphasis on understanding the topic, allows more student participation, ensures that all students

participate, and provides for greater improvement in lateral thinking than PBL, the responses were inconclusive.

Table 4 shows the responses to questions which are stipulated to discriminate PBL from CBL. The respondents were unanimous in their view that students' need to prepare before a CBL session. However, about two-thirds wrongly indicated that additional homework is required after the CBL session. Similarly, more than half wrongly indicated that CBL adopts open-inquiry approach. A significant fraction wrongly believed that the tutor plays a passive role in CBL. With regard to arriving at a diagnosis, majority agreed that a diagnosis has to be reached by the students without guidance from the facilitator. Majority correctly indicated that a single scenario is used in CBL. Over two-thirds wrongly thought that students are not required to formulate questions during CBL session. A large majority indicated wrongly that students are allowed to look up resources during the CBL session. More than half answered correctly that students are required to present during CBL sessions. The mean weighted score of correct answers was 39.85 per cent and it was significantly ($p < 0.001$) lower than the required 50 per cent, indicating a failure of the respondents to correctly identify differences between CBL and PBL.

Table 5 presents the respondents' attitude towards the CBL workshop. More than half agreed that the objectives of the workshop were clear and a similar proportion favoured the competency of the instructor. Over half endorsed that differences between CBL and PBL were highlighted during the workshop. It is observable that less than half agreed that they could differentiate between CBL and PBL. About 41.1 per cent of the respondents felt that CBL is a worthwhile progression from PBL, while less than a third recommended CBL over PBL.

Analysis did not display any difference in the proportion of correct answers or CBL preference by designation, level of engagement in PBL facilitation, basic degree, and postgraduate qualification or by discipline. A small to medium negative correlation was noticed between years of facilitating PBL and the CBL preference score ($r = -0.288$, $p = 0.033$).

Discussion

The transition from one curriculum design to another encompasses effort, time and preparation and might be troublesome to students and faculty.¹⁰ The result of this study was expected to highlight the ambiguity surrounding the differences between CBL and PBL and therefore blurring

the ability to differentiate between these two. Irrespective of the characteristics, authentic pedagogy should involve knowledge construction, disciplined inquiry, and transferability of information and concepts.¹¹

While the reason for the finding that the majority thought that CBL was more clinical than PBL (Table 3) is uncertain. It might be attributed to their understanding that students are discussing a single clinical scenario with the aim of reaching a diagnosis. Whereas in the PBL, the students are required to probe the problem to identify their learning objectives and making the correct diagnosis is not the primary objective. However, literature shows that PBL is not just restricted to the learning of basic and laboratory sciences, but it encompasses the learning of clinical sciences, as evident from its implementation into family medicine and other disciplines.⁸ All PBL packages in the preclinical years at the Faculty of Medicine, UiTM are clinically related, but the emphasis is on the learning of the related basic medical and laboratory sciences through these problems.

Participants also thought that CBL emphasizes more on self-directed learning than does PBL (Table 3). This again reflected a poor understanding of the differences between PBL and CBL by the participants. Although the two paradigms are meant to emphasize self-directed learning,⁹ students in the PBL are expected to act more independently with minimal guidance from the tutor and without prior knowledge or preparation about the case.¹²

Although the staff members were aware of the pre-session preparation required in CBL (Table 4), which probably marks the main difference between CBL and PBL, majority of the respondents still reported that students are required to do additional homework after the CBL session. Once again, it reflects a remarkable misunderstanding. It is possible that the respondents might have wrongly assumed that students act in a similar manner to that of the currently implemented PBL at UiTM. The structure of CBL mainly differs from that of PBL in that learning objectives in the former are already identified by the tutor and given to the students in advance.^{5,9,13}

The answer where more than half thought that the lecturer plays a passive role in CBL is surprising (Table 4), as the need for an active role of the facilitator in CBL was emphasized during the workshop. It is well accepted that the main reason for changing the teaching paradigm into problem-based was the dissatisfaction with the conventional didactic approach that is predominantly passive, teacher-centred and does not prepare the graduates for real life

experience.¹⁴ PBL emphasizes on self-directed learning, where the role of facilitator is passive and the students are encouraged and required to elaborate, justify and extend their thoughts to achieve the appropriate learning objectives by themselves and with little assistance from the tutor.¹⁵ However, with the inclusion of more clinical scenarios to better prepare the students for their professional life in dealing with patients afterwards, the need arose for an active role for the tutor. The tutor is expected to explain certain clinical terms that students do not understand, highlight facts about disease process and stimulate clinico-pathological reasoning.¹⁶ Thus, the role of tutor in the CBL was conceived to be one that is more active than passive.¹⁷ Moreover, despite the understanding of a less active role of the facilitators in PBL, many staff in our faculty still play active roles during PBL sessions because of the assumption that leaving the students without a definite answer might be regarded as misleading.¹⁸ Given this practice by some facilitators during a PBL session, it is conceivable that this might be one of the reasons why the respondents thought that CBL is less tutor-centered.

The finding of a vast majority of respondents wrongly thought that students in CBL are allowed to use additional resources, once again reflects on their lack of understanding of the philosophies behind PBL and CBL. The students in CBL are usually provided with articles and learning resources about the topic and the group is then assigned the role to present the material. In contrast, in PBL the students are required to use additional resources either during or after the PBL sessions.

The instructor/convener of the workshop was invited from a renowned institute overseas and had conducted similar workshops in different countries and was therefore assumed to have greater expertise and experience to effectively deliver the topic. The difficulty in identifying the differences between PBL and CBL might also reflect on the conduct of the workshop, or on the varied understanding of the participants. The instructor might not have adequately portrayed the important aspects of the CBL compared to PBL to participants who were already familiar and perhaps a little biased towards PBL. Moreover the lack of exposure of the respondents to published reports on CBL might be another important reason. Interestingly, the participants who attended the workshop felt that the instructor was competent and about half of respondents felt that the differences were clearly highlighted. Hitherto, social desirability bias might have influenced the responses. Besides this, the source of the confusion might also be attributed to the way in which the hybrid curriculum and

PBL is implemented in our institute that mimics CBL. Another factor that could affect the results is the varying teaching experience of the study sample.

Overall, from the responses of the participants it appears that the participants generally had poor understanding of the core differences between CBL and PBL (Tables 3 and 4). Regardless of the aim of CBL, it is considered by many as a variant of PBL, as it shares many characteristics in structure and implementation.⁸ A clear understanding of the philosophies and concepts of PBL and CBL is necessary for differentiating between the two. It is important that the academic staff fully understand the concepts, structure and processes in PBL and CBL before either of these can be effectively implemented. It was with this in mind that a workshop on CBL was held by the Faculty of Medicine and the findings indicate the need for more training of the staff for an effective implementation of CBL. Although the emphasis was not to evaluate the workshop but to highlight ambiguity between the two teaching paradigm, a more relevant approach would be familiarizing the trainers with the new teaching paradigm, then subjecting them to a practical training of constructing and implementing CBL with inclusion of students as a real teaching experience. The evaluation of such training would be accomplished with pre and post design method of assessing the changes in knowledge and perception of the trainers.

Conclusion

It seems that majority of the respondents failed to adequately differentiate between CBL and PBL and didn't favour CBL over PBL. It is unclear what their choice was based on, but it might be related to the varied interpretation in the scope and implementation of PBL between individuals and even between institutes. The implication of the, albeit limited findings, of this study if found widely prevalent elsewhere, could be far reaching, particularly when choosing an appropriate teaching paradigm. Without fully understanding the core concepts and the necessary processes involved in PBL and CBL, the implementation of either these would certainly be compromised.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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ETHICS COMMITTEE APPROVAL

This study was approved by institutional ethics committee of Universiti Teknologi MARA.

Table 2: Characteristics of the respondents

| Variable | | N | % |
|---|---------------------|----|-------|
| Sex | Male | 24 | 41.40 |
| | Female | 34 | 58.60 |
| Designation | Lecturer | 12 | 20.70 |
| | Senior Lecturer | 25 | 43.10 |
| | Associate Professor | 12 | 20.70 |
| | Professor | 9 | 15.50 |
| Discipline | Preclinical | 46 | 80.7 |
| | Clinical | 11 | 19.3 |
| Undergraduate Qualification | MBBS, MBChB | 28 | 87.5 |
| | BSc | 4 | 12.5 |
| Postgraduate Qualification | Master | 22 | 37.9 |
| | PhD | 33 | 56.9 |
| | Fellowship | 3 | 5.2 |
| level of engagement in PBL facilitation | Regular | 40 | 69.0 |
| | Once monthly | 3 | 5.2 |
| | Replacement | 11 | 19.0 |
| | Previously | 4 | 6.9 |
| Age (years) mean (SD) | 44.1(12) | | |
| Years of working in education mean (SD) | 12.2 (12.8) | | |
| Years of teaching PBL curriculum mean (SD) | 5.7 (6.3) | | |
| Years of teaching in this Faculty mean (SD) | 3.5 (2.4) | | |

Table 3: Respondents’ responses to statements on preference of CBL

| Statement | No | Yes | Not Sure |
|---|-----------|-----------|-----------|
| CBL is more clinical than basic science oriented | 14 (25.5) | 33 (60) | 8 (14.5) |
| CBL emphasizes on self-directed learning | 10 (17.9) | 39 (69.6) | 7 (12.5) |
| CBL provides more opportunities to apply learning to different cases | 10 (17.9) | 31 (55.4) | 15 (26.8) |
| CBL permits greater in depth exploration of a single case than does PBL | 14 (25.0) | 28 (50.0) | 14 (25.0) |
| CBL has a better structured environment that enhances learning | 11 (19.6) | 29 (51.8) | 16 (28.6) |
| CBL encourages the use of all learning resources. | 9 (16.1) | 38 (67.9) | 9 (16.1) |
| CBL helps to improve diagnostic skills than does PBL | 10 (18.2) | 24 (43.6) | 21 (38.2) |
| CBL uses time more efficiently | 10 (18.2) | 25 (45.5) | 20 (36.4) |
| CBL allows for a better assessment of students’ abilities | 12 (21.8) | 24 (43.6) | 19 (34.5) |
| CBL allows for greater emphasis on concepts than that in PBL | 14 (25.5) | 22 (40) | 19 (34.5) |
| CBL emphasizes more on skills than does PBL | 15 (26.8) | 27 (48.2) | 14 (25.0) |
| CBL promotes professional attitude more than that in PBL | 15 (27.3) | 24 (43.6) | 16 (29.1) |
| CBL emphasizes on understanding the topic more than that in PBL | 18 (32.1) | 18 (32.1) | 20 (35.7) |
| CBL allows for greater student participation than does PBL | 24 (42.9) | 18 (32.1) | 14 (25) |
| CBL ensures that quiet/shy students to participate in the discussion | 15 (26.8) | 21 (37.5) | 20 (35.7) |
| CBL helps to improve lateral thinking than does PBL | 11 (20.4) | 19 (35.2) | 24 (44.4) |

Table 4: Response to statements discriminating CBL from PBL

| Statement | Wrong | Not sure | Correct |
|--|-----------|-----------|-----------|
| | n(%) | n(%) | n(%) |
| In CBL, students need to prepare about the topic before the session starts | 8 (14.3) | 4 (7.1) | 44 (78.6) |
| A single case is used in the multiple sessions of one CBL package | 10 (18.2) | 8 (14.5) | 37 (67.3) |
| Students' presentations are not required in CBL | 19 (34.5) | 5 (9.1) | 31 (56.4) |
| In CBL, diagnosis needs to be reached by the students without the guidance of the lecturer | 18 (32.1) | 9 (16.1) | 29 (51.8) |
| In CBL, lecturer plays a passive role in the discussion | 28 (50) | 4 (7.1) | 24 (42.9) |
| CBL adopts open inquiry approach | 25 (44.6) | 13 (23.2) | 18 (32.1) |
| In CBL, students need to prepare after the session | 36 (66.7) | 4 (7.4) | 14 (25.9) |
| Students are not required to formulate questions during the CBL session | 31 (57.4) | 14 (25.9) | 9 (16.7) |
| Students are allowed to look up and read articles/text/references during a CBL session | 49 (89.1) | 4 (7.3) | 2 (3.6) |

Table 5: Respondent attitude toward CBL workshop

| Statement | SD-D | N | A-SA |
|--|-----------|-----------|-----------|
| The objectives of the workshop were clear | 10 (17.9) | 11 (19.6) | 35 (62.5) |
| The instructor was at the CBL workshop was competent | 7 (12.5) | 11 (19.6) | 38 (67.9) |
| The main differences between CBL & PBL were highlighted during the workshop | 11 (19.6) | 16 (28.6) | 29 (51.8) |
| At the end of the workshop I was able to clearly differentiate between PBL and CBL | 15 (26.8) | 16 (28.6) | 25 (44.6) |
| CBL is a worthwhile progression from PBL | 9 (16.1) | 24 (42.9) | 23 (41.1) |
| I would recommend CBL over PBL | 12 (21.4) | 27 (48.2) | 17 (30.4) |

Abbreviations: SD: Strongly Disagree, D: Disagree, N: Neutral, A: Agree, SA: Strongly Agree