

Comparative evaluation of perceptions of dental students to three methods of teaching in Ile-Ife, Nigeria.

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Abstract

Background: The World Health Organization in 1994 recommended that dental education should be problem based, socially and culturally relevant, and community oriented.

Objectives: To explore the perceptions of Pre-phase II (pre-clinical II) dental students on three methods of teaching used during two academic sessions.

Methods: All part IV dental students in two consecutive sessions undergoing pre phase II course in the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife were recruited into the study. Three different modes of teaching that is, Problem based learning (PBL), hybrid PBL and traditional teaching were used to teach the students. A twenty two itemed anonymous questionnaire on a five point Likert scale was administered to the students at the end of the course. Six perceived factors were extracted from the questionnaire using factor analysis.

Results: There was a statistically significant difference ($p < 0.01$) between the overall mean of PBL method compared to the other methods of teaching. The perceived factor "communication with peers" had the highest mean score for PBL in both sessions (4.57 ± 0.58 and 4.09 ± 0.93 respectively). However, PBL method was very helpful in all the six perceived factors while the students perceived that the traditional method of teaching was not helpful in "interaction with tutors" and "challenge to critical thinking".

Conclusions: The findings showed that students preferred the PBL method to other forms of teaching. PBL enhanced the students' communication skill, was very useful as pedagogic tool and improved their critical thinking.

Keywords: *Problem-based learning, Hybrid Problem-based learning, Traditional teaching*

Résumé

Contexte: L'Organisation mondiale de la Santé en 1994, a recommandé que l'enseignement dentaire doive être basé sur des problèmes, socialement et culturellement approprié et orienté vers la communauté.

Objectifs: Pour explorer la perception des étudiants en médecine dentaire de la pré-phase II (préclinique II) sur trois méthodes d'enseignement utilisées au cours de deux sessions académiques.

Méthodes: Tous les étudiants en partie IV de médecine dentaire dans deux sessions consécutives soumis aux cours de pré-phase II de la Faculté de Médecine Dentaire, Université Obafemi Awolowo, Ile-Ife ont été recrutés dans l'étude. Trois différents modes d'enseignement qui sont, l'apprentissage par problème (APP), APP hybride et l'enseignement traditionnel ont été utilisés pour enseigner les étudiants. Un questionnaire à vingt-deux éléments anonyme sur une échelle en cinq points de Likert a été administré aux étudiants à la fin des cours. Six facteurs perçus ont été extraits du questionnaire en utilisant l'analyse des facteurs.

Résultats: Il y avait une différence statistiquement significative ($p < 0,01$) entre la moyenne totale de la méthode APP par rapport aux autres méthodes d'enseignement. Le facteur perçu "communication avec les pairs" avait le score moyen le plus élevé pour APP dans les deux sessions ($4,57 + 0,58$ et $4,09 + 0,93$, respectivement). Cependant, la méthode APP a été très utile dans tous les six facteurs perçus alors que les étudiants estimaient que la méthode traditionnelle de l'enseignement n'a pas été utile dans "l'interaction avec les tuteurs" et "défi à la pensée critique".

Conclusions: Les résultats ont montré que les étudiants préfèrent la méthode APP par rapport aux autres formes d'enseignement. APP a amélioré l'habileté de communication des élèves, était très utile comme outil pédagogique et a aussi amélioré leur esprit critique.

Mots-clés : *apprentissage par problème, hybride apprentissage par problème, enseignement traditionnel*

Introduction

Problem-based learning has been defined as both a method and philosophy involving problem first, learning via work in small groups and independent study [1]. Problem-based learning curricula have been

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introduced in many medical schools around the world [2,3]. The aim of its introduction to medical and dental schools is to improve teaching and learning. Problem-based learning (PBL) is the flagship of all learning methods [4]. It is a student-centered, instructional strategy in which students collaboratively solve problems and reflect on their experiences. It was pioneered and used extensively at McMaster University, Canada.

In PBL, learning is driven by challenging and open-ended problems. Students work in small collaborative groups, and teachers take on the role as facilitators of learning. It represents a change in focus from teachers and teaching, in conventional programs, to learners and learning [5]. It enhances critical thinking skills and problem solving abilities for clinical application, improves communication skill, enhances knowledge in different areas and encourages experience to sustain the learning programme in the absence of the facilitator [7-10].

There are different PBL working forms: The pure PBL and one of its common variants Hybrid PBL [11]. The latter incorporates a case based problem solving approach supplemented with lecture, tutorials, and clinical supervision. Its main advantage is that it achieves a balance between the advantages of PBL and resolving issues regarding limited financial and staff resources [11].

The conditions required for effective PBL include substantial manpower needed in terms of experienced facilitators, staff training facilities, computers and journals [12,13]. These conditions could be limitations to its effective introduction in developing countries such as Nigeria where most medical and dental educators are not familiar with this method of teaching. Hence, in most of the medical and dental schools, teaching and learning is based on the traditional teaching method which is basically teacher centered. Since the teacher centered learning is based on teaching, most of what is taught in the classroom settings is forgotten, and much of what is remembered is irrelevant [14]. This may affect the cognitive, affective and psychomotor domain of learning of the medical and dental students with consequent effect on the health care delivery system in future.

A cross sectional study conducted on fourth-year medical students at Karachi Medical and Dental College, Pakistan, found that a majority (85 percent) said PBL was helpful in developing their communication skills, interpersonal relationships, problem-solving capacity, and activation of prior knowledge [10]. Similarly, study done by educators at the University of Adelaide, showed that students like PBL and have a more positive reaction to dental school than students who were taught under the traditional method in previous years [15]. Also a systematic review of the effect of PBL in medical

schools on the performance of doctors after graduation showed clear positive effect on physician competence. This effect was especially strong for social and cognitive competencies such as coping with uncertainty and communication skills [16].

Presently there are no studies from Nigerian dental schools evaluating the effect of any teaching method on learning outcomes. Hence the present study aimed to evaluate the perception of dental students on the three methods of teaching used in the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife, Nigeria with a view to sensitize educators to the best method preferred by the students and to justify or jettison its introduction to medical and dental faculties in Nigeria.

Materials and method

All part IV dental students in two consecutive sessions (2009/2010 and 2010/2011) undergoing pre phase II course in the Faculty of Dentistry, College of Health Sciences, Obafemi Awolowo University Ile-Ife in preparation for the clinical dental courses were recruited into the study. The pre phase II is a phase between the preclinical and clinical phases of dental students' training which run for a period of five months. During this period, the students received instructions in Prosthodontics, Operative Techniques and Dental Material Science. They also do their practical exercise on manikins as well as in the laboratory. The students in the present study had never been taught previously using PBL and were not informed that their perceptions on the teaching method would be evaluated at the end of the course.

During this period, three different modes of teaching that is, PBL, hybrid PBL and traditional teaching were used to teach the students. There were four tutors involved in the teaching of the students; one of the tutors was trained in the use of PBL method of teaching prior to the commencement of the study. The students had been previously taught in their preclinical years using teacher centered learning. Here the teacher teaches for the whole lecture period and the students are expected to take notes during the lecture period. The hybrid PBL involved giving all instructional materials to the students at the commencement of the course. The students have the responsibility of reading the instructional materials on their own and the lecture periods are set aside for discussion on what they have read. The PBL method used involved the division of the students into tutorial groups of five per group.

At the first contact with the students, course guidance was given to the students on problem based learning and they were taught on how to source for evidence using electronic and print journals. In the subsequent lecture period, a clinical scenario/task on a course topic is then given to the students and each

tutorial group is then asked to find solutions to the task given and submit their report usually as powerpoint presentation to the email address of the tutor. The following lecture period was used as the time for group presentation and discussion. The tutor did not get directly involved in the discussion but served as guide to focus the students on the topic of discussion and the instructional objective of the clinical scenario. The tutors and students were not aware and were not informed about the study before and throughout the duration of the course. Ethical clearance was obtained from the Ethics Committee of the Obafemi Awolowo University, Ile-Ife. Approval was also obtained from the appropriate authorities of the Faculty of Dentistry, Obafemi Awolowo University, Ile-Ife. One of the authors (E.O) who did not teach any of the courses and unknown to the students administered the questionnaire at the end of the 5 month course period.

The questionnaire used to assess the students' perception of these three methods of teaching was a modified form of the one used by Rich *et al* [17]. It consisted of a set of twenty two items to determine the students' perception of PBL, hybrid PBL and traditional teaching as pedagogical methods. Each item on the questionnaire was rated on a 5 point Likert scale by the students: 1 – not helpful, 2- somewhat helpful, 3- helpful, 4- very helpful and 5 – outstanding. This scale was applied to the three modes of teaching used and the students were asked to rate the modes of teaching. The questionnaire was completed anonymously, that is

information regarding the name, sex and age of the students recruited into the study were not obtained. A test retest reliability of the students' response to the questionnaire was done first by administering the questionnaire to a group of five students. The same questionnaire was administered to the same group of students after a week interval and their responses were compared. This group of students was excluded from the study.

Data collected were entered and analyzed using SPSS version 11. To evaluate the reliability of the questionnaire Cronbach coefficient was used. Six perceived factors that influenced teaching and learning process were extracted from the twenty two itemed questionnaire using factor analysis. These are 'Challenge to critical thinking', 'Communication with peers', 'Usefulness as pedagogical method', 'Adequacy of the teaching method', 'Organization' and 'Interaction between students and tutors'. Simple descriptive method of analysis such as means, standard deviation and proportions were employed where appropriate. Student t test and pair wise multiple comparisons of means (Games Howell) were used to compare means. Statistical significance was inferred at p.

Results

Thirty eight out of 41 students in the 2009/2010 session returned the questionnaire while 41 of the 50 students in the 2010/2011 session returned the questionnaire.

Table 1: Mean and standard deviation for 'perceived factors' of three teaching methods by academic session

Perceived Factors	2009/2010 Session			2010/2011 Session		
	PBL Means (SD)	Hybrid Means (SD)	Traditional Means (SD)	PBL Means (SD)	Hybrid Means (SD)	Traditional Means (SD)
Challenge critical thinking	4.27(0.85) ^a	2.94(1.05) ^b	1.98(1.14) ^c	3.79(1.09) ^d	2.27(1.04) ^e	1.97(1.03) ^f
Communication with peers	4.57(0.58) ^a	3.01(1.19) ^b	1.88(1.06) ^c	4.09(0.93) ^d	2.49(1.02) ^e	2.03(0.98) ^f
Usefulness as pedagogic tool	4.50(0.70) ^a	2.79(1.05) ^b	1.89(1.00) ^c	3.50(1.03) ^d	2.49(1.04) ^e	2.19(0.98) ^f
Adequacy of teaching	4.04(0.79) ^a	2.91(1.23) ^b	2.55(1.19) ^c	3.47(1.09) ^d	2.50(1.08) ^e	2.57(1.13) ^f
Organization	3.82(1.07) ^a	2.89(1.29) ^b	2.15(1.14) ^c	2.89(1.33) ^d	2.28(1.12) ^e	2.36(1.22) ^f
Interaction with tutors	4.42(0.83) ^a	2.29(1.19) ^b	1.54(0.89) ^c	3.65(1.19) ^d	1.94(0.90) ^e	1.75(0.74) ^f

Games Howell multiple comparison of Means (P<0.05)

Challenge critical thinking: ^{a,b,c,d,e,f} p<0.05

Communication with peers: ^{a,b,c,d,e,f} p < 0.05

Usefulness as a pedagogic tool: ^{a,b,c,d,e,f} p < 0.05

Adequacy of teaching: ^{a,b,c,d,e,f} p <0.05

Organization: ^{a,b,c,d,e,f} p < 0.05

Interaction with tutors: ^{a,b,c,d,e,f} p < 0.05

Note: a,b,c,d,e,f, represent each column for easy reporting of comparisons of means

Thus, a total of 79 pre phase part IV dental students were involved in the study. None of the students has ever been involved in the study. The reliability of the questionnaire was evaluated. Chronbach's alpha coefficient was 0.814.

Table 2: Overall mean and standard deviation by teaching method and session

Session	PBL Mean(SD)	Hybrid Mean(SD)	Traditional Mean(SD)
2009/2010	4.27(0.78) ^a	2.86(1.20) ^b	2.06(1.09) ^c
2010/2011	3.61(1.09) ^a	2.37(1.04) ^b	2.19(1.03) ^c
t	3.06	1.94	0.53
p	0.003	0.056	0.600

Games-Howell multiple comparisons:

2009/2010 Session- ^{a,b,c} $p < 0.01$

2010/2011 Session- ^{a,b,c} $p < 0.01$

Note: a,b,c, represent each column for easy reporting of comparisons of means

The highest mean score for both PBL and Hybrid methods in the 2009/2010 session was for the perceived factor "communication with peers", 4.57 ± 0.58 and 3.01 ± 1.19 respectively while the perceived factor with the least mean score under PBL and Hybrid methods were "organization" (3.82 ± 1.07) and "interaction with tutors" (2.29 ± 1.19) respectively. However, in the Traditional method 2009/2010 session, the perceived factor "adequacy of teaching" had the highest mean score (2.55 ± 1.19) while the perceived factor with the least mean score was "interaction with tutors" (1.54 ± 0.89). (Table 1).

In the 2010/2011, the highest mean score for the PBL method was for the perceived factor "communication with peers" (4.09 ± 0.93) while for both Hybrid and Traditional methods, it was the perceived factor "adequacy of teaching" 2.50 ± 1.08 and 2.57 ± 1.13 respectively. The least mean scores in this session was for the perceived factor "organization" (2.89 ± 1.33) for PBL method while for both Hybrid and Traditional methods, it was the

Table 3: Mean Response of students' perception to the three methods of teaching for the two sessions combined

Perception Items	No of Respondents	Method of Teaching in Pre-phase course					
		PBL		Hybrid PBL		Traditional	
	No	Mean	SD	Mean	SD	Mean	SD
Able to provide intellectual stimulation	79	4.10	0.94	2.82	1.01	2.15	1.06
Challenge students to develop their knowledge to appropriate level	79	4.33	0.83	2.62	1.10	2.00	0.93
Sensitive to student needs and limitations	78	3.53	1.31	2.46	1.05	2.00	1.01
Actively helpful when students had difficulties or concern /approachable	79	4.04	1.02	2.45	1.10	1.95	0.95
Encourage students to ask questions and express their own ideas	79	4.43	0.86	2.97	1.19	1.94	1.11
Effective in assisting the group to identify relevant hypothesis and learning needs	79	4.25	0.71	2.51	1.04	1.64	0.78
Effective in explaining rationale behind procedure	76	4.29	0.81	2.90	1.18	2.14	1.00
Enhance critical thinking	75	4.40	0.81	2.76	1.20	1.81	0.97
E mail communication from coordinator	77	4.01	1.20	1.78	1.03	1.36	0.83
Organization of rotation and seating plans	73	3.10	1.43	2.42	1.24	1.88	1.13
Handout exercise	76	3.79	1.19	3.34	1.16	2.32	1.15
Videotapes	76	4.29	0.88	1.85	1.21	1.63	0.94
Quizzes	74	3.61	1.20	2.45	1.21	2.14	1.26
Instrumentation Exams	63	3.24	1.24	2.61	1.33	2.57	1.35
Student Faculty ratio	67	2.85	1.26	2.61	1.11	2.40	1.12
Enhance communication skill	79	4.28	0.85	2.68	1.03	2.18	1.14
Laboratory exercise	77	4.05	0.93	2.27	1.18	3.24	1.26
Curriculum content/minicases	69	3.65	1.04	3.05	1.12	2.77	1.13
Pre sessions	68	3.62	1.15	2.74	1.23	2.33	1.13
post sessions	69	3.72	1.20	2.72	1.18	2.34	1.14
Improved internet use	79	4.62	0.58	2.84	1.24	2.08	1.16
Ability to appraise evidence	79	4.35	0.86	2.62	1.22	1.89	1.12

perceived factor “interaction with tutors” 1.94 ± 0.90 and 1.75 ± 0.74 respectively (table 1).

Generally, the highest mean scores for all the perceived factors were observed in the PBL method for the 2009/2010 session (table 1). Under the perceived factor “challenge critical thinking”, statistically significant differences were observed between the mean scores of PBL and other modes of teaching in both sessions. However, there was no significant difference between the other perceived factors and the different methods of teaching (Table 1).

Table 2 showed that there was a statistically significant difference ($p < 0.05$) between the overall mean scores of the 2009/2010 and 2010/2011 sessions in the PBL method. Also there was a statistically significant difference ($p < 0.01$) between PBL method and the other methods of teaching in both sessions. Similarly, a statistically significant difference ($p < 0.01$) was observed between the Hybrid and Traditional methods of teaching in 2009/2010 session.

Table 3 shows the mean response of students’ perception to the three methods of teaching during two academic sessions under review. The means of all the perception items were highest in PBL method compared to other teaching methods. The perception item “Improved internet use” had the highest mean score (4.62 ± 0.58) while the perception item “Student faculty ratio” had the least mean score (2.85 ± 1.26) under PBL.

Discussion

The general perception of dental students in this study was that PBL is very helpful. The mean scores of the six factors extracted from the twenty two itemed questionnaire used were highest for PBL method compared to the other methods of learning in both academic sessions. This is similar to the findings of Tu *et al*, [18] in which most students seemed to express a conservatively positive attitude towards PBL. Also a study by Townsend *et al* [15] showed that students like the PBL program and have a more positive attitude to dental school than students who were taught under the traditional curriculum in previous years. In the same vein, a study conducted among dental students in Malaysia showed that a statistically significant number found the PBL session to be an interesting method of learning [19].

The factor “communication with peers” had the highest mean score in the PBL method in both academic sessions in this study. The reason may be due to the design/approach of PBL which is basically a group discussion and learning educational method organized by tutors around a case. Thus, it motivates

students to conduct a discussion among themselves and this in turn enhances their communication skills. Similarly, Seneviratne *et al* [20] observed that PBL helped to improve communication skills among students and problem-solving skills of students. Berman *et al* [19] in their study found that PBL provided an opportunity for the students to improve their group interaction skills.

“Usefulness as a pedagogic tool” had the second highest mean score as recorded by students of the 2009/2010 session but had third highest mean score by those of the 2010/2011 session. In medical education, PBL has been shown to enhance both transfer of concepts to new problems and integration of basic science concepts into clinical problems (that is, deep learning). This in turn enhances intrinsic interest in the subject matter, motivation, and self directed learning skills [9]. It also stimulates a deep understanding of basic mechanisms and developing clinical reasoning [21,22]. In fact, a number of studies in medical education suggest that PBL – trained students are better able to learn and retain information [23,24] and integrate basic science knowledge into solution of clinical problems [25]. Furthermore, the educational context of PBL encourages students to use a more educationally desirable approach to their learning than students in a traditional medical course [25]. PBL instructions may have distinct cognitive advantages over non-PBL processes, with PBL students revealing significantly greater use of hypothesis-driven reasoning and greater coherence in explanations relating to evaluation of clinical case study [5].

The factor “interaction with tutors” was also scored high under PBL compared to other methods of teaching by the students in both academic sessions. This implies that PBL unlike the other methods of teaching was actively helpful when students had difficulty or concerns and the tutors were approachable. The role of the tutor is very different from the usual teacher’s role. Rather than being a “content expert” who provides the facts, the tutor is a facilitator. He or she is to encourage student participation, provide appropriate information to keep students on track, avoid negative feedback, and assume the role of a fellow learner [26].

In this study, PBL may have challenged the critical thinking of the students most when compared to the other methods of teaching. Unlike the other methods of teaching, PBL involves debates and questioning during meaningful discussion and this enable students to build mental structures necessary for critical thinking. Studies [27,28] have shown that programs like PBL and case-based seminars have

created an environment conducive for the cultivation of critical thinking. Though, a study by Pardamean [29] showed that students showed no continuous and significant incremental improvement in their overall critical thinking skills scores during their PBL-based dental education. The study was based on the use of Health Sciences Reasoning Test (HSRT) to measure the critical thinking level of the students after PBL session. However, it must be recognized that the subjective feeling of individual student is of importance when measuring such psychological parameter.

One of the disadvantages of PBL is the student faculty ratio since the learning is done in small groups. PBL involves a tutor to a group of five students. This may be a reason for the use of Hybrid PBL. This is particularly so in developing countries which lack adequate number of faculty staff and over admission of students. This was true for our study where only one staff was involved in the PBL session. Organization had the least score in both sessions under PBL even though it was higher than the other teaching methods. This may be due to inadequate number of lecture/seminar rooms in our faculty.

Overall the PBL sessions showed significant higher mean scores when compared with the other teaching methods over a period of two years as rated by the dental students. Although there was a significant reduction in the mean score of the PBL session after the second academic session, this difference may not be explained under the present circumstance since the same learning environment, problem questions and tutors were used.

In conclusion, this study showed that the perception of dental students was more positive to PBL when compared to other teaching methods. PBL enhanced the students' communication skill, was very useful as pedagogic tool and improved their critical thinking. Therefore, it seems justified that PBL should be used as pedagogic method for the training of dental students even in a resource limited environment.

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