

RESEARCH ARTICLE

Medical students' achievement on the Bachelor of Medicine, Bachelor of Surgery/Chirurgery Final Part I and II licensing examination: a comparison of students in problem-based learning, community-based education and service, and conventional curricula in Ghana

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Abstract

Purpose: Problem-based learning is an established method of teaching and learning in medical education. However, its impact on students' achievement on examinations is varied and inconsistent. We compared the levels of achievement on the Bachelor of Medicine, Bachelor of Surgery/Chirurgery (MB ChB) Part I and II licensing examination of students in problem-based learning, community-based education and service (PBL/COBES), and conventional curricula. **Methods:** In 2014, we analyzed the MB ChB Final Part I and II licensing examination results of students in three classes (2004, 2005, and 2006) of the School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana. Ninety-three students in the 2004 and 2005 cohorts followed a conventional curriculum, and 82 students in the 2006 cohort followed a PBL/COBES curriculum. Using appropriate statistical tools, the analysis compared individual discipline scores and the proportions of students who received distinction/credit/pass grades among the classes. **Results:** The PBL students had significantly higher mean and median scores than the conventional students in Obstetrics and Gynecology, Internal Medicine, Community Health and Family Medicine, Surgery, and Psychiatry, but not in Child Health and Pediatrics. Also, a significantly ($P = 0.0010$) higher percentage, 95.1% ($n = 78$), of the PBL students passed all the disciplines, compared to 79.6% ($n = 74$) of the conventional students. **Conclusion:** The PBL students significantly performed better in all the disciplines except child health and pediatrics, where the conventional students scored higher. These findings demonstrate that the benefits of the PBL/COBES curriculum are tangible and should be fostered.

Key Words: Achievement; Educational status; Educational measurement; Licensure; Problem-based learning; Ghana

INTRODUCTION

Problem-based learning (PBL) has been considered, adopted, and implemented as a method of teaching and learning in medical education since the late 1960s in many parts of the

world, such as the United State of America, Canada, the United Kingdom, the Middle East, Asia, and Africa, including Ghana [1]. It has been well established as a learning method. Fundamentally, PBL is an instructional method characterized by the use of patient problems as a context for students to learn problem-solving skills and acquire knowledge about the basic and clinical sciences [2]. In Ghana, undergraduate medical training consists of four years basic science training and three years clinical training, for a total of seven years duration. The

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teaching and learning methodology is largely a conventional discipline, lecture-based approach. Recently, however, there have been calls to revise this methodology towards a student-centered, self-directed problem-based approach to medical education. In May 1992, the University for Development Studies (UDS) was established by Provisional National Defence Council (PNDC) Law 249 as a multi-campus university, the fourth public university to be created in Ghana. Established in 1996, the University for Development Studies, School of Medicine and Health Sciences (UDS-SMHS) was created as a medical school with the clear mandate to execute, in the training of health care professionals, a curriculum at the center of whose philosophy is problem-based learning, community-based education and service (PBL/COBES). In responding to its original mandate and the calls for change in the teaching and learning methodology, UDS-SMHS, the first in Ghana, and probably in the West African sub-region, adopted and implemented a PBL/COBES curriculum for its medical students. Until then, the UDS-SMHS had been using a conventional, lecture-based, discipline- and department-organized curriculum.

The adoption and implementation of the PBL/COBES curriculum resulted in the running of two parallel curricula in which the conventional curriculum was applied to all students who were admitted before 2006. The pioneering batch of PBL students graduated in 2013 after sitting for the Ghana Medical and Dental Council Bachelor of Medicine, Bachelor of Surgery/Chirurgery (MB ChB) Final Part I and II examinations. As UDS-SMHS is a pioneer medical school in the implementation of PBL in Ghana, it was pertinent for us to assess the effectiveness of this new curriculum, at least on the students' performance in the MB ChB licensing examinations. We therefore compared the performance of students in a PBL/COBES curriculum with that of students in a conventional curriculum by analyzing their scores on the Ghana Medical and Dental Council licensing examination for the MB ChB degree.

METHODS

PBL/COBES curriculum

In 2007, UDS-SMHS adopted and implemented a PBL/COBES curriculum. Students who were admitted into the class of 2006 and had completed their conventional preparatory first year (PBL 0) at the end of the 2006/2007 academic year followed the PBL/COBES curriculum for the 2007/2008 academic year (PBL 1) as pioneering students. They are referred to as the "PBL students" in this study. The preparatory first year employed traditional didactic lectures for teaching and learning. It also granted the students who had recently graduated from high school the opportunity to take prerequisite courses and establish a good foundation for the medical

program. The PBL/COBES curriculum comprised three years of preclinical training and three years of clinical training. It emphasized small-group, student-centered, self-directed learning of basic and clinical science material incorporating COBES. Teaching and learning were organized around discipline integrated blocks (4-6 weeks duration).

The objectives of each block were met through tutorials, skills training, practical laboratory training, and lectures. Students were put into tutorial groups of 8-10 peers and provided with a tutor. Together with the tutor, the group met twice a week for two-hour sessions to discuss cases. In the small group tutorial discussions, the students generated learning issues that served as the stimuli for their self-directed learning and small-group discussions. They also had a two-hour interactive lecture two or three times a week. The lectures were meant to clarify concepts from the tutorials that the students did not understand or that were part of difficult subject matter. The students also spent two hours per week in medical skills training at a skills laboratory and two hours at a practical laboratory or dissection laboratory. In the PBL clinical clerkships, the students learned to apply the functional knowledge and clinical reasoning skills they had acquired during the first three years of the PBL course through paper cases, to identify and find solutions to a variety of clinical problems in real patients. Multiple teaching strategies were used to address these learning needs. The learning opportunities included PBL tutorials, case presentations and case write-ups, bedside teaching sessions, expert resource sessions, practical procedures, and grand rounds. The PBL clinical clerkship curriculum contained explicit lists of core clinical problems that the students would incrementally encounter and become familiar with over the three years of clinical clerkship. The students rotated through each clinical discipline in groups of about 8-10, and each group in a class was exposed to similar clinical conditions. The students were expected to keep logbooks of all the important clinical encounters. The logbooks were issued by the individual disciplines.

Conventional curriculum

The classes of 2004 and 2005, referred to here as the "conventional students," followed a lecture-based curriculum from preclinical (3 years) to clinical clerkships (3 years). Like the PBL students, the conventional students had to complete a preparatory first year before embarking on medical training in their second year. The conventional, traditional curriculum was generally organized around various disciplines, including anatomy, biochemistry, microanatomy, immunology, physiology, and neuroscience. Other disciplines included pathology, pharmacology, medical microbiology, and other relevant courses. These disciplines were taught through lectures for the en-

tire preclinical year (years 2 to 4). The fifth to seventh years were used for clerkship rotations following the conventional methodology.

Participants, data source, and the MB ChB Final Part I and II licensing examination

The study sample consisted of 30 medical students in the class of 2004 and 63 medical students in the class of 2005, all of whom followed the conventional curriculum. It also comprised 82 students in the class of 2006, who followed the PBL curriculum. This resulted in a total sample size of 175 students (93 conventional and 82 PBL). No changes in the applicant pool or selection processes accompanied the curriculum change. Entrance and admission criteria did not change for the two cohorts of students. The study was retrospective and considered the raw scores of all the 175 students (100% response rate) in the MB ChB Final Part I and II) examinations. With written permission, the results were obtained from the Examinations office of the UDS-SMHS.

The two-part qualifying examination evaluates the competencies considered essential for the practice of medicine by all medical doctors in Ghana. Part I comprises two papers written at the end of the fifth year (second year of clinical training). These papers include topics on Pediatrics and Child Health, and Obstetrics and Gynecology. Part II is usually written at the end of the sixth year (third year of clinical training) of the MB ChB; it comprises four papers on Surgery, Community Health and Family Medicine, Internal Medicine, and Psychiatry. The examinations are moderated and supervised by the Medical and Dental Council of Ghana, the official regulatory body for Doctors and Dentists. Both part I and II examinations consist of a theory and clinical papers. The theory paper is usually made up of multiple choice questions, short answer questions, and long essay questions. The clinical paper, which is practical, comprises three short cases and one long case conducted at the bedside. Students also take an oral examination with a panel of examiners to answer general questions. The scores from each of the three components (theory, clinical, and oral) are averaged to form a composite score for a discipline. As a regulation, students must pass the clinical paper irrespective of their scores on the other components of the exam in order to pass the discipline.

Statistical analysis

We performed all data analyses using GraphPad Prism ver. 5 (GraphPad software, San Diego, CA, USA; <http://www.graphpad.com>). Using a Student t-test, we compared the scores of the PBL students and conventional students in the various disciplines of the MB ChB Final Part I and II examinations. In addition, we used Fisher exact test to evaluate the differences

in the proportion of students obtaining distinction-credit-pass-fail grades for the PBL students compared to the conventional students, in the various disciplines. In all statistical tests, a value of $P < 0.05$ was considered significant. Distinction-credit-pass-fail grades were obtained by using the UDS-SMHS examination regulations: 80-100, distinction; 65-79, credit; 50-64, pass; and < 50 , fail.

RESULTS

Examination results were obtained for all the students (both PBL and conventional), resulting in a response rate of 100.0%. Table 1 shows the demographic characteristics of the students. More than 50% ($n = 104$) of them were male. Eighty-two students (49.6%) followed the PBL method of teaching and learning, and the rest followed the conventional methodology. Table 2 presents the students' mean and median scores. As shown, the PBL students had higher mean and median scores than the conventional students in obstetrics and gynecology, community health and family medicine, surgery, and psychiatry. However, the conventional students had higher scores than the PBL students in pediatrics. The grades obtained by the students in the various disciplines are presented in Table 3. A significantly ($P = 0.0068$) higher percentage, 15.9% ($n = 13$), of the PBL students obtained credits in obstetrics and gynecology compared to 3.2% ($n = 3$) of the conventional students. In contrast, however, in community health and family medicine, a higher proportion of the conventional students (24.7%, $n = 23$) than the PBL students (17.1%, $n = 14$) obtained credits. The differences were not significant when students' grades were stratified according to the teaching and learning methodology. Significantly, the number of students failing in surgery ($n = 8$ vs. $n = 1$) and in child health and pediatrics ($n = 2$ vs. $n = 11$) was higher for conventional students than for PBL students. Overall, 95.1% ($n = 78$) of the PBL students passed all the disciplines, compared to 79.6% ($n = 74$) of the classical students. The differences were significant when students' overall performance were stratified by the teaching and learning methodology.

Table 1. General characteristics of the students ($n = 175$) in a comparison study of students in problem-based learning community-based education and service and conventional curricula, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

Demographic characteristic	Frequency (%)
Gender	
Male	104 (59.4)
Female	71 (40.6)
Teaching methodology	
Problem-based learning	82 (46.9)
Conventional	93 (53.1)

Table 2. Mean and median scores of students for various disciplines in a comparison study of students in problem-based learning (PBL) community-based education and service and conventional curricula, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

Subject	PBL group (n = 82)		Conventional curriculum group (n = 93)		P-value
	Mean (95% CI)	Median score (25%, 75%)	Mean (95% CI)	Median score (25%, 75%)	
Obstetrics and Gynecology	60.7 (59.6-61.7)	60.6 (56.9, 63.9)	58.5 (57.6-59.4)	58.5 (55.5, 62.0)	0.002
Community Health and Family Medicine	73.6 (72.4-4.7)	72.8 (70.7, 78.1)	61.2 (60.2-62.3)	61.0 (48.0, 65.0)	<0.001
Surgery	62.5 (61.8-63.3)	62.7 (54.9, 65.1)	60.5 (59.3-61.7)	59.0 (56.3, 64.0)	0.006
Pediatrics	51.4 (49.7-53.1)	51.5 (46.9, 56.4)	55.6 (54.5-56.7)	56.0 (52.0, 60.0)	<0.001
Internal Medicine	58.7 (58.0-59.4)	58.8 (56.9, 60.5)	55.0 (54.2-55.8)	56.0 (53.0, 57.9)	<0.001
Psychiatry	75.9 (74.9-77.1)	76.0 (73.9, 80.0)	67.8 (66.4-69.3)	69.0 (63.5, 72.0)	<0.001

Table 3. Students' grades in the various disciplines (n = 175) in a comparison study of students in problem-based learning (PBL) community-based education and service and conventional curricula, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

Discipline	PBL curriculum group (%) (n = 82)	Conventional curriculum group (%) (n = 93)	P-value
Obstetrics and Gynecology			
Credit	13 (15.9)	3 (3.2)	0.007
Pass	69 (84.1)	88 (94.6)	0.026
Fail	0	2 (2.2)	0.499
Community Health and Family Medicine			
Credit	14 (17.1)	23 (24.7)	0.267
Pass	65 (79.3)	68 (73.1)	0.379
Fail	3 (3.6)	2 (2.2)	0.666
Surgery			
Credit	22 (26.8)	22 (23.7)	0.727
Pass	59 (72.0)	63 (67.7)	0.622
Fail	1 (1.2)	8 (8.6)	0.038
Pediatrics and Child Health			
Credit	4 (4.9)	2 (2.2)	0.421
Pass	76 (92.7)	80 (86.0)	0.224
Fail	2 (2.4)	11 (11.8)	0.021
Internal Medicine			
Credit	3 (3.7)	0	0.101
Pass	79 (96.3)	80 (86.0)	0.019
Fail	0	13 (14.0)	0.001
Psychiatry			
Credit	81 (98.8)	69 (74.2)	<0.001
Pass	1 (1.2)	23 (24.7)	0.001
Fail	0	1 (1.1)	1.000
Overall performance			0.001
Passes all	78 (95.1)	74 (79.6)	
Not all	3 (3.7)	19 (20.4)	

DISCUSSION

We compared the achievement levels of students following a PBL/COBES curriculum with those of students following a

conventional curriculum. Our findings demonstrate that, on average, the PBL students performed significantly better than their conventional counterparts and graduated with a higher number of credits in the various disciplines. Specifically, they had significantly higher mean scores and a higher number of credits in Internal Medicine, Obstetrics and Gynecology, Community Health and Family Medicine, Surgery, and Psychiatry. However, this was not the case in Pediatrics and Child Health, where the conventional students performed better.

Our findings are in consonance with the report that the mean scores were higher on the United States Medical Licensing Examination (USMLE) Step 1 for classes taught under the PBL curriculum than for classes taught under the traditional curriculum [3]. It was also observed that the implementation of PBL markedly affected National Board Dental Examination (NBDE) Part I scores, graduation rates, attrition rates, entrance into postdoctoral plans, and the percentage of graduates entering General Practice Residency/Advanced Education in General Dentistry (GPR/AEGD) programs [4]. Further, the PBL-track students scored significantly higher in all four discipline-based portions of the national licensing examination and also in the aggregate, and scored well in comparison with the performance of dental students nationally [5]. Meanwhile, in another cohort observation of medical students' performance in the USMLE Step 1 and Step 2, there was no significant difference between the performance of students in a PBL curriculum and those in a traditional curriculum across a seven-year period (1992-1998) [6].

This study offers an enhanced opportunity to evaluate program effectiveness compared with cross-sectional, single point in time studies. We did not control other factors such as age, sex, and high school grades, which may have had an influence on the students' performance. This was a cross-sectional study involving analysis at a single point in time. Longitudinal analyses are required to measure the long-term effects of the new curriculum, and additional studies are needed to document the consistency of the outcomes of success. This study does, however, provide a basis for the design of future longitudinal

studies.

In conclusion, the findings of this study provide assurance that the use of PBL does not compromise medical students' attainment of basic science and clinical knowledge, although the adoption and implementation of PBL at UDS-SMHS has been a tedious and challenging task. It needs to be emphasized that the PBL method of teaching and learning is at least comparable to the conventional method and may be superior. Should the above findings stand, a revision of the conventional method of teaching and learning of medical students in Ghana is imminent.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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SUPPLEMENTARY MATERIAL

Audio recording of the abstract.

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