A cross-sectional study of basic education influence on the clinical training: Attitudes and perception among Jordanian medical students

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ABSTRACT

Background: Over the past century, the medical educational model has been static with no significant improvement. Studies show that students are leaning towards a more active, dynamic, learner-centered education model that fits their needs and encourages them to be more responsible for their learning. Thus, we conducted this study to investigate Jordanian medical students' perceptions and attitudes towards the value of basic sciences in their clinical training.

Methodology: This was a cross-sectional study that utilized an online, self-administered questionnaire targeting medical students in their clinical years. The questionnaire comprises 5 domains targeting students' perceptions, attitudes, and suggestions of the medical educational system in general and basic sciences in specific.

Results: Overall, 578 medical students completed the survey with a male to female ratio of 0.7, and 56% of participants studied were studying at Mutah University, while 42% were at the University of Jordan. Approximately three-fourth (73.9%) of the students reported that basic medical sciences are critical to their development as physicians. Approximately, 82% believe that it is vital to integrate the clinical practice into basic science teaching. Besides, 82.4% of students agreed that faculty members' teaching style influences the educational content's delivery at the basic level. Moreover, 73% of students lean towards the inclusion of problem-based learning into their curriculums. On the other hand, 41.7% of students reject basic science questions in their written clinical exams.

Conclusion: Our study highlights the positive attitudes of Jordanian medical students towards basic medical sciences. It also demonstrates that students are more comfortable with an active and dynamic educational model that fits their needs and qualifications. Thus, we recommend a student-centered medical educational model trail to maximize learning and teaching efficiency and develop competent medical practitioners.

1. Introduction

Over the last century, medical education has been dichotomized into basic and clinical sciences [1]. The 'basic plus clinical' medical model was initially described in the report by Flexner [2], a proponent of integrating basic sciences into the educational model, yet acknowledged the bounded usefulness of such basic knowledge. This standing model of medical education is based on the unverified hypothesis that a physician's sound clinical reasoning and decision making are based on understanding basic medical sciences [3]. No other alternatives have disturbed the present model's convenience.

Such a conventional model administers basic sciences in a lecture-based and teacher-centered teaching fashion predominantly taught by basic scientists [4]. Jordanian medical schools have exclusively adapted the conventional model of medical education since their conception. The education system favors a '3 + 3' model variation. Basic sciences and

clinical sciences are given 3 years each, which is similar but more dragged-out than the American and Canadian medical education [2]. During their first three years of basic sciences, students lack any experiences oriented around clinical practices whether in the forms of electives, shadowing or mere observerships of real-life clinical practice. There are six medical schools in Jordan, all of which are designed to accommodate students from all geographical sectors. Their medical curriculums are almost exactly the same in terms of content, yet they have slight differences in the chronological order of minor aspects, such as the order of majors or elective medical training. The acceptance criterion of these medical schools is solely based on the competitive averages of the nationwide "Tawjihi" secondary exams due to the high competition and increasing student numbers [5,6].

Both medical students and clinicians have disputed the quality and quantity of taught basic sciences within a clinical context. This dismissive stance arises from the students' perceptions of basic sciences as "irrelevant" in clinical practice and the enigma portrayed by skillful physicians who are not evenly experienced with medicine's basic foundations [3]. On the other hand, various reports stress the significance of basic sciences as they provide a conceptual framework for learning clinical medicine, fortify one's ability to reach clinical diagnoses, and enable accurate explanations of clinical cases [7–9].

Thus, this study explores medical students' attitudes in their clinical years towards basic medical sciences in terms of relevance to their clinical education. Also, it aims to transform this feedback into a curriculum that properly integrates both pillars of the conventional model and focuses on increasing the relevance of basic sciences within appropriate clinical contexts.

2. Methodology

2.1. Study design and sampling

This cross-sectional study was conducted in two schools of medicine in Jordan. Participants were medical students in their clinical years (4th, 5th, and 6th-year students) during the 2019–2020 academic year at both the University of Jordan and Mutah University. The total number of students in their clinical years across Jordan's six medical schools is 5148 students. Approximately 2065 students are in their clinical years across the University of Jordan and Mutah University. The study utilized an online, anonymous, self-administered questionnaire. Google forms were utilized for the creation and administration of the questionnaire, in which participants were only limited to one response as to avoid duplicated data or exaggerated responses. The questionnaire was administered and shared within the official social media groups of the targeted batches of students (e.g. Facebook and WhatsApp) as to maximize the questionnaire's reach. Study participants were encouraged to disseminate the questionnaire among their peers and colleagues to create a snowball sample. Participants are medical students in their clinical years who gave informed consent and had fully completed the questionnaire. Overall, 578 participants were included in the study.

2.2. Instrument development

The data collection instrument was designed based on a thorough literature review and authors' consensus towards the instrument's domains' objectives. The questionnaire is comprised of five unique domains that include attitudes, perceptions of basic sciences as a general educational asset, perceptions of basic sciences within a clinical context, proposals to improve the relevance of such sciences, and most recalled basic sciences. The first four domains were composed of a 5-point Likert scale (ranging from "strongly agree" to "strongly disagree").

The first domain included two items aimed at exploring students' attitudes towards medical education in general. The first item investigated the importance of acquired knowledge for clinical practice, while the second explores students' perceptions of the importance of attending lectures. The second domain inspected students' perceptions of the importance of basic medical sciences in terms of whether it assists in retaining information, contributes to better clinical care, or fluctuates in value due to the faculty members' delivery.

The third domain investigated the perceived value of basic medical sciences in clinical practice. The fourth domain explored the possibility of improving the importance and relevance of basic medical sciences. It proposes solutions and techniques such as integrating problem-based learning (PBL), exam reformations, teaching basic sciences in a clinically-oriented context, and introducing medical training in medical education.

The fifth and final domain included two items that investigate which basic sciences were most recalled and least important from students' perspectives. The validity of the questionnaire's content was determined among the authors, through which consensus over each objective of every item was reached.

2.3. Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23 (Chicago, USA). Questionnaire items were reported as frequencies [n (%)]. Mann-Whitney U test was utilized to test fo significant differences between different genders and observed responses. Kruskal Wallis test was used to detect associations between student clinical level and observed responses. A P-value of less than 0.05 was considered statistically significant.

2.4. Ethical considerations

The Institutional Review Board (IRB) at both the University of Jordan and Mutah University have approved the research's protocol and granted its ethical approval. In addition, an online consent form was obtained from all participants before accessing the questionnaire.

3. Results

Out of 578 participating medical students, 340 (58.8%) were females, and 238 (41.2%) were males. The majority of participants were 4th-year medical students (40.7%) followed by 6th-year medical students and 5th-year medical students (31.1% and 28.2%). Overall, 56% of all participants studied at Mutah University, while 42% were at the University of Jordan.

The responses demonstrate that 41.4% of students agreed that physicians could efficiently provide patient treatment without being uniformly aware of the biological processes involved. However, 73.9% of participating students believe that basic sciences experiences and information are critical to future physicians' roles. Nearly 82% of students recognized the importance of integrating basic science concepts into clinical sciences, while 74.7% agreed that basic sciences' general concepts are vital to have a competent working background. Nonetheless, 41.7% of students reject the inclusion of basic sciences' questions into their clinical exams.

More than 65% of students agreed that faculty members are responsible for integrating basic sciences into clinical practice, as 82.4% believed that a member's teaching style influenced basic knowledge delivery. Students felt that only certain subjects are essential for clinical practice (80%). Nonetheless, despite their consensus on the fundamental role of basic sciences for physicians (50%), only 11% of medical students reported that basic sciences' exams were of significant value in clinical practice.

To improve the relevance of basic sciences, 73% of medical students support the inclusion of PBL into their curriculums. In addition, 80% believed that the new curriculums should focus only on general concepts without concentrating of vast amounts of minute basic sciences' details. Overall, 80% of medical students believe that the clinical context should be incorporated into the early years of basic sciences education. Table 1

Table 1
Collective students' response rates.

Statement no.	Statement	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
1	A physician can effectively treat most patients without knowing the details of the biological processes involved.	38 (6.6%)	159 (27.5%)	142 (24.6)	189 (32.7)	50 (8.7%)
2	The information (basic and clinical) and experiences I have gotten to date are fundamental to my future role as a physician.	12 (2.1%)	47 (8.1%)	92 (15.9%)	279 (48.3%)	148 (25.6%)
3	Applying basic medical sciences to clinical practice is a skill which should be reinforced early on in medical education.	5 (0.9%)	41 (7.1%)	61 (10.6%)	177 (30.6%)	294 (50.9%)
4	What students should learn in basic sciences are general concepts that aids them in formulating a good working background without memorizing all facts.	13 (2.2%)	49 (8.5%)	86 (14.9%)	208 (36.0%)	222 (38.4%)
5	Including of basic sciences' questions in written exams helps clinical years students to retain basic sciences' information.	63 (10.9%)	178 (30.8%)	157 (27.2%)	141 (24.4%)	39 (6.7%)
6	Faculty members (in basic sciences) may influence the delivery of basic sciences subjects through their way of teaching.	11 (1.9%)	26 (4.5%)	65 (11.2%)	205 (35.5%)	271 (46.9%)
7	Faculty members (in basic sciences) play a main role in the integration of basic sciences subjects into clinical practice.	43 (7.4%)	75 (13.0%)	85 (14.7%)	168 (29.1%)	207 (35.8%)
8	Basic sciences subjects are fundamental for good clinical practice.	20 (3.5%)	78 (13.5%)	126 (21.8%)	242 (41.9%)	112 (19.4%)
9	Certain basic sciences are inessential for clinical years' knowledge.	9 (1.6%)	43 (7.4%)	66 (11.4%)	227 (39.3%)	233 (40.3%)
10	Problem-based learning lectures in the basic years are important for clinical practice.	9 (1.6%)	42 (7.3%)	100 (17.3%)	236 (40.8%)	191 (33.0%)
11	It would be more beneficial to learn the general concepts of a subject without going through all the small details in order to memorize it during basic years.	8 (1.4%)	36 (6.2%)	66 (11.4%)	158 (27.3%)	310 (53.6%)
12	The basic years subjects are fundamental to my future as a physician.	32 (5.5%)	102 (17.6%)	151 (26.1%)	219 (37.9%)	74 (12.8%)
13	The basic years' doctors' questions in the exams helped me in clinical practice.	176 (30.4%)	216 (37.4%)	122 (21.1%)	53 (9.2%)	11 (1.9%)
14	Theory learning classes are more beneficial than skill-oriented lab sessions.	170 (29.4%)	244 (42.2%)	98 (17.0%)	45 (7.8%)	21 (3.6%)
15	Starting clinical training along with studying basic sciences can be helpful to the process of integration of both sciences.	14 (2.4%)	45 (7.8%)	68 (11.8%)	220 (38.1%)	231 (40.0%)

shows the detailed students' responses).

In terms of basic sciences recall, pathology, physiology, and anatomy were the most recalled subjects (71.3%, 59.5%, and 55.5%), respectively (Fig. 1). On the other hand, biochemistry and histopathology were the least recalled (3.1% and 1.6%, respectively). Furthermore, students believe that biochemistry (55.5%) and microbiology (21.6%) are the least important in clinical practice (Fig. 2).

Our results demonstrate a statistically significant difference among different student levels in terms of PBL integration, including basic science questions in clinical exams and early basic science integration in clinical practice. Moreover, a significant difference was found between genders in terms of faculty members' roles, focus on general concepts, early integration of clinical contexts into basic education, and the value of theory lectures compared to lab-oriented skills (Refer to Table 2).
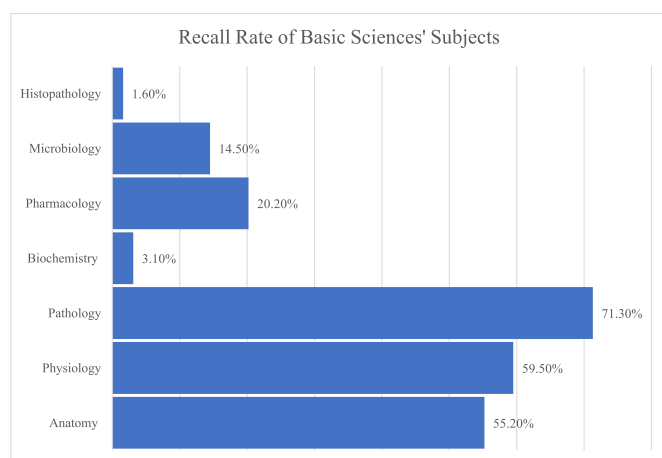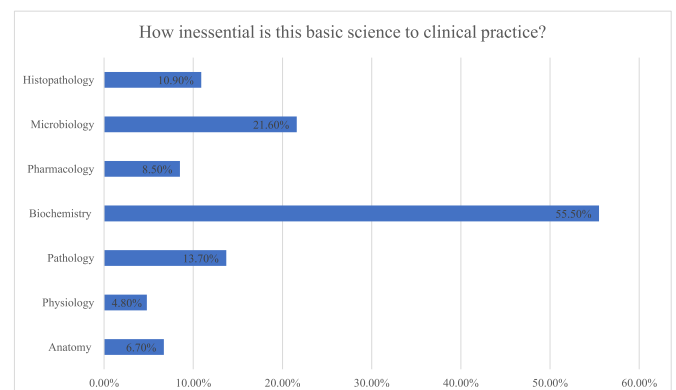

Fig. 2. The importance of basic sciences' subjects on the clinical practice.

4. Discussion

In Jordan, the medical curriculums are categorized into three years of basic sciences teaching and three years of clinical education. The three years of pre-clinical education are all lecture-oriented with minimal lab integration, all of which are taught by faculty members exclusively conversant in basic sciences. Such practices have led to a considerable disconnect between basic and clinical sciences, which promoted students to perceive basic sciences as a barrier to reaching clinical training [10]. Understanding basic sciences is a precondition to understanding clinical medicine, as it aids in fact recall, contributes to better diagnostic formulations, and assists in solving complex and atypical clinical scenarios [11].

Jordanian medical students showed a sound understanding of the importance of basic sciences. Moreover, they displayed a positive attitude towards the integration of PBL into their present curriculums. Such a phenomenon is readily present in the literature since students would

Fig. 1. Recall rate of basic sciences' subjects.

Table 2
Statistical analysis of differences between sub-groups.

Statement no.	Statement	Gender* (P-Value)	Student's Current Clinical Year** (P-Value)
1	A physician can effectively treat most patients without knowing the details of the biological processes involved.	P = .409	P = .064
2	The information (basic and clinical) and experiences I have gotten to date are fundamental to my future role as a physician.	P = .933	P = .127
3	Applying basic medical sciences to clinical practice is a skill which should be reinforced early on in medical education.	**P = .027**	P = .299
4	What students should learn in basic sciences are general concepts that aids them in formulating a good working background without memorizing all facts.	**P = .003**	P = .922
5	Including of basic sciences' questions in written exams helps clinical years students to retain basic sciences' information.	P = .285	**P = .004**
6	Faculty members (in basic sciences) may influence the delivery of basic sciences subjects through their way of teaching.	P = .395	P = .289
7	Faculty members (in basic sciences) play a main role in the integration of basic sciences subjects into clinical practice.	**P = .002**	P = .057
8	Basic sciences subjects are fundamental for good clinical practice.	P = .428	P = .938
9	Certain basic sciences are inessential for clinical years' knowledge.	P = .344	P = .099
10	Problem-based learning lectures in the basic years are important for clinical practice.	P = .326	**P = .048**
11	It would be more beneficial to learn the general concepts of a subject without going through all the small details in order to memorize it during basic years.	**P = .002**	P = .233
12	The basic years subjects are fundamental to my future as a physician.	P = .655	P = .801
13	The basic years' doctors' questions in the exams helped me in clinical practice.	P = .461	P = .520
14	Theory learning classes are more beneficial than skill-oriented lab sessions.	**P = .007**	P = .246
15	Starting clinical training along with studying basic sciences can be helpful to the process of integration of both sciences.	P = .058	**P = .048**

*Mann-Whitney test was used to for 2-sampled nonparametric analysis
 **Kruskal-Wallace test was used for K-sampled nonparametric analysis

opt to experience PBL learning due to its learner-centered nature, which allows them to discover their strengths and weaknesses as they learn basic sciences' concepts within a clinical context [4]. Moreover, a PBL-oriented model encourages students to use in-depth learning methods and be intrinsically interested in the learning process, leading to higher long-term knowledge retention [12]. The preference of more student-centered approaches can be seen through their negative response towards the value of theory-based lectures compared with

skills-based laboratory experiences. The transition to a student-centered teaching model was consistently stressed upon by medical educators [13]. However, for such a transition to take place, commitment from the faculty should be ensured.

Our results demonstrate that medical students recognize the value of basic sciences. This observation can be deduced by analyzing their positive attitudes towards the statements that describe such sciences' benefits. The students concur that understanding basic medical sciences is critical to their development as future physicians. Integrating a clinical context to basic science learning is of immense long-term value as it provides students with a working background that aids them in clinical practice. This positive attitude was observed in studies done in medical schools in India and Nepal [14,15]. However, studies conducted in the Netherlands and Saudi Arabia showed increasing negative attitudes towards basic sciences as students' progress through their medical education [16,17].

Medical students at Jordanian universities recall the essential information from pathology, physiology, and anatomy. Such sciences are frequently preferred because they seamlessly mend the gap between practical skills and fundamental theory. Basic sciences such as anatomy, are of practical value during surgeries and surgical rounds, while pathology and physiology contribute to an essential understanding of diseases and are taught in a more clear fashion in the curriculum [18]. On the other hand, students believed that biochemistry and microbiology are the least useful in clinical practice. Such an unfavorable attitude may stem from the curriculum's incompetency, as it may overload the student and consume his attention and energy. The problem of inefficient, content-heavy curriculums can be solved by adopting a core teaching module supplied by additional elective topics that promote self-learning and share the responsibility of maintaining learning with the student [19]. Further explanations for such a phenomenon arise from inconsistent clinical textbook coverage of basic concepts and exam inadequacies [20].

Our results suggest a statistically significant difference between genders in the statements concerning early integration, faculty member roles', focus on general concepts, and theoretical lectures' value. A gender-based difference can be attributed to the hypothesis that males are usually more technically-oriented than females, leading them to value basic sciences more frequently than females [21]. Furthermore, we observed a significant difference between students of different clinical years regarding attitude towards PBL learning and early integration of clinical context into basic science teaching. This can be explained by the experience and confidence of senior students in comparison with their junior counterparts. However, a positive attitude from senior students towards basic sciences can result from recall bias, yet might also imply that students' concerns over basic sciences are only temporal and molded with time and experience within the clinical field [13].

In light of what's above, a prototype problem-based curriculum should be attempted across Jordanian medical schools juxtaposed against the present conventional curriculum. A student-centered curriculum, built around integrating clinical context within basic sciences, would allow students to self-criticize their education and motivate them to voluntarily seek diverse modalities of learning. Moreover, a module-based design would promote self-learning among students and hold them responsible for their own extended learning. Such curriculum should be objectively appraised through longitudinal studies.

4.1. Limitations

Our study has several limitations. First, the cross-sectional study design precludes a cause-effect relationship. Besides, the study utilized an internet-based questionnaire, which could have misrepresented the targeted population. Moreover, the study's sample might not represent all Jordanian medical students as its participants were primarily from two universities. Moreover, the external validity of this study might not be guaranteed due to the different forms of curriculums and teaching

style implemented in medical schools worldwide. Thus, prospective studies are needed to compare students' attitudes in the pre-clinical, clinical, and after graduation. This paper is reported in line with the STROCSS guideline [22].

5. Conclusion

Our study demonstrates that students at two Jordanian medical schools show positive attitudes towards basic medical sciences, yet they believe that these fundamental sciences are not well-presented. Moreover, they call for integrating clinical contexts within their basic sciences' education to improve the learning process and use it in their clinical practice. Students perceived a PBL-oriented curriculum as more comfortable and more adaptive to their needs and qualifications. Thus, a transitional trail of an integrated problem-based curriculum can be introduced and compared meticulously with the present curriculum to maximize the learning process' efficiency and ensure the development of competent, well-qualified medical practitioners. Such a transition requires faculty commitment to compensate for continuous learning assessments, limited resources, and other inadequacies.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.amsu.2020.11.022.

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Ethical approval

The Institutional Review Board (IRB) at Mutah University has approved the project without amendment (reference number: 202012).

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In addition, an online consent form was obtained from all participants before accessing the questionnaire.

Consent

No identifying details are included in the study

Author contribution

Emad Aborajooh: Study concept and design, data analysis, writing the paper and approving final manuscript.

Raed Al-Taher: Study concept and design, data analysis, writing the paper and approving final manuscript.

Nafez Abu Tarboush: Study concept and design, approving final manuscript.

Abdallah Al-Ani: Final manuscript writing and data analysis.

Nuha Qasem: Data collection and literature review.

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Bashayer Al-Saeedi: Data collection and literature review.

Shahed Al-Husaini: Data collection and literature review.

Amina Bucheeri: Data collection and literature review.

Registration of research studies

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Unique Identifying number or registration ID: researchregistry6097

Hyperlink to your specific registration (must be publicly accessible and will be checked): https://www.researchregistry.com/browse-the-registry#home/registrationdetails/5f8047ea3f5d5600167392bd/

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