

Medical Students satisfaction and performance towards implementation of Anatomy laboratory guide in a discipline-based curriculum

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ABSTRACT

Background: Anatomy is considered a crucial subject essential to many relevant medical fields, such as health science. The anatomy practical is the best teaching strategy for learning anatomy and is the most suitable place for privilege, discovery, and discussion. The gross anatomy laboratory sessions are small group sessions that allow medical candidates to examine prosecuted human cadaveric specimens. Although the instructor is available to direct learners through the activities in these anatomy laboratory classes, these classes are meant to be led by students working in groups. Student involvement through the anatomy practical will let them be able to identify the anatomical features of each part on dissected human cadavers, specimens, and plastic anatomical models, as well as practice these in the discussion of functional and applied aspects of the different body parts.

Methods: This is a mixed-method study conducted at the end of September 2020 at the College of Medicine, King Khalid University, Abha, KSA, on medical students in the 2nd year of the preclinical phase. A combination of tools was used:

A. An-inquiry-based student-centered guide for practical anatomy which contains items for learning and assessment of a mixture of cognitive skills.

B. A 19-item structured questionnaire was employed to gather relevant data regarding medical students' perception towards the implementation of the anatomy practical manual.

Results: Out of 132 enrolled students in ANA 212 and ANA 213 courses, 69.8% were male students while 30.2% were female students. The overall look indicated that a decisive majority of the respondent agreed or strongly agreed with the items almost more than 60% of most of the questions agreed and strongly agreed. All the responses were focused on praising or criticizing the existing anatomy guidelines as a teaching method. Still, none came up with new things like introducing new methods or strategies. Most of the students' comments concentrated on finding the course valuable, helpful, and essential in reducing the confusion about the difficulties of anatomy practical sessions and a fun way to learn anatomy. One-third of students agreed that the practical guide is written in simple language, whereas ten percent of them strongly disagree. The findings stated that many students strongly agreed that the supervising staff members were helpful and available during the practical sessions. Sitting individually discussing with some candidates, they praised the instructors' knowledge and behavior but found their number insufficient compared to the number of students present in each session. Students were also satisfied with the laboratory manual assessment criteria and commented that it was fair and realistic.

Conclusion: To sum up, our study showed that medical students (both boys and girls of levels three and four) are positive about the implementation of the anatomy practical guide. In conclusion, student performance is seriously enhanced (students scored) affected by the changes in the academic guidelines. This study will allow anatomists to confidently implement anatomy's methods, rules and regulations without the horror of losing education and risking student performance.

INTRODUCTION

Anatomy may be a very crucial subject as essential to many relevant medical fields, such as health science^{1,2}. The anatomy practical is the best resource for learning anatomy and is a wonderful place for privilege, discovery, and discussion³. The gross anatomy laboratory sessions are small group sessions that allow medical candidates to examine prosecuted (well-dissected) specimens of the human cadaveric material. Although the instructor is available to direct learners through the activities in these anatomy laboratory classes, these classes are meant to be led by students working in groups. Student involvement

through the anatomy practical's will provide them with the ability to identify the anatomical features of each part on dissected human cadavers, plastinated specimens, and plastic anatomical models, as well as apply these to the discussion of functional and applied aspects of the body system⁴. Dividing students into small groups for learning activities is more powerful in promoting critical thinking, problem-solving, communication, psychomotor and oral skills⁵⁻⁸.

A paradigm shifts in medical education from teacher-centered, information gathering towards purposeful student-centered, inquiry-based learning. Innovative learning methods and strategies such as

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problem-based, team-based, and case-based learning⁸.

With this knowledge, students engage in learning activities during the practical sessions where the instructor guides candidates and encourages each student to actively participate in the learning process. Candidates are constantly encouraged to investigate, monitor and share knowledge and experiences that help their learning and their peers^{9,10}. Practical anatomy is a distinguished environment for discovery and candidates are given the chance to explore the cadaveric specimens, engage in interactive discussions and find answers and explanations for themselves. To gain and obtain all these learning skills, a laboratory manual was implemented to achieve these essential skills. With the aid of this laboratory guide, learners were grouped into five or six groups for this practical session. Learning how to learn, interact and collaborate in a team is important for achievement in future career environments. Moreover, there is strong evidence that team-based learning supports greater student engagement and longer retention of knowledge¹¹.

Attendance at laboratory sessions is compulsory and should be recorded in the class at the commencement of each session. Arrival more than 15 minutes after the beginning of the session will be recorded as an absence. It is the student's responsibility to ensure that the instructor records his/her attendance and that no discussions will be allowed after the end of the session. Satisfactory completion of the task set for each class is essential. It should be noted that non-attendance for other than documented medical or other serious reasons, or unsatisfactory performance, for more than one practical class during the session may result in an additional practical assessment exam or ineligibility to pass the course¹². The candidate who misses a practical session due to illness or other reasons must submit a copy of the medical report or other documents to the course coordinator. Using practical guides in small groups which resemble team-based learning may help students achieve the same or better knowledge scores than using more traditional practical methods¹³.

Problem Statement: The limitations of the discipline-based approach in supporting the integration of anatomical knowledge in clinical practice and developing problem-solving skills (Elaborate).

Research Question: Does an introduction of a structured, inquiry-based guide for learning practical anatomy contribute to developing critical thinking and problem-solving skills among pre-clinical medical students in a discipline-based curriculum?

OBJECTIVES

General Objective: Satisfaction and performance of medical students towards using the anatomy laboratory manual in practical sessions

Specific Objective: The study aims to:

- Explore the medical students' satisfaction regarding the new anatomy practical guide.
- Validate the implementation of the new anatomy practical manual as a new instructional method.
- Assess the medical students' performance before and after the introduction of the practical guide.

MATERIAL AND METHODS

Study Design and Setting: This mixed-method study was conducted at the end of April 2021 at the College of Medicine, King Khalid University, Abha, KSA, on medical students in the 2nd year of the preclinical phase. A combination of tools was used.

A. An inquiry-based student-centered guide for practical anatomy which contains items for learning and assessment of a mixture of cognitive skills, including:

I. knowledge recall: through short answer questions for identification of different anatomical structures.

II. Comprehension of knowledge: through context-rich multiple-choice questions.

III. Problem-solving: through case-based, short structured questions.

The student's performance was assessed and compared before and after the introduction of the anatomy practical guide.

B. A 19-item structured questionnaire was employed to gather relevant data regarding medical students' perceptions towards implementing the practical anatomy manual.

A 5-point Likert scale, with five responses stated as "Strongly Agree," "agree," "neutral," "disagree," and "Strongly Disagree," was used. In addition, students were asked to follow-up questions related to positive and negative aspects of the Laboratory manual and to make suggestions for improvement.

Questionnaire item selection, the language of the questionnaire, and sequences of questions were decided and constructed with the help of a panel of experts, including researchers, anatomists, and medical educationists. Cronbach alpha of the questionnaire was also calculated. Descriptive statistics were calculated, i.e., mean, SD frequencies, and percentages. A T-test was used to measure the significant differences. The level of significance was 0.05. The study duration was from February to December 2021.

Administrative Consideration: Informed consent was obtained from all the respondents (Medical students of Anatomy courses) that their information would be kept confidential and the questionnaire was anonymous.

Ethical Consideration: Before Interviewing, informed consent was asked from all samples. Then, all participants had the right not to participate in the study or withdraw from the measurements before completion. The researcher explained the purpose to all respondents. Confidentiality and privacy were guaranteed for all participants.

An electronic questionnaire was used, and instructions regarding the questionnaire were mentioned before the initial section of the questionnaire.

Participants: A convenience sampling method was taken, and 200 hundred 2nd year medical students of both male and female sections were included in the study: seventy females and hundred and thirty male students in the academic year 2021.

Pilot Study: Before the start of data collection, the study tool was tested through a pilot study on 20 students (whose responses were not included in the main study) to test the clarity of the questionnaire's wording. Any ambiguity or difficulty in the statements was dealt with accordingly. Consequently, the final form of the data collection tools could be reached.

Statistical Analysis: Analysis of students' results and comparison of pre and post-test performance.

The responses were analyzed using descriptive statistics to determine frequencies, averages and percentages. A basic descriptive statistical analysis of the Likert items was conducted by calculating frequencies; and regrouping the responses into similar categories. A T-test was used to measure the significant differences. The level of significance was 0.05. The software used was SPSS ver 29.

Table 1: Item score

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The practical sessions helped me to familiarize with safety guidelines	10%	12%	21%	35%	22%
The dissection room is ideal for performing the tasks	20%	10%	15%	35%	20%
The supervising staff members were helpful during the practical sessions	12%	20%	17%	24%	25%
The supervising staff members were available throughout practical sessions	25%	12%	8%	35%	20%
The practical guide is written in simple and clear language	12%	13%	8%	34%	33%
The assessment criteria for the lab manual are realistic	14%	18%	8%	25%	35%
The practical guide enhances my study	20%	15%	15%	15%	35%
The practical guide covers the whole course objectives	7%	18%	17%	25%	33%
The practical guide is comprehensive and covers all the practical skills	18%	12%	8%	38%	24%
The practical guide provided me with some communication skills with my classmates	10%	22%	9%	29%	41%
The practical guide helps me for a better understanding of the subject	12%	18%	12%	21%	37%
The practical guide improves my academic performance	21%	12%	17%	23%	35%
The number of groups in the session of discussion is suitable	18%	21%	3%	35%	23%
The specimens are adequate for studying	12%	18%	12%	21%	37%
The practical guide improves my knowledge of the subject?	21%	12%	17%	14%	36%
The practical guide helps me to utilize the whole practical time	18%	21%	3%	33%	25%
The practical sessions helped me to develop my anatomy skills	18%	21%	3%	35%	23%
The practical guide is helpful to improve grades	12%	18%	12%	21%	37%
The practical sessions were interactive and more useful than the previous method	21%	12%	17%	14%	36%

RESULTS

Table 1 depicts the responses regarding the items of the questionnaire, overall look at the table indicated that a decisive majority of the respondent agreed or strongly agreed with the items and almost more than 60% of most of the questions agreed and strongly agreed.

Tables 1 and 2 depicted the responses regarding the questionnaire items and gender differences, respectively. In contrast, tables 3 and 4 compared students’ scores before and after implementing new guidelines and the pass rate: figures 1 and 2 revealed changes in students’ results and gender distribution. Out of 132 enrolled students in ANA 212 and ANA 213 courses, 69.8% were male students, while 30.2% were female students. An overall look at the table indicated that a decisive majority of the respondent agreed or strongly agreed with the items. More than 60% of most questions agreed and strongly agreed. All the responses were focused on praising or criticizing the existing anatomy guidelines as a teaching method. However, none came up with new things like introducing new methods or strategies. Most of the students’ comments concentrated on finding the course valuable, helpful, and essential in reducing the confusion about the difficulties of anatomy practical sessions and a fun way to learn anatomy. 34 % of students agreed that the practical guide is written in simple language, whereas 12 % strongly disagreed. The findings of table 1 stated that 25% of the students strongly agreed that the supervising staff members were helpful and available during the practical sessions. Sitting individually discussing with some candidates, they praised the instructors’ knowledge and behavior but found their number insufficient compared to the number of students in each session. Students were also satisfied with the laboratory manual assessment criteria and commented that it was fair and realistic. Most students strongly agreed (38%) that the practical guide was comprehensive and covered the course objectives and all the practical skills.

Furthermore, 29% of the candidates mentioned that the practical guide gave them some communication skills with their classmates. Some students thought that the practical guide improved their academic

performance (23% agreed, 37% strongly agreed) on the Ospe and would improve their final grade for the course. Many candidates responded that the number of students in the practical session was suitable and the laboratory manual helped them to utilize the whole practical time compared to the former conventional method of teaching practical anatomy. In addition, the practical sessions were interactive (14% agreed, 36% strongly agreed), and the practical sessions helped to familiarize with safety guidelines (35% agreed, 22% strongly agreed).

We have compared the gender differences and we did not observe any significant gender differences (P value is above 0.05).

Regarding the ITEMS scoring (we considered items having a Likert score above 3.00 to have a significant impact), interestingly, we noticed that all of our items included in the questionnaire have an average score above 3.00, which reflects that all items included in the questions have significant importance. Further, it has been confirmed that all of our items significantly impact students. (Table 1).

We also tried to establish gender-wise comparisons regarding each item. We noticed significant differences between gender in none of the items, which showed that irrespective of gender, all students agreed on the importance of the selected items in the questionnaire (Table 2). At the same time, we tried to compare before and after implementing the new practical guidelines. We considered the average score of the students as a parameter and observed the significant differences before and after the implementation of guidelines. The average score significantly increased after implementing new practical guidelines (Table 3). Although we already have a good pass rate in a practical exam, it was further enhanced and increased after implementing the new guidelines that showed the importance and significance of the new guidelines, Table 4). We observed a significant increase in both genders regarding the scoring in practical exams, which means that irrespective of gender, we observed an increase in students’ scores. (Figure 1).

Table 2: Gender differences: this table depicted that we did not observe significant gender differences while comparing the items. Further, in all items, the degree of agreement is higher than the degree of disagreement, which means the Likert average will be above 3.00. Some Items mentioned below show the agree and strongly agree compound percentage above 60.0%.

Items	Female					Male					P-value
	1	2	3	4	5	1	2	3	4	5	
The practical sessions helped me to familiarize with safety guidelines											N.S
The dissection room is ideal for performing the tasks	11%	7%	19%	38%	25%	13%	15%	10%	34%	28%	N.S
The supervising staff members were helpful during the practical sessions	12%	6%	19%	38%	25%	8%	18%	18%	32%	24%	N.S
The supervising staff members were available throughout practical sessions	15%	4%	21%	36%	24%	13%	10%	15%	28%	34%	N.S
The practical guide is written in simple and clear language	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S
The assessment criteria for the lab manual are realistic	18%	10%	12%	28%	32%	8%	24%	8%	34%	26%	N.S
The practical guide enhances my study	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S
The practical guide covers the whole course objectives	11%	7%	19%	38%	25%	13%	15%	10%	34%	28%	N.S
The practical guide is comprehensive and covers all the practical skills	12%	6%	19%	38%	25%	8%	18%	18%	32%	24%	N.S
The practical guide provided me with some communication skills with my classmates	15%	4%	21%	36%	24%	13%	10%	15%	28%	34%	N.S
The practical guide helps me for a better understanding of the subject	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S
The practical guide improves my academic performance	18%	10%	12%	28%	32%	8%	24%	8%	34%	26%	N.S
The number of groups in the session of discussion is suitable	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S
The specimens were adequate for studying	12%	6%	19%	38%	25%	8%	18%	18%	32%	24%	N.S
The practical guide improves my knowledge of the subject?	15%	4%	21%	36%	24%	13%	10%	15%	28%	34%	N.S
ide helps me to utilize the whole practical time	18%	10%	12%	28%	32%	8%	24%	8%	34%	26%	N.S
sions helped me to develop my anatomy skills	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S
The practical guide is helpful to improve grades	12%	6%	19%	38%	25%	8%	18%	18%	32%	24%	N.S
The practical sessions were interactive and more useful than the previous method	15%	4%	21%	36%	24%	13%	10%	15%	28%	34%	N.S
The practical sessions helped me to familiarize with safety guidelines	11%	7%	19%	38%	25%	13%	16%	9%	35%	27%	N.S

1= strongly disagree, 2= Disagree, 3 Neutral, 4 Agree, 5 Strongly agree

Table 3: Comparisons of students’ scores before and after the implementation of newguideline

Courses	Average scores before implementation of guidelines		Average scores after implementation of guidelines		p- value
	Mean	S.D	Mean	S.D	
	Course 1	67.5	2.5	88.5	
Course 2	74.5	3.5	95.5	3.8	0.000001
Course 3	78.5	1.2	98.5	1.4	0.00001
Course 4	79.1	0.08	92.1	1.8	0.000001
Course 5	73.5	1.2	92.4	1.6	0.000001

Table 3 depicts that we have observed the significant differences after the implementation of new practical guidelines in all courses of the anatomy department.

Table 4: Pass rate

Pass rate	
88%	Before
99%	After

Table 4 depicted the pass rate is significantly increased (P-value =0.0000001)

Figure 1 depicted the increasing change in students' scores after implementation of guidelines (Students’ scores).

DISCUSSION

The current research manifested that King Khalid medical students found the practical guide of anatomy was a sound, engaging and active learning

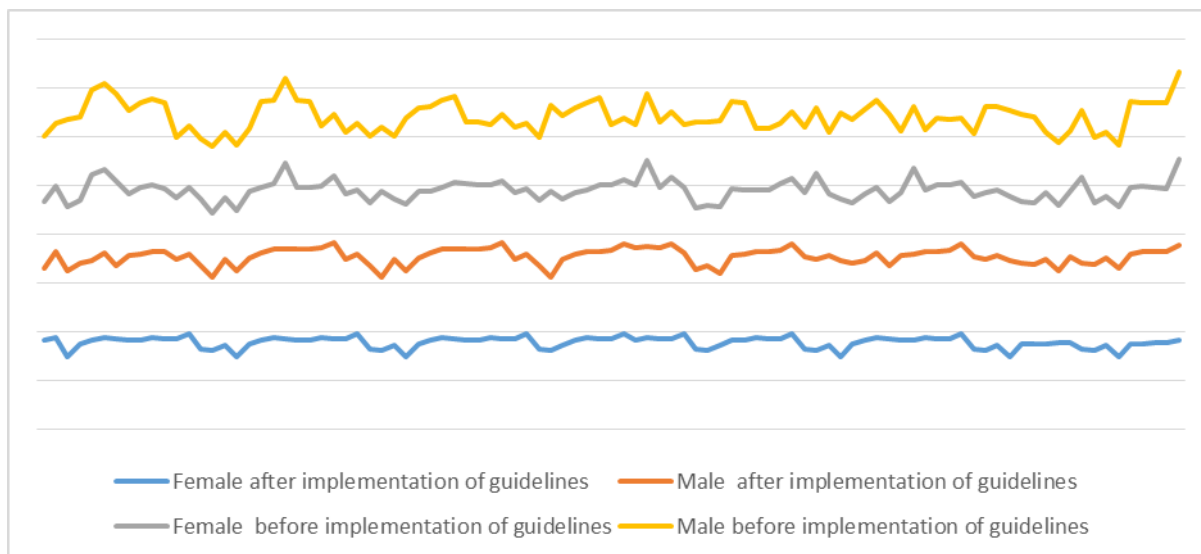


Figure 1: Change in student’s results

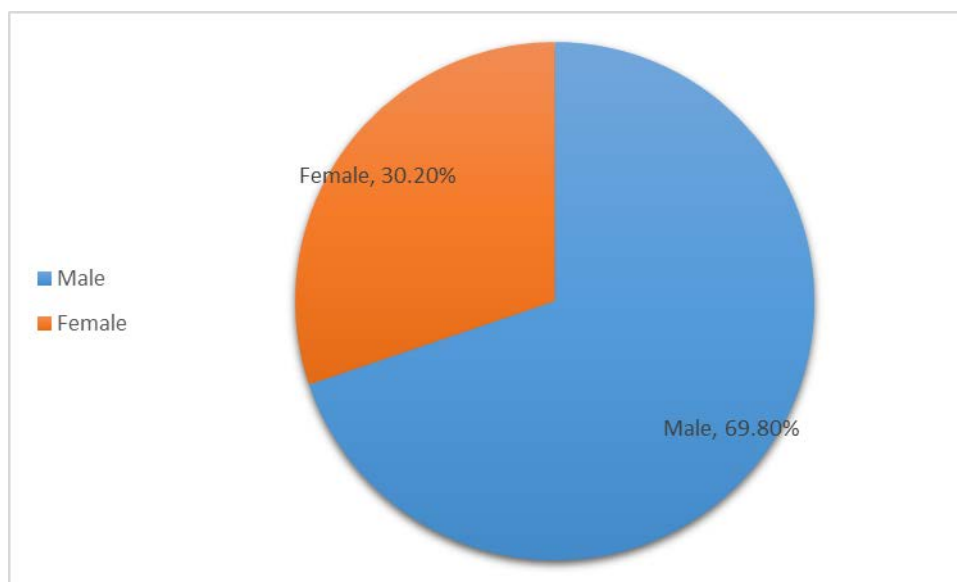


Figure 2: Gender distribution

strategy. It assisted our students in utility and administering knowledge in a practical, active and delightful way, exploiting their intelligence, curiosity and creativity. Several recent studies have used advanced complementary technology-based innovative teaching approaches with clinically focused and mixed pedagogical technologies in basic science teaching to fill this gap. The active and engaging learning strategy gave the student some responsibility¹⁴. Moreover, medical students gain self-reliance as they play the role of instructors to their peers. Studies have demonstrated that using such approaches in medical education can ameliorate medical students’ critical, observational, and diagnostic skills^{15,16}.

Change in medical education is an international program and many medical institutions have witnessed experimentation and experienced challenges¹⁷. Similarly, a contemporary medical curriculum has emphasized teaching anatomy using an active and integrated approach¹⁸. Many studies have demonstrated the advantages of multimodal teaching methods by integrating updated Dissection, digital technologies, and problem-based instruction in anatomy and other disciplines¹⁸. However, one of their key drawbacks is that they

promote rote memorization of names and structures and convey one-sided information through passive learning, which prevents learners from developing critical thinking skills¹⁹. A well-designed active and engaging learning strategy in a suitable and relaxed environment can help overcome these challenges and limitations.

The main objective of this study is to evaluate the student's perception regarding the modifications in the Anatomy practical guidelines. The shift in medical education is a global agenda and many medical schools have faced difficulties and experimentation. An involved and integrated approach to teaching anatomy has also been stressed in the current medical curriculum²⁰⁻²⁴.

Diversity in the experiences of students results in variability among students in terms of their educational background in a university setting and, thus, learning styles. Therefore, a more captivating and immersive strategy is required to keep students interested in the course topics.

Recent studies have used creative teaching strategies with clinically oriented and diversified pedagogical approaches in basic science

teaching based on modern complementary technology. The active and engaging learning approach provides the student with the general responsibility and freedom to construct presentations that are easy to understand, recall and remember for themselves.

In our study, experienced instructors connected significantly with students' satisfaction in practical sessions; further altered and student-focused changes were made to get more satisfied and quality medical students.

Our findings showed that the new modifications are beneficial for students. It enabled them to use and apply information in a positive, active, fascinating manner and to take advantage of their imagination, curiosity and intellect. These findings coincide with those of other studies²⁵.

In this research, we did not find a relationship consistent with other studies between satisfaction and gender, which is matchable with many studies.

The findings of this study will open the gateway for new researchers and anatomists to adopt the changes, especially in the practical sessions of Anatomy courses which will increase the student's satisfaction level and ultimately produce good quality satisfied doctors. One of this study's themes is evaluating the student's scores in the practical examinations of the anatomy courses as we have made some significant changes in practical guidelines and assessment methods. Skills laboratories provide comprehensive skills instruction for students in almost all contemporary medical curricula.

The practical anatomy examinations are usually conducted on specimens in the dissection room (referred to here as the "traditional" method). Here we have made some changes in the guidelines to improve the students' learning skills.

This is good for the student but also for patient care. They have proven skills in learning clinical and communication skills before students reach the hospital and engage in real-life patient interaction. This study needs to measure the improvement in the student's learning skills. In line with many other studies, our study also showed changes. Our study strongly supported the changes in the medical guidelines^{26,27}. We must adopt the scientific changes in our rules of teaching and assessment regarding anatomy practical's. More integration practical sessions will enhance the student's interest and perception in the anatomy courses. The majority of students agreed that they feel secure dealing with new standards and that learning abilities and psychomotor skills would be strengthened.

Changes in guidelines increase the student's satisfaction level and they learned complex anatomical practical sessions comparatively easily and in a reasonable manner.

Study Limitations: The current study faced many limitations. First, Second, the number of students in college is few, consequently affecting the sample size and the study's statistical power. Thirdly, students were not exposed to previous studies targeting their learning styles.

Further research should be done to examine the efficacy of the various modalities of the active and engaged learning technique in anatomy and other disciplines using a large number of medical students. The present finding should be presented to the medical education unit in the college and both instructors and students to increase their awareness.

The main theme of this study is to evaluate the student's scores in the

practical examinations of the anatomy courses as we have made some significant changes in practical guidelines and assessment methods. Skills laboratories provide comprehensive skills instruction for students in almost all contemporary medical curricula.

Practical examinations in anatomy are usually conducted on specimens in the anatomy laboratory (referred to here as the "traditional" method). Here we have made some changes in the guidelines to improve the students' learning skills.

CONCLUSION

Our study showed that medical students (boys and girls of levels three and four) are optimistic about implementing the practical anatomy guide. In conclusion, student performance is seriously enhanced (students scored) affected by the changes in the academic guidelines. This study will allow anatomists to confidently implement anatomy's methods, rules and regulations without the horror of losing education and risking student performance.

Many candidates reported that the number of students in the practical session was suitable and the laboratory manual helped them to utilize the whole practical time compared to the old conventional method of teaching practical anatomy. Furthermore, the practical sessions were interactive and assisted them in familiar with safety guidelines. Additionally, students' opinions revealed the need for some modifications in the anatomy practical guide to enhance their learning experiences, such as the incorporation of more three-dimensional images, detailed feedback, an increasing number of supervising staff and the development of self-assessment skills. After reviewing the laboratory manual and based on the candidates' opinions, the instructor has already started introducing innovations into the lab manual to match the student's learning needs. To summarise, the findings of this study lead to the conclusion that the Anatomy practical guide is a meaningful and fair teaching strategy for medical students at the College of Medicine, KKU. Consequently, students' perceptions guide us in our reflective attempts to improve our educational practices and achieve a higher quality of learning and education for our students. Finally, changes in the guidelines of Anatomy practical sessions will help students and instructors attend medical college's goals.

RECOMMENDATIONS

New teaching techniques and materials have to be introduced to the laboratory manual to meet all the evolving needs of medical students. Such as the introduction of computer-based learning modalities.

For successful and engaged learning, a novel teaching approach should be used. The use of active and exciting learning strategies in teaching anatomy is constantly being studied and evaluated. Learners must be involved as partners in learning design.

Providing access to content, career development and professional learning groups through the use of information and communication technology (ICT).

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Competing Interest: None

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