How to adjust the strategy of radiopathologic teaching to achieve the learning outcomes?

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ABSTRACT

Background: The integrated-based education must pay attention to the beneficiaries, in whom our learning outcomes would be achieved. For establishing any curriculum for integrated-based medical schools, one must be aware with the psychological aspect of concerns, of these, learning style of the students must be considered on selection of the teaching strategy and tools to be compatible with the students' understanding. **Objectives:** The main objectives of the present study were to construct an episodic evaluation of our radiopathology curriculum. To attain that, we found the primary step is to be acquainted with how the students perceive both radiology and pathology lectures. Thus, the recognition of the students learning style was the initial and primary pace in the extended chain of challenges and changes that have been done in the radiopathology curriculum. The students learning style acts as a core for the adjustment of both radiology and pathology teaching. In harmony with the results obtained, adjustment of some teaching strategies and tools have been done in a sequential manner by the adjustment of the lecture to be matched the students' learning style. **Materials and Methods:** This study was conducted in the two following years on two consecutive undergraduates by Faculty of Medicine, Albaha University (FMBU), where two classes have been selected for this study. Each class includes 60 students. The learning style was evaluated through responding to the well-structured questionnaire designed by Medical education unit of FMBU. This instrument breaks up the students into figures attached, audiovisual, and observable or perceptible learner. Consistent with the results obtained, adjustment of the pathology and radiology lectures have been done. For this purpose, eight modules were selected for the study and control group, i.e. four for each. The changes in the lecture were made in the modules of the study group only. **Results:** The majority of the students subjected to this study have figure attached learning style, so adjustment of the lecture was done to become more interactive and to match the students' learning style. The study revealed significant differences between the degree of pathology in both the study and control group with $P = 0.019$, also a significant difference was obtained between the degrees of radiology in both groups with $P = 0.004$. No significant differences were found between the degree of pathology and radiology either in the study or in control group. **Conclusion:** Recognition of learning style is particularly imperative for curricular development and its periodic evaluation. Not all ways of the interactive lecture are suitable for the students, but those elaborated from student learning style is the most active that make our lecture more attractive and more impressive, and hence, improvement of the student performance have happened which reflects on achieving intended learning outcomes.

KEY WORDS: Learning Style; Interactive Lecture; Student Performance

INTRODUCTION

Development of our radiopathology curriculum of Faculty of Medicine, Albaha University (FMBU), had been finished and implemented 7 years ago. During this period, many questions have been called to mind, of these: Does our radiopathology curriculum esteem students' learning style?

Is the students' learning style well-matched with the teachers' teaching style and strategies? These two questions have to be answered and many clarifications are considered necessary. Inspection of our students exposed that many of them have different learning styles, some students have a preference for illustrated textbook and colored atlas, and other students like better with watching videos, and others favor the written formula books. Consequently, we have been aggravated to recognize our students' learning style.

Initially, what is the learning style? A learning style is the process of educating conscientious to an individual that is supposed to allocate that individual to learn best. The idea of learning styles is a somewhat unsupported presumption of the observation that most people have particular types of interactions when it comes to learning.[1]

Campbell[2] reviewed many of instruments for determining learning style preferences. Some of these instruments are free and some are not. Some can be self-administered, but trained personnel must administer others. Coffield et al.[3] have extensively reviewed the learning styles literature, evaluated the major learning style models, and discussed the implications for practice. They identified 71 learning models and instruments and categorized 13 of these as major models. Despite this large number of instruments, there are many criticisms toward these instruments.[4]

The main objectives of our presenting study were to construct an episodic evaluation of our radiopathology curriculum. To attain that, we found the primary step was to be acquainted with how the students perceive both radiology and pathology lectures. Thus, the recognition of the students' learning style the initial and primary pace in the extended sequences and chain of challenges and changes that have been occurred in the radiopathology curriculum. The students' learning style acts as a core for the adjustment of both radiology and pathology teaching. In harmony with the results obtained, the adjustment of the teaching strategies and tools have been done in a sequential manner by the adjustment of the lecture to be matched the students' learning style.

MATERIALS AND METHODS

This study was conducted in two consecutive years on two successive undergraduates by FMBU. Two classes have been chosen for this study, the 1st Class implicated was the 2nd semester of Grade II (Level V) during the year 2014, and ended with the 1st semester of Grade VI (Level 7) in the year of 2016. The 2nd Class started with the 2nd semester of 2015 and ended with the 1st semester of Grade VI by the year of 2017. Each class embraced 60 students. All the students of the two classes have been inquired to recognize their own individual learning styles through responding to the short questionnaire instrument organized by the medical education unit, FMBU. The questionnaire was simple and its results divided the students

into figures attached, audiovisual attached, and observable or perceptible learner. The figure attached is the student who learns more by seeing figures and graphs. The audiovisual attached is the person who learns more by attaching video, tubes, scientific conferences, the observable, or perceptible learner is the student who does more practice, prefer writing a notice, summarize, etc., Analysis of the data obtained from the questionnaire was done and according to these results, one of the teaching tools; lecture, have been adjusted.

As our curriculum is an integrated-based which include vertical and horizontal type of integration, for each class, eight vertical modules have been selected for both the study and control group, i.e., four for each.

The selected modules for the study group were the respiratory system for Level IV, the musuloskeletal system for Level V, the nervous system and special sense for Level VI, and basic imaging for level Level VII. The modules selected for the control group were the cardiovascular system for Level IV, the gastrointestinal system for Level V, reproductive system for Level VI, and laboratory medicine for Level VII.

These selected modules were vertical modules in which the students end the module and start new one, to put in mind the same students of both the study and control modules are implemented in the study.

Adjustment of the pathology and radiology lectures have been made upon the selected modules for the study group of the two classes. The modifications occurred in the of pathology lectures were in the form of incrimination of illustrated figures in all PowerPoint slides including histopathological photograph either gross or microscopic, illustrated figures for clinical signs, schematic presentation and flowcharts to describe the pathogenesis, risk factors, and complications, and maps for identification of the epidemiology of the disease. Regarding radiology lectures; all PowerPoint slides were exclusive for sequences of X-rays, computed tomography, magnetic resonance imaging (MRI), ultrasonography, and others that cover imaging theme. Regarding radiology, in each PowerPoint slide, a normal and abnormal findings were put in parallel to facilitate the students to identify the differences and the students have been asked to make comments. In both pathology and radiology lectures, multiple short videos that aid in transferee the knowledge have been also incriminated. Students were asked to write periodic summaries and share in apart of lecture. For the control group, the lectures were more traditional containing fewer figures and more written words.

According to the blueprint of modules, the weight of pathology and radiology questions has been estimated, and so a number of radiology and pathology questions in each module either study or control modules have been accurately calculated. Initially, both pathology and radiology questions and answers for all the study modules were collected as one

block, and a total mark for each student was given according to his right answers. The same was done for control modules. Accordingly, we stand on both radiology and pathology grade for each student in both groups. The modules selected for both groups have the same number of pathology questions, but, it is different for radiology questions. Both groups have the same study level in parallel, and the students were the same. All modules are arranged vertically, so that the same students will be transferred to the upcoming one. The pathology and radiology lectures in both groups were prepared by all pathology and radiology staff members, so all members have the same mode of the delivery of knowledge to the students as well as the same teaching style. All the pathology and radiology questions applied for both groups have the same level of depth of knowledge. A workshop was done for all staff members incriminated in the teaching process either to the study or control group to unify their teaching style and agree on the mode of delivery of knowledge. Hence, the teachers are the same throughout the study, and the difference was restricted only to changes done in their lectures in both pathology and radiology teachings, as shown in Figure 1.
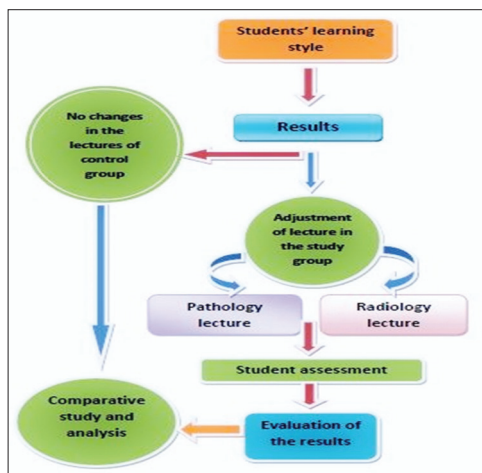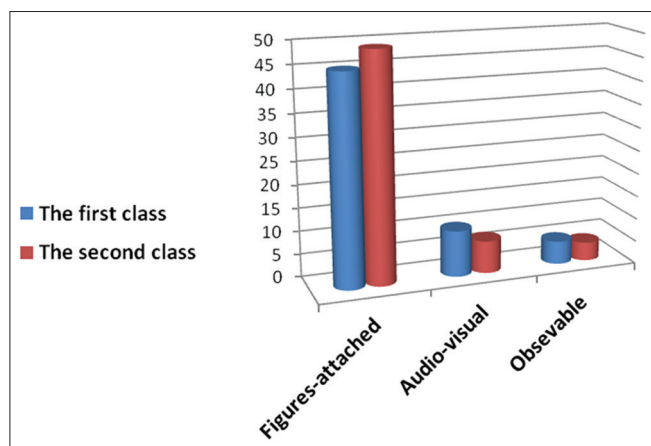

Figure 1: Flowchart showing schematic presentation of the current study

Graph 1: Graph showing the distribution of students relative to their learning styles

RESULTS

This study was conducted on two classes, each class contain 60 students, each student received the planned learning style questionnaire and the following results were obtained: For the 1st Class, 45 students (75%) were figures attached learner, 10 students (16.6%) were audiovisual, and 5 students (8.3%) were observable or perceptible learner. For the 2nd Class, 49 students (81.6%) were visual learner, 7 students (11.7%) were audiovisual, and 4 students (6.7%) were observable or perceptible learner [Graph 1].

According to the results mentioned later, the modifications have been implemented in both pathology and radiology lectures in the modules related to the study group only, otherwise no changes have been occurred.

DISCUSSION

The integrated-based education must pay attention to the beneficiaries, in whom our learning outcomes would be achieved. For establishing any curriculum for integrated-based medical schools, one must be aware with psychological aspect of concerns, of these, learning style for the students must be considered during foundation of teaching strategy and selection of tools that aid in achieving learning outcomes. Noteworthy, the pathology and radiology teaching show a deviation toward traditional teaching despite our faculty follow the integrated-based education, with no attention toward the students' learning style. Accordingly, this resulted in, to a large extent, lowering of the performance of some students, and hence, some of the intending learning outcomes cannot be achieved. As our curriculum must be periodically reevaluated, one of our strategies is to identify the learning style of our student to stand on the pro and cons of teaching tools that our staff used. Hence, the planned questionnaire instrument was elicited. This instrument divides the students into figures attached, audiovisual, and observable or perceptible learner.

Concerning our students' learning style, we found the majority of them having figures attached style; the minority has audiovisual style and a few of them have observable style [Graph 1]. Consequently, we modified both pathology and radiology lectures to be more harmonized with the students' learning style. The interactive learning is designed to match with the way which the student would prefer to learn. Therefore, by shifting toward the more interactive learning, we found a marvelous response in the students' performance as seen in the tables and figures which demonstrate the degree of students in both the study and control group [Tables 1-4 and Graphs 2-4].

What are the changes that have been done in both pathology and radiology lectures to be more attractive to our students? Many of the changes were done to match with the students' style.

Table 1: Distribution of pathology and radiology questions among the modules of the study group

Module	Level	Number of pathology questions	Number of radiology questions
Respiratory	4	16	6
Musculoskeletal	5	20	6
Nervous system and special sense	6	18	8
Basic imaging module	7	6	40
Total		60	60

Table 2: Distribution of students according to their degrees in both pathology and radiology questions in the study group

Subject	Range of students degree in both pathology and radiology group in the study group (out of 60)								Chi-squared and *P* value
	55–60	50–54	45–49	40–44	35–39	30–34	25–29	<24	
Total degree of students in pathology	13	21	27	32	9	7	6	5	Chi-squared equals 8.009 with 7° of freedom. The two-tailed *P* value equals 0.3318*
Total degree of students in radiology	10	25	18	37	9	10	7	4	

*The comparison between pathology and radiology result in the study group is statistically insignificant with *P*=0.3318

Table 3: Distribution of pathology and radiology questions among the modules of the control group

Module	Level	Number of pathology questions	Number of radiology questions
Cardiovascular	4	12	13
Gastrointestinal	5	16	16
Reproductive	6	14	14
Laboratory medicine	7	18	17
Total		60	60

Table 4: Distribution of students according to their degree in both pathology and radiology in the control group

Subject	Range of students degree in both pathology and radiology group in the control group								Chi-squared and *P* value
	55–60	50–54	45–49	40–44	35–39	30–34	25–29	<24	
Total degree of students in pathology	5	18	35	34	8	7	5	8	Chi-squared equals 7.599 with 7° of freedom. The two-tailed *P* value equals 0.3692* not statistically significant
Total degree of students in radiology	4	19	29	29	12	9	11	7	

*The comparison between pathology and radiology result in the control group is statistically insignificant with *P*=0.3692

First, regarding pathology lecture; all PowerPoint slides contain illustrative impressive figures or graph form and no written words except learning objectives. Second, the participation of the students, i.e., all students were asked to give comments on what they see. Third, some videos and clip that simplify the learning objectives and match with audiovisual students were introduced. Fourth, the students were asked to draw some figures that translate their understanding the objectives, this match with the students who are of observable style. Fifth, some students were asked to give periodic summaries every 10 min. Sixth, short multiple choice questions at the end of lecture were introduced to provide feedback about student understanding. All these changes made our lectures more interactive and the lecture is being transformed into what is called student-centered lecture instead of a tutor or instructor-based. Several changes on traditional lecture are recommended by other authors,[5-7] but according to our students' learning style, we selected what is the suitable for them.

Regarding radiology lectures, the theme and learning objectives were identified and the lecture was divided into four sessions, the first one was specified for different X-rays including normal and abnormal finding, the tutor illustrated what the student must be taught to interpret and report, then, the students were asked to report either verbal and or in the written form. All students participated in the lecture. The second session was for CT, the third was for MRI, and last session was for others and the same action in the first session

Table 5: Relation between between pathology results for both the study and control group

Group	Range of the students' degree in pathology in both groups								Chi-squared test and P value
	55–60	50–54	45–49	40–44	35—39	30–34	25–29	<24	
Total students in study group	13	21	27	32	9	7	6	5	Chi-squared equals 16.696 with 7° of freedom. The two-tailed P value equals 0.0195*
Total students in control group	5	18	35	34	8	7	5	8	

*The comparison between pathology results in both the study and control group is statistically significant with *P*=0.0195

Table 6: Relation between between radiology results for both the study and control group

| Group	Range of the students' degree in radiology in both groups								Chi-squared and P value
	55–60	50–54	45–49	40–44	35–39	30–34	25–29	<24	
Total in the study group	10	25	18	37	9	10	7	4	P value and statistical significance: Chi-squared equals 20.875 with 7° of freedom. The two-tailed P value equals 0.0040*
Total in control group	4	19	29	29	12	9	11	7	

*The comparison between radiology results in both the study and control group is statistically significant with *P*=0.0040
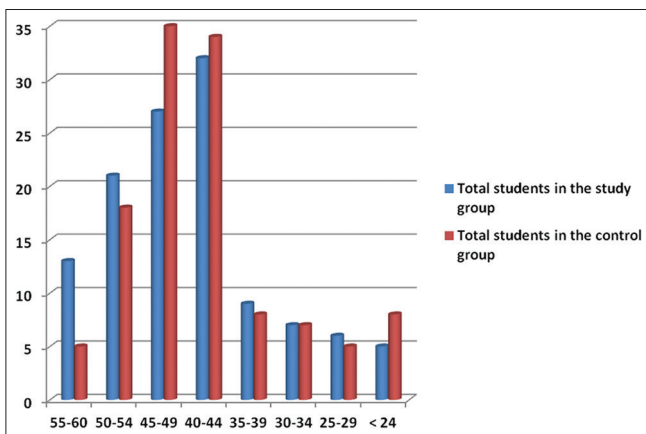
Graph 2: Graph reflects the comparison between the pathology degree of the students of both classes between the study and control group
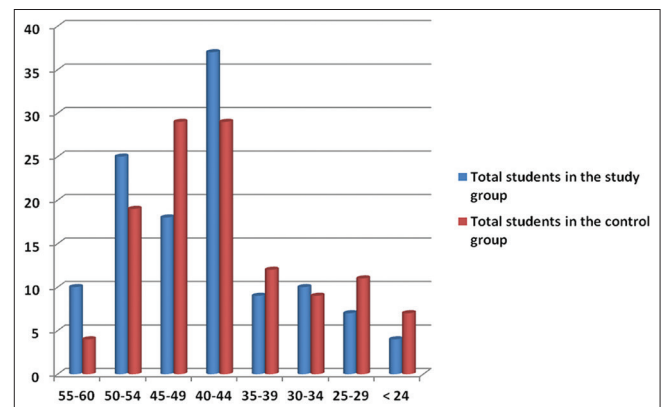
Graph 3: Graph reflects the comparison between the radiology degree of the students of both classes between the study and control group
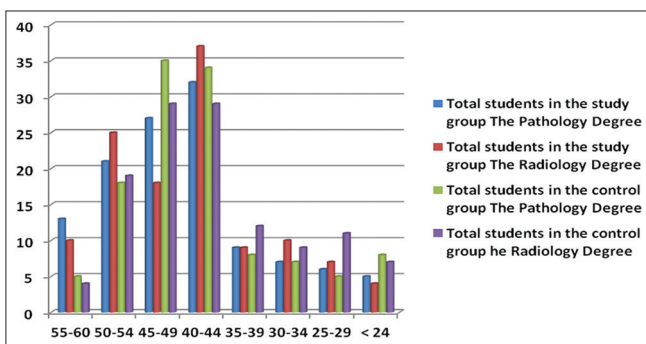
Graph 4: Graph reflects and summarizes the comparison between the degree of both pathology and radiology degree of the students of both classes between the study and control group

was repeated. All these sessions are enclosed under one topic or theme.

The results of this paradigm shift in enhancing the pathology and radiology lectures were reflected positively in the students'

performance in both sciences. The results obtained from the study group showed marked improvement compared with that of control group with significance difference [Tables 1, 3, 5, 6 and Graphs 2-4]. This is compatible with many studies done either for radiology teaching[8,9] or for interactive lecture.[10] No statistical significance was obtained between the pathology and radiology degree in the study group, as well as between both of them in the control group [Tables 2 and 4]. This means that selection of both pathology and radiology teaching to be studied is a good choice as they are nearby equal in both teaching strategy and students' performance, hence, any modification in the teaching tool for both will augment and alleviate the response toward the student' performance.

The role of radiologist in the radiology lecture, in the present study, was to outline the basic knowledge and give impulses to the students to motivate them to describe what they observe. In some instances, there is shortage in radiology staff; hence, this shortage may be compensated by junior tutor or even qualified resident. Scheiner and Mainiero[11]

compared the lecture performed by radiologist with that performed by resident in radiology course for undergraduate medical students; they found no statistical difference between students' performance in both groups.

It is documented that amplified student participation shows the way to change in attitude and learning outcomes.[12,13] This is compatible with what we noticed in the enhancement of the students' performance in the study group than in the control group, Butler[14] has shown that students who are actively involved in the learning activity will learn more than students who are passive recipients of knowledge. Pajares[15] found that interactive lectures draw attention to common fallacies apprehended by the students and give confidence to students to question, and thus increases self-efficacy of student which is linked to their academic achievements.

Regarding introduction of interactive lecture, we have observed that the attendance of students has being enhanced. This is corresponding with the positive data acquired by Maloney and Lally.[16] Goldberg *et al*. have recognized that interactive lecturing strengthens the educational worth of lecture time,[17] permit discussion,[18] lessen the repetitiveness of the passive learning,[19] and enhance the students' level of understanding and their capacity to generate and amalgamate material.[20]

The point of weakness of our study may come from the interindividual variations of teachers included in the study either for study or control group although the teaching was done either for the study or control group by the same teachers.

CONCLUSION

Recognition of learning style is particularly imperative for curricular development and its periodic evaluation. Not all ways of interactive lecture are suitable for the students, but those elaborated from student learning style is the most active that make our lecture more attractive and more impressive, and hence, improvement of the students' performance will be happened which reflects on achieving intended learning outcome.

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