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# Integrated Quiz Competition: A Innovative Method of Teaching and Learning in Undergraduate First Year Medical Course at RAKMHSU, UAE

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## **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

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## ABSTRACT

**Objectives:** The main objective of this innovative active learning approach was to increase student's interest in basic science subjects and to enhance student participation in acquiring the knowledge in the core and applied aspects of anatomy, physiology and biochemistry.

**Study Design:** Comparative cross sectional study.

**Place and Duration of Study:** Ras Al Khaimah medical and health Sciences University, 6months

**Methodology:** It was a comparative cross sectional study to find out whether Quiz competitions are effective teaching learning methodologies. There were 96 students in the class and students were asked to make their groups for the competition. Level of the questions asked in the integrated quiz varied from simple recall, comprehension, to application type from all three specialties.

**Results:** A total ninety six students were involved in the study and results of the study showed a statistically significant improvement in the performance of students who have participated in the competition.

The study also compared the performance of students who participated in the competition with non-quiz participants and we found that there was a statistically

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significant improvement in the performance of students who participated in the quiz competition with non-quiz participants  $P < 0.001$  both in theory (RRE) as well as in MCQ section.

**Conclusion:** The results in this study suggest that the integrated quizzes stimulate self and collaborative learning. They enhance the cognitive level of medical students and also help them to retain academic content.

*Keywords: Quiz competitions; medical students; knowledge; participation.*

## 1. INTRODUCTION

In today's world of education, there is lot of information available to the students and they are overburdened with increasing academic load making learning painful instead of enjoyable. New Innovative curricula's provide solutions to ensure that tomorrow's medical students receive the need-based education [1-4].

Innovative methods of teaching are a goal of many educators to deliver innovative curriculum. Teaching students in ways that keep them engaged and interested in the content is a challenge to any educator.

Learning is a lifelong process in medical field and to achieve this goal student should always be competitive in learning. Many studies have shown that, in the last two decades how people especially students learn. Students actively learn by observing and performing activities, the process of learning is far more accelerated when a practical implementation is associated and the learner is benefited with the applied knowledge and skills and it also involves trial and error at times during self-exploration [5].

It's more effective if the students are made to perform and apply the concepts rather just asked to remember some information. The applied and implicit knowledge should be the ultimate goal of the education system. A typical classroom environment with a presentation from the course teacher accompanied by a lecture does not promote learners to participate and does not build a required involvement level of the students [5].

Most of the learners just copy the notes from lecture or class room sessions considering its part of their responsibility being in the class. Many students just listen and will not involve in the class to understand the concepts. This typical environment only promotes a fraction of students who start thinking at their own and try to raise questions taking initiatives.

Today is the era of science and technology and there is a great need to improve quality of education specifically in the section of science education. This can be possible by bringing fundamental changes by introducing innovative techniques through which teachers can provide students centered learning environment that can make learning process interesting and understandable to the young learners [6].

Among the several methods of learning and teaching, quizzes are considered to be one of the most effective [7]. During preparatory phase prior to the quiz, students are encouraged to study more intensively [8]. Post-quiz it may generate interest in several topics that may otherwise be ignored by the students [9].

The quizzes can be in the form of assessment tool or in the form of competition which can drive the students learning. Assessments give an extra burden and pressure of scoring marks. Learning is a complicated phenomenon as it involves complex mental activities such as ability to solve problems and critical thinking [10].

The competitive quiz programs can act as alternative for the student learning in the form of understanding and applying the knowledge. As it promotes self-learning and motivates students to be more attentive. It may also act as an integration tool for different subjects.

To evaluate the student's learning, new teaching strategies should be scientifically investigated through questionnaire, student's comments and evaluation of assessment outcome [11].

Medical schools are also changing their educational programs and teaching strategies, at national and international levels, to ensure that students have active responsibility for their learning process and are prepared for life-long, self-directed learning [12]. The effort toward developing active learning was based on meaningful learning which ensures understanding and applying concepts rather than memorizing only which is note learning [13].

Meaningful learning involves the acquisition of "useful" knowledge so that it can be assessed from different starting points and has to correlate with previous knowledge.

Main objective of this innovative active learning approach was to increase student's interest in basic science subjects and to enhance student participation in acquiring the knowledge in the core and applied aspects of anatomy, physiology and biochemistry.

Main aim of this study was to investigate whether participation in a quiz program stimulated self and cooperative learning and performed better in summative examinations in first year medical subjects.

## **2. MATERIALS AND METHODS**

It was a comparative cross sectional study to find out whether Quiz competitions are effective teaching learning methodologies. Quiz competition was conducted for 1<sup>st</sup> year MBBS students studying in the first semester during the month of January in the year 2013. There were 100 students in the class and students were asked to make their own groups for the competition. The announcement of the quiz competition was done well in advance. Each group consisted of 4 students and total 7 groups participated in the competition. The remaining students attended the competition as audience. Four students enrolled but could not make up for the quiz competition so they were excluded from the study.

Rules for the quiz were as follows: There were four rounds, Round 1-Oral, 2-Buzzer-3:Rapid Fire, 4-Audio-visual/Case history based round.

Round 1-Oral Round: Evaluated quiz participants understanding and comprehension on must know category learning outcomes of Anatomy, Biochemistry and physiology basic concepts using level -1 recall one word answer questions.

In this round a question was asked to a team and if they are unable to answer it was be passed to the next team. Each team was asked 1 question each; it has three sub rounds (Total: 3 questions per team with 28 questions). Each question has 10 marks for correct

answer and 5 negative marks for wrong answer. If a team could not answer the question, they passed the question and then the question was forwarded to the next team. Bonus was 5 marks. Answering time was only 30 seconds. Team discussion was allowed.

Round 2 -Buzzer Round: Questions in this round covered level-1 recall and level-2 comprehension one word answer questions in must and need to know category learning outcomes in hematology, cardiovascular, respiratory, and gastrointestinal systems of Anatomy, Biochemistry and physiology.

In this round a question was asked and the team who pressed the buzzer answered first. A total of 12 Questions,10 marks for the correct answer and negative 5 marks for the wrong were given or if team did not answer after they press Buzzer–forwarding answer was not allowed. Question could be asked to audience if team failed to answer. Answering time was only 30 seconds.

Round 3 -Rapid Fire Round: Questions in this round covered level -1 recall and level -2 comprehension one word answer questions in must to know category learning outcomes in hematology, cardiovascular, respiratory, and gastrointestinal systems of Anatomy, Biochemistry and physiology.

Each team was asked 6 questions one after another in one minute time. Time keeper kept the time, 10 marks for the correct answer and negative 5 marks for the wrong answer. Answering time was only 10 seconds. Team discussion allowed. If a team could not answer the question, they could say pass for the next question. Question which was passed was not revisited again. The question was not be forwarded to the next team.

Round 4 -Audio-visual/Case Based round: Questions in this round covered level-3 application and analytical one word answer questions in must, need and nice to know category learning outcomes in hematology, cardiovascular, respiratory, and gastrointestinal systems of Anatomy, Biochemistry and physiology.

Teams were shown either video clips of clinical conditions or projected case scenarios with imaging and laboratory data, to answer the questions. Each team would be asked 1 scenario with 3 questions per case scenario. 10 marks for the correct answer (Total 30 marks) and negative 5 marks for the wrong answer were given. Answering time was only 30 seconds. No passing of question to the next team was allowed. Audiences were allowed to answer. (Total of 7 questions in this round)

There was a surprise round in case of tie in the final round, Spot questions were asked to the tied groups and correct answer given by the group were the winner.

Judges to the competition were Chairperson and Professor of Pathology and Associate Professor of Pediatrics.

Quiz competition was in the form of power point presentation which had some extra questions for each round to serve reserve for tie round.

Well qualified faculties with postgraduate degrees of good teaching experience in various disciplines involved in delivering the curriculum content were asked to prepare questions for this quiz competition, based on the learning outcomes which would test factual knowledge,

critical thinking and application to real world scenarios. Before administering to the quiz participants vetting committee of the quiz competition thoroughly vetted the questions.

**Table 1. Bloom's taxonomy of cognitive learning domain characteristics of the quiz questions**

Round Number	Name of the round	Tested domain
1	Oral	K, C, A
2	Buzzer,	K, C, A
3	Rapid Fire,	K
4	Audio-visual/Case history Based	K, C,A

*K: Knowledge C: Comprehension A: Application*

The cumulative scores of all the rounds were taken to decide about the team winning the quiz competition.

At the end of the session mementos were presented to the team scoring highest marks and certificates were given to all the participants.

RAKMHSU is a multinational and multicultural university initially first year medical students in semester one were asked to voluntarily make groups for this competition for the following reasons, to have comfort level and to develop the skill of interpersonal relations so that subject understanding would be better with retention, so priming is done initially.

After the quiz competition a pre tested pre validated questionneria was distributed to the participants of quiz competition. All the feed-back was collected from the students at the same time and the data was analyzed using SPSS version 18.

The students responded to the various questions in the Likert scale which ranges from 1-5 1- Strongly agree, 2- Agree, 3- Neutral, 4-Disagree, 5- Strongly disagree.

We compared between the students' performance before the quiz (in course Assessment-1) with (In course Assessment-2) which was conducted after the quiz competition.

To know the effectiveness of quiz on overall subject performance, we compared the students performance who have participated in the competition and students who were opted to be audiences.

The data was analyzed using SPSS version 18 and comparison between the groups was done using student "t" test and results were expressed in percentage. "P" value smaller than 0.05 was taken as significant.

### 3. RESULTS

A total ninety six students were involved in the study and results of the study are shown below.

The results of the study showed statistically significant ( $P < 0.001$ ) improvement in the performance of quiz competitors in the summative in course assessments, (ICA-1 and ICA-2) which were before and after the quiz competition. Significant Improvement in the performance was seen in MCQs and RRE of Biochemistry and Physiology. However not

Significant Improvement in the performance was observed in MCQs and RRE of Anatomy due to the fact probably some of the concepts like names of the muscles of upper and lower limb and general embryology topics are challenging to students. More time is needed to have concepts cleared to them. As shown in the Tables 2 and 3.

**Table 2. Performance of students (quiz competitors) before and after the quiz competition in different subjects. ICA-1: Before the quiz competition, ICA-2: After the quiz competition**

Quiz competitors(N=28)	ICA-1(Mean±SD)	ICA-2(Mean±SD)	P Value
Anatomy Mcq's	23.61±5.79	23.11±5.95	0.535
Anatomy RRE	8.43±2.72	5.67±2.42	0.001
Physiology Mcq's	22.60±6.22	26.39±5.30	0.001
Physiology RRE	5.75±2.42	6.80±3.54	0.04
Biochemistry Mcq's	23.32±6.49	29.03±6.59	0.001
Biochemistry RRE	6.05±3.37	6.19±3.40	0.789

*ICA: In course assessment, RRE: Restricted response essay, MCQ: Multiple choice questions*

**Table 3. Overall comparison of student's performance who participated in the quiz competition**

Quiz competitors(N=28)	ICA-1(Mean±SD)	ICA-2(Mean±D)	P Value
Total Mcq's	23.17±6.11	21.18±6.38	0.001
Total RRE	6.75±3.08	6.22±3.16	0.113

*ICA: In course assessment, RRE: Restricted response essay, MCQ: Multiple choice questions*

We also compared between the students who participated in the quiz competition with non-quiz participants in both MCQs and RRE section. We found that student's performance was much better and statistically significant ( $P < 0.001$ ) in quiz competitors than non-quiz participants. As shown in the Table 4.

**Table 4. Overall comparison of student's performance who have competed and not competed in the quiz competition**

	Quiz competitors (N=28)	Non-Quiz competitors(N=68)	P Value
Total Mcq's (Mean±SD)	21.18±6.38	17.59±5.97	0.001
Total RRE (Mean±SD)	6.22±3.16	2.91±2.37	0.001

*ICA: In course assessment, RRE: Restricted response essay, MCQ: Multiple choice questions*

We also had taken the feed-back from the participants the responses are shown in the Table 5. The responses from the students were encouraging and many students responded that they were motivated by the competition. As shown in the Table 5.

**Table 5. Showing the Feed-back from the quiz competition participants(N=22)  
Feedback of the participating students in the Quiz**

Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. Did quiz competition provide you a learning environment?	18(81.8%)	3(13.7%)	1(4.5%)	-	-
2. Did quiz competition made you to build the concepts about the subjects?	10(45.5%)	10(45.5%)	2(9%)	-	-
3. Did quiz competition Improved your communication skills?	9(40.9%)	9(40.9%)	4(18.2%)	-	-
4. Did quiz competition provide an environment for group learning?	16(72.8%)	4(18.2%)	1(4.5%)	1(4.5%)	-
5. Did quiz competition made you have good relationship with your colleagues	10(45.5%)	10(45.5%)	2(9%)	-	-
6. Did quiz competition help you to understand and comprehend the subjects together?	12(54.5%)	8(36.5%)	2(9%)	-	-

#### 4. DISCUSSION

Rak medical and health sciences university (RAKMHSU) an evolving university in United Arab Emirates was started in 2006 with a mission to prepare graduates who are able to develop critical skills in their practice and application of knowledge, equipping them with practical and clinical skills and enabling them to make a valuable contribution to patient and health care as individuals and as responsible members of society.

To achieve the above mission curricular design was done using system based approach to teach Anatomy, Physiology and Biochemistry. Learning outcomes for these disciplines were made into three categories, must to know, need to know and nice to know. Two thirds of the curriculum is delivered using various active learning methodologies involving "cooperative learning" like, case based learning, problem based learning (PBL), seminars, and project based learning. One third of the curriculum is delivered using didactic lectures.

Cooperative Learning techniques employ converting a class in to small groups of three or more, rather than alone or in pairs, to work together in such a way that each group member's success is dependent on the group's success.

Grouping students in three or four, has many advantages, students learn how to listen to each other, resolve conflicts, delegate tasks, set deadlines and support each other thus making each person accountable.

Students who engage in cooperative learning enjoy their classes learn significantly more, remember it longer, and develop better critical-thinking skills.

Medical Students after completion of studies take up jobs which require team work with consultants from various disciplines, nurses, physiotherapists, dieticians, for efficient patient care. Cooperative learning helps students develop the skills necessary to work in teams [14].

Any assessment in medical course should keep in mind the effectiveness of knowledge application and this is more important in medical graduates as they spend most of their time in solving clinical problems, devising treatments plans, and appraising their efficacy, not recalling factual knowledge [15,16].

Assessments at RAKMHSU has two components (a) Theory Continuous Assessments (contributes 60% to the final marks for the course) which include four in-course assessments, (contributes 30% of the total continuous assessment marks) two assignments, (contributes 15% of the total continuous assessment marks) three Quizzes (contributes 10% of continuous assessment marks) and PBL sessions (contributes 15% of continuous assessment marks) over the year held during designated periods within the year. There are three practical continuous assessments (contributes 30% of the total continuous assessment marks) which are held during the academic year in the form of objective structured practical examination (OSPE). (b)The Comprehensive final Examination (contribute 40% to overall marks for the course) has both theory and OSPE components.

Quiz is an itemized study of a small area/topic in the course. The objectives of conducting the Quizzes are to (i) motivate the students to learn and assess the level of knowledge related to specific content covered, (ii) test the analytical and critical thinking ability of students on selected topics.

The Continuous Assessment for theory comprises multiple choice questions (MCQ) and restricted response essays (RRE). The numbers of questions are related to the theory credit hours of the respective courses.

Restricted response essays (RRE) are structured essay items useful in measuring learning outcomes at various cognitive levels like knowledge, comprehension and application. Main advantage over long essays is that subjectivity is minimized.

The studies have shown that apart from conventional teaching the quizzes are considered effective in formative assessment [17] and allow the students to develop competitive spirit.

At RAKMHSU quizzes are used to test all the cognitive domains and marks are taken for summative assessments.

Research in cognitive psychology has shown that testing of knowledge can directly affect learning by promoting better retention of information, a phenomenon known as the testing effect [18].



This testing effect is extrapolated to our study results. In ICA-2 all the quiz participants performed well in MCQs and RRE which means they have studied the concept several times knowing that they would be tested. Frequent testing not only has a direct effect on learning, but also encourage students to study more either individually or collaboratively to score better on standardized tests [19].

Data in this study indicated that students read and discussed various topics of quiz competition both before, during as well after the quiz.

We also compared the performance of the students, who participated in the quiz with students who did not participate in the quiz competition and was statistically significant.

In the current study, the feedback from the participants was obtained which was positive. We also received quite useful suggestions regarding improvement in various facets of the quiz.

1. They appreciated this innovative method of teaching learning as it was different from the routine lecture classes, and helped them learn the course in depth.
2. It was useful as they could develop competitive spirit and it offered them scope for whole class participation.
3. It was very motivating,
4. Cases presented were interesting and relevant to the first year,
5. It helped them to build the concepts and fill the learning gaps and in the process integrate the three subjects.
6. Working in group's facilitated critical thinking and learning was more effective.

Our findings are only preliminary with a small sample size; extended studies with additional participants need to be conducted to increase the overall strength of our findings.

We proposed that voluntary participation opportunities in academic activities such as quizzes provide a platform for learning and self-assessment for students. These activities are not high-stakes, (i.e., licensing and certification examinations) yet are challenging for the participants possibly because of the presence of audience [20].

Our research can be compared with a study done by Rachna Gupta et.al in order to evaluate final MD examination, out of the 6 examinees, 4 participated in the quiz program while 2 did not. Overall performance of the candidates who participated in the quiz was better in comparison to those who did not. Further, those who scored more in the quiz also performed better during the examination [21].

Another study also showed similar results where a series of two quiz competitions were conducted to teach family welfare and demography during the year 1999 to medical undergraduates. Competitions were arranged between four teams of 4-5 students. Each quiz consisted of case history, visual and rapid-fire rounds. The performance of students in quiz was encouraging [22].

## **5. CONCLUSION**

The results in this study suggest that the integrated quizzes stimulate self and collaborative learning. They enhance the cognitive level of medical students and also help them to retain academic content.

Academic growth without competition is difficult to imagine. Our society has created a competitive situation where, in order to climb from one phase to the next phase, you must excel in the present phase, but also achieve more than others in the same setting to survive. Academic competition is a motivating force. Faculty often uses team-based competitions to make academic material entertaining, fun and more interesting to students.

## **6. RECOMMENDATION**

Such type of academic activities should be a part of the curriculum which promote self, peer learning and better student and faculty interactions and in-depth content understanding.

## **7. LIMITATION**

With large sample size, prior screening to have more heterogenous group our study can be extended to increase the overall strength of our findings.

## **CONSENT**

All the participants had given their consent to participate in this study.

## **Ethical Approval**

The study was approved by the RAKMHSU institutional ethical committee.

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## **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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## APPENDIX

### Sample Questions

#### Round 1:

1. Which segment of the ECG indicates delay in the conduction of current between atria and ventricles? (Atrio-ventricular delay)
2. A patient had difficulty in getting up from a chair and walking up the stairs. Which nerve is most likely to be injured in the above patient?
3. Why are Asians more sensitive to toxic effects of alcohol?
4. A 20 year old female presents with pain in the medial aspect of the thigh and the pain coincided with her mid cycles. What is the most likely explanation for her pain?

#### Round 3: Rapid fire round

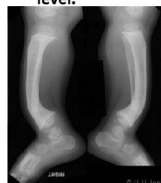
1. Name the plasma protein mainly responsible for the maintenance of blood volume
2. "Straight leg raise" test detects compression of which spinal nerve?
3. Name the 2 major products formed during the Hexose monophosphate shunt pathway .
4. Rigor mortis, a phenomenon which occurs after death is due to
5. Which compound mediates the Transfer of amino acid via Meister's cycle ?
6. ANATOMY SLIDE

#### Round 2: Buzzer round

1. Which gastro intestinal secretion has the highest pH?
2. The shoulder pain felt in liver abscess is due to irritation of which nerve?
3. What is the cause of Pernicious anemia ?
4. Name the carbohydrate used in assessing kidney function tests
5. What is the most likely reason for the triangular appearance of the colon by colonoscopy?
6. A patient was admitted in unconscious state after being rescued from a fire accident. Name the compound which inhibits ATP generation in this patient.

#### Round 4: Case based /audiovisual round

- A 24-month-old girl was brought to the Out Patient clinic with complaints of unusual gait.
  - Her weight (8 kg) and height (72.5 cm) are below the 3rd percentiles for her age. Her diet consists predominantly of breastfeeds.
- Biochemical investigations showed:
- Increased total alkaline phosphatase
  - Decreased serum calcium & Decreased 25-hydroxyvitamin D level.



1. Identify the disorder?
2. Why the active form of the vitamin is not used as an indicator of Vitamin D status?
3. Why was this particular part of the body subjected to an X ray?

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