ORIGINAL ARTICLE

VIDEO-AIDED LEARNING EFFICIENCY IN ELUCIDATING PHYSIOLOGICAL CONCEPTS USING KIRKPATRICK'S MODEL

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Background: The use of video-aided learning is increasingly adopted in medical education to simplify complex physiological concepts and improve student engagement. Despite its growing use, systematic evaluation of its educational impact remains limited. Objective was to evaluate the effectiveness of video-assisted learning in the elucidation of physiological concepts using Kirkpatrick's Model. **Methods:** A total of 84 medical students in 1st year MBBS were included in the study. At the end of the Musculoskeletal module, a pre-test of 25 MCQs was conducted. The pre-test was followed by a video session comprising the same topics being asked in the pre-test. After that, a post-test of the same 25 MCQs was given. A feedback proforma was filled out by all participant students. Data was analyzed on SPSS-25. Scores of pre- and post-test were compared using paired sample *t*-test and a $p \leq 0.05$ was considered statistically significant. Data obtained from feedback from students for closed-ended questions was expressed as percentages, whereas, the data obtained for open-ended questions was thematically analysed. **Results:** The post-test scores of the participants were significantly higher statistically ($p=0.000$) compared to pre-test responses. Most of the students agreed that the video session was an effective way of clearing concepts of physiology. **Conclusion:** Teaching physiology by using video sessions as a tool was found very beneficial for understanding and clarification of concepts.

Keywords: Effectiveness, Kirkpatrick's Model, Video-assisted learning

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INTRODUCTION

Making a value judgement regarding the information gathered is part of the evaluation process.[1] Programmes for health profession education must be comprehensively and thoroughly evaluated if they are to continue developing and improving.[2] The systematic gathering and analysis of data pertaining to the creation, execution, and results of a programme with the aim of tracking and improving the program's calibre and efficacy is known as the programme evaluation process.[3] The requirements of medical education accreditation groups and financial sources that encourage innovative education are among the more significant reasons for programme review.[3]

Kirkpatrick's approach, the Logic Model, the Context/Input/Process/Product (CIPP) model, and the experimental/quasi-experimental approach are the four often used models for evaluating programmes.[3] The Kirkpatrick hierarchy has influenced programme evaluation in the health professions for almost 40 years due to its widespread adoption.[4] Originally developed as a framework for assessing human resources training, a variety of its four outcome-levels are currently used in many studies assessing health sciences programmes.

It encompasses four levels, level-1 constitute Reaction which measures participants' responses including their level of satisfaction, level-2 constitute learning which encompasses the changes in knowledge that reveal the effectiveness of the teaching strategy, level-3 demonstrates behaviour which appraises the changes in behaviour in the working environment and level-4 comprises of results which indicates the overall impact on organisational performance.[3] The model's dominance can be clearly attributed to the fact that it offers a straightforward taxonomy for making evaluation decisions through the use of a simple structural hierarchy that prioritizes the outcomes of highest interest. It is an outcomes-driven evaluation strategy that can produce data demonstrating the 'work' of our initiatives.[5]

The effectiveness of video-aided learning in this research was evaluated using the first two levels of Kirkpatrick's Model. Level-1: Reaction focused on students' immediate response to the video-based session. A brief feedback form was administered to assess satisfaction, clarity of content delivery, engagement, and perceived usefulness of videos in supporting understanding of physiological concepts. This provided an overview of learners' acceptance of the instructional method. Level-2: Learning examined the change in knowledge following the intervention. A pre-test was conducted to determine baseline understanding, followed by a post-test after the video session. Comparison of pre- and post-test performance helped determine the extent to which the video-aided approach enhanced comprehension of the targeted content.

Previously teaching in pre-clinical years was through the traditional methods of teaching, which targeted students who were unable to organize their work and were dependent on the teachers for instructions.[6] It was observed that this mode of teaching places constraints on the student's learning process by imposing cognition overload on the students.[7] They lose interest and concentration within the first twenty minutes of the lecture, making it challenging to teach today's generation of doctors and medical students.[8]

Different teaching modalities are now being practiced in the current medical education system to uplift medical knowledge. Adapting technology-based multiple curriculum delivery methods into the educational environment can improve the learning of medical students. It is assumed that the implementation of visual aids like footage, videos, and projectors can be effective in the course of teaching. Visual aids create a thought-provoking and engaging environment that enhances student interest, along with improvement in their vocabulary and clarification of difficult concepts while decreasing cognitive overload.[9,10] They pay attention to the presented material, mentally organizing the presented material into a coherent structure and integrating the presenting material with existing knowledge.[11]

The rationale of conducting this study was to determine the effect of video sessions on learning Physiological concepts by conducting pre-tests and post-tests at the end of the Musculoskeletal module and to determine the impact of video sessions on students' learning.

METHODOLOGY

This Quasi-experimental study was conducted in AJK Medical College, Muzaffarabad after the approval from the ethical review committee vide Ref # ERC/Phy/17.

A total number of 84 medical students of first-year MBBS were included in the study through convenience sampling. Informed consent was taken from all the students. The cognitive abilities were tested at the end of the ongoing module of musculoskeletal physiology by a pre-test of 25 MCQs. After this, an educational video session of 30 minutes was carried out on the taught topics being assessed in the pre-test. A post-test of the same 25 MCQs was taken after the video session. After the post-test, students provided feedback through an 11-item Likert-scale questionnaire and two open-ended questions to assess their perceptions of the video-based learning approach. Qualitative data were analysed thematically, and quantitative results were summarized using Mean±SEM, percentages, and paired *t*-tests to evaluate the effectiveness of the intervention. To minimize the biased responses, no identity disclosure was asked from the participants.

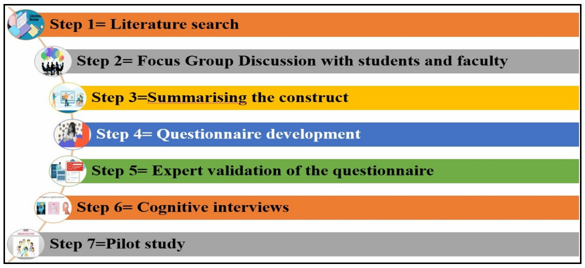
Feedback from students was obtained by developing a feedback proforma using the steps mentioned in AMEE Guide 87, Developing Questionnaire for Educational Research.[12]

In the first step, literature search was done and some constructs were identified regarding the impact of video-assisted learning in medical education.[9–11] In step-2, a focus group discussion was arranged between the chosen representatives of 1st year students which included a number of 5 students and the faculty of physiology was also part of this focus group discussion. Different constructs which were deducted from this focus group discussion included effectiveness, attitudes and integration of video-assisted learning, quality of video content, engagement and convenience and interactive learning.

In Step-3, the information that was being collected in first two steps was used to summarize the final constructs that would form the basis of the questionnaire development. In step-4, a proforma questionnaire was developed which included 11 closed-ended questions and the participants were asked to record their responses on a 5-point Likert scale ranging from strongly disagree to strongly agree. There were two open-ended questions in the feedback proforma in which participants wrote their viewpoints regarding the usefulness of video-assisted learning and the areas of improvement in its incorporation during the course of teaching and learning medical education.

Level-1 of Kirkpatrick's model which constitutes the reaction and level of satisfaction was addressed through the feedback proforma which was then analysed through quantitative and qualitative data analyses.[13] Results of closed-ended questions in the proforma were analysed by determining the percentages of the responses for each of the 5-points on the Likert scale. The open-ended questions in the feedback proforma were analysed by content analyses guided by a procedure outlined by Malor *et al*.[14] The open-ended questions included number 12 and number 13 and the responses were viewed and labels constituting key words and phrases were established through open coding. Labels were unified into categories using the axial coding. Finally the categories were grouped into the themes.

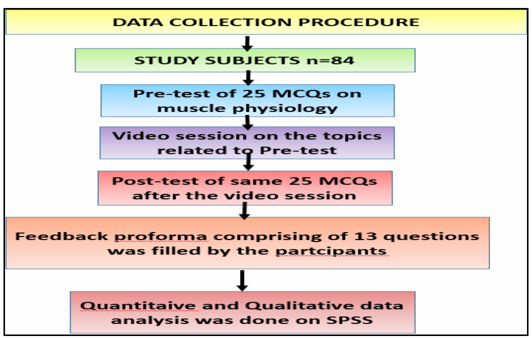
In step-5, the content validity of the feedback proforma was confirmed by two Professors of Physiology and their Content Validity Index was calculated. Step 6 and step 7 were not done due to time limitation.



Flow Chart-1: Steps of questionnaire development

Level-2 of Kirkpatrick's model which constitutes learning, was addressed by taking a pre and post-test of the participants with the intervention of video-assisted learning in-between, to assess the participant's knowledge and understanding of the core concepts.[13]

The data was analysed using SPSS-25. Mean±SEM of the pre-test and post-test were compared using paired sample *t*-test and $p \leq 0.05$ was considered statistically significant. Feedback proforma was analysed by determining percentages of the responses and the open-ended questions of the feedback proforma were analysed qualitatively using codes and themes.



Flowchart-2: The data collection procedure

RESULTS

A total of 84 medical students of 1st Year MBBS were recruited in the study after informed consent. There were 68 female and 16 male students in the study. Mean±SEM post-test (54.96±3.067) scores showed significant ($p < 0.001$) improvement compared to Pre-test (49.64±3.372) scores. Figure-1 shows the comparison of the pre-test mean with the post-test mean among the male and the female participants which shows significant improvement in results. A paired sample *t*-test was used to determine the Mean±SEM.

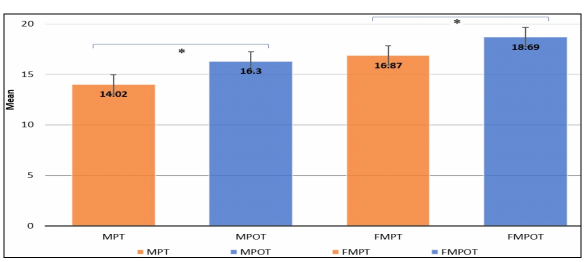


Figure-1: Comparison of pre- and post-test scores

MPT= Male pre-test mean, MPOT= Male post-test mean, FMPT= Female pre-test mean, FMPOT= Female post-test mean. $^{*}p < 0.000$

The feedback questionnaire comprised of 13 questions in total, of which 11 were closed-ended and Q:12 and Q:13 were open ended questions. The feedback responses to closed ended questions were analyzed using the percentages of each of the responses on 5 point Likert scale. Figure-2a and 2b shows the percentages of feedback responses to the first 11 closed-ended questions on the effectiveness of video-assisted learning in the elucidation of concepts of physiology. Figure-2a showing the percentages of feedback responses to first 6 questions while Figure-2b showing the percentages of feedback responses from question 7–11.

Open-ended questions of feedback proforma were qualitatively analyzed by thoroughly reviewing the responses. Each response of question 12 was coded into 13 categories and out of these categories 4 themes were generated. Similarly, responses to question 13 were coded into 9 categories and 2 themes were generated as shown below in Table-2a and Table-2b.

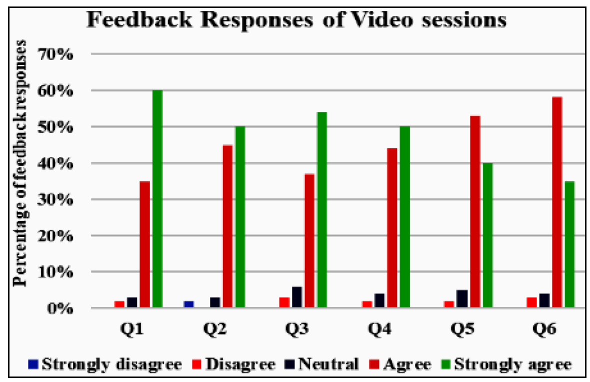


Figure-2a: Feedback responses after a video-assisted learning session to 1st Year MBBS students at the end of Musculoskeletal Module

Q1: Content of Video session, Q2: Video session for reinforcement, Q3: Working audiovisual aids, Q4: Session alignment with module, Q5: Adequate time allocation, Q6: Understanding of difficult topics

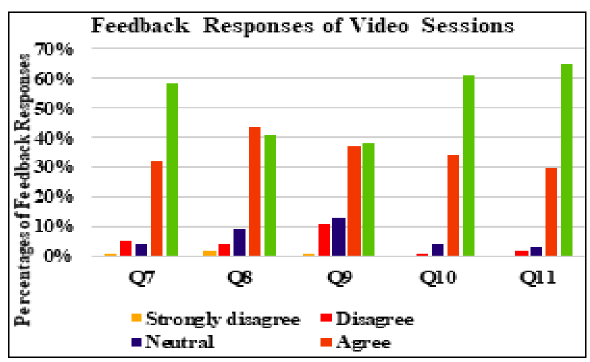


Figure-2b: Feedback responses after a video-assisted learning session to 1st Year MBBS students at the end of Musculoskeletal Module

Q7: Focus during video session, Q8: Application of concepts in problem based learning, Q9: Impact in confidence uplifting, Q10: Helpful in long-term retention, Q11: Recommendation of use of video session

Table-2a: Content analysis of open-ended question 12 in feedback proforma: 'What are the factors that enhanced learning during the video session?'

Theme 1	Categories\coding
Good quality audiovisuals	Clear visuals
	• Good sound quality
	• Interesting visuals
	• Adequate speed of video
Theme 2	**Categories\coding**
Video content	• Relevant content
	• Adequate cognitive load
	• Short video sessions
	• Captions are helpful
Theme 3	**Categories\coding**
Visual Learners	• Enhanced student engagement
	• Augments retention of information
	• Beneficial for visual learners
Theme 4	**Categories\coding**
Comprehension	• Complex concepts simplified
	• Highlights the importance of the topic

Table-2b: Content analysis of open-ended question 13 in feedback proforma: 'What are the factors that hampered learning during the video session?'

Theme 1	Categories\coding
Poor quality Audiovisuals	• Poor internet connectivity
	• Bad sound quality
	• Blur visuals
	• Noisy environment • Improper room lighting
Theme 2	**Categories\coding**
Video content	• Irrelevant content
	• Huge cognitive load
	• Longer duration video sessions
	• Lack of focus

DISCUSSION

The study was conducted to evaluate the impact of video sessions in enhancing the learning abilities of medical students using Kirkpatrick's first two levels. Physiology encompasses some arduous concepts which can better be understood when they are visually seen. This can empower the students to strengthen their concepts as human physiology is immensely important for preparing medical students for their clinical practice.

Incorporating video session in the curriculum after the module can boost student learning and revamp their performance. The dominant reason is that the content taught during the module through lectures was reinforced at the end of module by showing the same content in the form of videos. This was also observed in a study[15] in which two batches of 3rd year were shown a video lecture as well as a didactic lecture on bipolar disorders and students underwent a pre- and post-test demonstrating a significant improvement in the post-test scores. This finding is similar to our study which also showed significant improvement in the post-test means conducted in the musculoskeletal module of first year.

Another study by El-Sayed R *et al*[9] assessed the learning outcomes and satisfaction of video-assisted learning in 27 nursing students. They concluded that video-based lectures offer more successes and reduce failures in the immediate and follow-up measures compared to traditional method of teaching anatomy and physiology that was based on printout illustrations and also rated highly, all the items assessing their acceptance and satisfaction with video-based lectures. That finding is similar to our findings which also showed students' satisfaction in video-assisted learning. The difference in that and our study is that they didn't opt for a pre- and post-test.

There are several advantages of visual images over verbal communication. Videos can clarify difficult concepts, are able to provide more useful information in a short time interval, and provide an effective way of getting the audience attention and interest to gain more knowledge. Yunus *et al*[16] used a questionnaire as well as face-to-face interviews to determine the effects of visual aids in enhancing students interest and recommended use of visual aids. This is also reflected in our study in which 65% respondents strongly agreed in recommending the use of visual aids in teaching. Their study was qualitative only while we used both quantitative and qualitative analysis to reach the conclusion.

Incorporation of visual images into teaching process enhances learning retention. One study compared the results of showing only video sessions, delivering lectures only, and combined effect of delivering lectures and showing its visuals. After that, the students were asked to recall the lesson at 3 hours and after 3 days in 3 groups. The results were significant for the third group proving that visual images enhanced learning retention.[17] Our study also showed this in the feedback proforma in which 61% of the students strongly agree that video sessions enhance memory retention although we didn't take the post-test more than once to check the memory retention that was done in the study by Shivaraju[17].

Feedback from the students can improve teaching methods and the suggestions can be incorporated into the modules for better performance of the students. The present study also focused on the feedback about video sessions which were incorporated within a module after the interactive lectures. The results showed 50% of the students strongly agreed and 45% agreed that incorporation of video session enhanced their learning. This finding is similar to a study[18] which compared the results of giving interactive lectures alone and interactive lectures with audiovisual aids.

A recent study conducted by Ashour[19] on medical students studying at the University of Jordan using a web-based questionnaire adapted from Student Evaluation of Educational Quality Survey. Participants perceived greater benefit in terms of learning, instructor enthusiasm, content organization and breadth of teaching, when using video-based learning. Our study also showed a significant number of positive responses when video-assisted learning was compared with traditional learning. Ashour *et al* used only the questionnaire to determine the effectiveness while we used both pre- and post-test and a feedback questionnaire to assess the effectiveness of video sessions.

Another study by Yang and Oh[20] used an experimental, pretest-posttest design. Ninety-eight medical students (54 in the video-assisted education group and 44 in the traditional classroom education group) were recruited in a paediatric CPR education. The level of knowledge of paediatric CPR, the level of paediatric CPR practice skills, and the satisfaction score of each student were evaluated and found to be significantly higher than their pre-test scores. The satisfaction scores of the students in both groups were similar.[20] Their finding of improved post-test scores is in conjunction with the findings in our study but the finding of satisfaction scores is in contrast to our study.

LIMITATIONS OF STUDY

The small sample size used was a limitation to the study. The feedback of video sessions can be compared with different teaching strategies. A control group could have been added. Future studies may be directed towards comparison between video sessions and other learning strategies.

CONCLUSION

The use of video-based instruction contributed to improved understanding and clarification of selected physiological concepts among first-year medical students. Students' feedback supported the intervention, with many reporting that video sessions facilitated comprehension of difficult topics and enhanced their learning experience. Integrating video-assisted learning as a supplementary component to conventional teaching may be beneficial in Physiology. Designing video sessions aligned with specific learning objectives and curricular needs may further strengthen conceptual understanding and promote better knowledge retention.

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HM: Data collection, analysis, and interpretation, Medical writing
SJ: Literature search and data analysis
AA: Data analysis and interpretation
SM: Study design and methodology
SM: Data analysis and medical writing
PS: Data analysis and interpretation

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