

“Expectations and Perceptions of Medical Students From a 4-Week Research Module: A Longitudinal Cohort Survey”

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ABSTRACT

OBJECTIVES: Clinical decision-making revolves around evidence-based medicine. Evidence-based medicine entails research problems, their evaluation against available scientific literature and implementing the results into practice. Medical undergraduates lack experience in the research process. This study aimed to analyze the difference between the precourse expectations and postcourse perception of students after an interventive, mandatory research module.

METHODS: This longitudinal cohort survey was conducted at Azad Jammu Kashmir Medical College, Muzaffarabad. Fourth-year medical students were included in this study. After ethical review board approval, online survey questionnaires were circulated at 2 data points: before starting the research module and after it ended. Data were analyzed and nonparametric Mann-Whitney *U* test and Wilcoxon tests were applied to compare the difference in responses, regarding expectation and perception of the research module.

RESULTS: Total participants were 104; the response rate was 100% for the expectation questionnaire, whereas it dropped to 77% for the perception questionnaire. Female students had a higher response rate. In comparison of the 2 questionnaires, a statistically significant difference was observed in the student's ability to conduct literature search and critical literature appraisal ($P = .000$ and $.00$, respectively). There was also a perceived improvement in scientific writing, problem-solving abilities, and communication skills. Overall, a significant difference was found between the expectation and perception of students.

CONCLUSION: Students had high expectations from the research module. After the course, their perception of their own communication skills, research abilities, scientific writing, and research aptitude has significantly improved.

KEYWORDS: research activities, expectations, perceptions, undergraduate medical students

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Introduction

In today's modern era, clinical decision-making revolves around evidence-based medicine (EBM). EBM entails identifying and evaluating available scientific literature and implementing the results into practice.¹ Thus to better use EBM, literature search, critical appraisal of literature, data collection, and its handling must be taught to students at the undergraduate level.² However, medical undergraduates generally have minimal exposure to the research process and often do not understand the long-term value of research.³ Additionally, many medical schools integrate research modules into their core curricula. The training in research methodology should be part of the healthcare curriculum.⁴ The development of research skills improves the students' understanding of the scientific basis and their attitude to becoming lifelong learners. This would also improve the quality of health care they can provide to the community upon graduation. A study shows

that more than 80% of medical residents working in research programs became academicians.⁵

The curricula in medical institutes are usually integrated at the undergraduate level, but this is not the case with research. The World Federation of Medical Education recommends that research activities should be reflected in the undergraduate curriculum, enabling learners to participate in medical research effectively.⁶ Many undergraduate students consider research an independent aspect of medicine. They think it has nothing to do with diseases, patients, the clinical environment, and people. Since they do not have clear concepts of processes involved in medical research, the focus of research is on individuals, and its output must translate into tangible change for the masses. Ironically, medical educators involved in research work also do not get the opportunity to share their research accomplishments with their students.⁶

Students consider research to include only literature review and literature appraisal. However, they do not follow through



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with the whole “research process,” such as critically analyzing data and drawing inferences. Few research studies have explored students’ learning from research programs via the expectations/perceptions design. Using this study, undergraduate research training can be enhanced by enriching teaching and learning strategies. This study aimed to analyze the difference between precourse expectations and postcourse perceptions of learning achieved during a research module.

This study had the following objectives: (a) The precourse expectations of students about the knowledge and skills they would acquire after attending the research module. (b) The students’ perception of the knowledge and skills they have developed after attending the course. Therefore, the research question was: “Is there any difference between students’ precourse expectations and post-course perceptions about the knowledge and skills attained from the research module”?

This study is primarily based on adult learning and transformative theories,⁷ which state that adults are internally motivated and self-directed. They relate life experiences to learning experiences. Moreover, the learner’s interpretation of their experience is central to their learning process (transformative theory).⁸ Students’ ongoing participation and adoption of new learning contexts shape knowledge and understanding.

Methods

This longitudinal cohort survey was conducted at Azad Jammu Kashmir Medical College (AJKMC), Muzaffarabad, a public sector institute. AJKMC runs a modular, integrated curriculum for its undergraduate medical program. The research module is a mandatory part of the curriculum and is taught in the fourth year of the program, making it an appropriate setting for this study. This mandatory research module is a prerequisite for graduation. Medical students complete their research projects under trained faculty supervision while working in teams. Medical students are encouraged to submit their manuscript draft within 4 weeks of the research module.

The quantitative questionnaire used was an adapted version of the Möller and Shoshan questionnaire.⁹ It was an online form based on a 5-point Likert Scale. Students were provided with web links to the form and asked to independently fill it out.¹⁰ (The questionnaire used is attached as a supplementary file). The survey responses provided guidance about students’ characteristics, attitudes, and behaviour.¹¹

Nonprobability sampling was done using the consecutive technique. This was done because it focuses on the purpose of our research and verifies previously obtained data.^{12,13} This method provided relevant and rich information related to students’ expectations and perceptions about research. All medical students in fourth year who attended the research module were included in the study. All repeaters/detained students in fourth year (students who had to repeat the module due to failure on the previous attempt) were excluded from this study. Sample size was calculated using:

Confidence level	95%
Margin of error	5%
Population proportion	50%
Population size	110
Sample size	86

Complete information about the study was provided to all the participants, along with a written informed consent form. Anonymity and confidentiality of data were maintained at all levels of research. The study was conducted after ethical review board (ERB) approval from Azad Jammu & Kashmir Medical College, Muzaffarabad on June 14, 2021 (Appl# No. ERB/AJKMC/Phy-21/37). The expectations questionnaire (precourse) was circulated among the fourth-year AJKMC students after ERB approval was granted.

Data were collected at 2 separate data points: first (student’s expectations) at the start of the mandatory research module. Second (students’ perceptions) after completion of the compulsory research module. The duration of the study was one month (from August 2, 2021 to September 3, 2021).

Figure 1 represents 6 steps of curriculum development for this research module. Initially, the need to develop a research module was identified, followed by the application of knowledge and skills of research into clinical practice after objective analysis of results, finally leading to educational scholarship. This research module includes critical appraisal of literature, scientific discussion, scientific writing, statistical skills, problem-solving, and development of research questions, along with soft skills such as communication skills and research ethics.

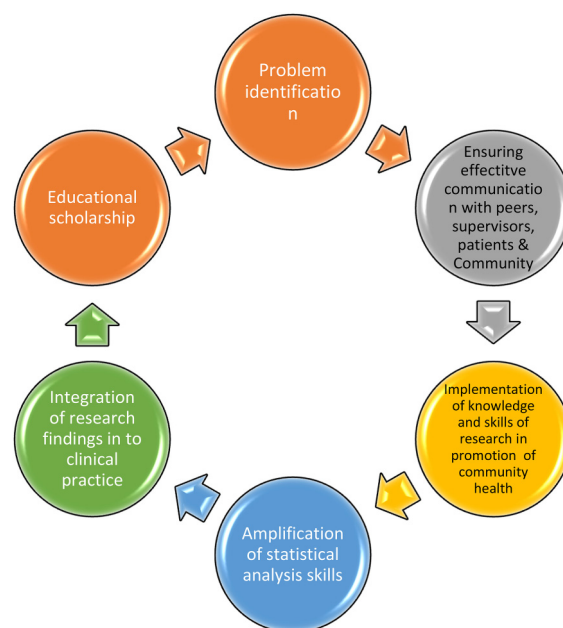


Figure 1. Outline of curriculum development of research module.

The online survey questionnaires were sent to 104 undergraduate medical students. The questionnaires were distributed to a larger sample size as calculated, to counter noncompliance or dropout of participants. The response rate for the student's expectation questionnaire was 100% ($n = 104$). However, the response rate for students' perception questionnaire dropped to 77% ($n = 81/104$).

Statistical Analysis

Statistical analysis of quantitative data was done via Statistical Package for the Social Sciences software (SPSS version 23.0). Data were entered in SPSS, and a nonparametric Mann-Whitney

U test and Wilcoxon test were applied to observe the difference in responses between expectation and perception of learners after attending this course. Compilation, analysis, and interpretation of quantitative data identified specific trends in students' expectations and perceptions about the research module. Subsequently, the differences between students' expectations and perceptions were identified.

Results

Data were collected at 2 different data points regarding medical student's expectation and perception via specific survey questionnaires.

Table 1. Descriptive statistics of responses on expectation and perception.

Items	Not at all	To little extent	To some extent	To great extent	To very great extent
Expectation					
How to search literature?	-	02	31	36	35
How to critically appraise the literature?	-	02	32	41	29
Participate in research?	01	02	21	39	41
How to do scientific writing?	-	08	24	33	39
How to improve skills of statistics?	-	08	27	33	36
How to develop research question?	01	04	22	41	36
How to improve my problem-solving ability?	-	01	14	31	58
How to improve my communication skills?	01	-	13	25	65
Will this module enhance my interest in research?	01	02	25	40	36
I want to learn research ethics.	-	04	20	42	38
Perception					
How to search literature?	-	06	46	29	0
How to critically appraise the literature?	05	16	39	21	0
How to participate in research?	05	16	37	21	02
How to do scientific writing?	09	12	44	15	01
How to improve my skills of statistics?	41	17	0	20	03
How to develop research question?	02	13	32	31	03
How to improve my problem-solving ability?	02	10	36	27	06
How to improve my communication skills?	02	02	32	36	09
It has enhanced my interest in research?	01	10	35	29	06
I have learned research ethics?	02	08	38	25	08
This module helped me to understand the basis of scientific research?	01	06	38	26	10
Can I integrate my knowledge now?	-	09	48	19	05
This module helped me to develop additional knowledge and competencies?	09	11	32	29	-
This module helped me to develop additional knowledge and competencies?	01	10	33	31	06

Table 2. Comparison of pre-expectation and post-perception after attending the course.

Factors	Mann-Whitney <i>U</i> test	Wilcoxon <i>Z</i> test	<i>P</i> value
How to search literature	2290.00	5611.00	.00
How to critically appraise the literature	1862.50	5183.50	.00
Participation in research	1614.50	4935.50	.00
How to do scientific writing	1740.00	5061.00	.00
How to improve skills of statistics	1356.00	4677.00	.00
How to develop research question	2282.50	5603.50	.00
How to improve my problem-solving ability	1566.50	4887.50	.00
How to improve my communication skills	1840.50	5161.50	.00
It will enhance my interest in research	2471.00	5792.00	.00
I want to learn research ethics	2353.00	5674.00	.00
Did the questionnaire evoked any thoughts or reactions?	3951.00	7272.00	.00

* $P \leq .05$ statistically significant.

Expectation questionnaire was filled and returned by 104 (100%) participants, whereas 81 (77%) students filled the perception questionnaire.

The mean $\pm$ SD (years) of age in the premodule, expectation survey response was 22.22 ± 0.61 SD (years). The average age of participants in postmodule, perception survey was 22.30 ± 0.70 SD (years). The percentage of male participants in the expectation questionnaire was 40.3% ($n = 42$) while it was 59.6% ($n = 62$) for female. In the perception questionnaire, 38% ($n = 31$) of the participants were male and remaining 61.7% ($n = 50$) of the participants were female. Seventeen percent (17%, $n = 18$) of the participants who filled the expectation questionnaire mentioned that they have previous research experience. While the remaining 82.6% ($n = 86$) of the participants do not have any past research experience.

From the descriptive analysis of the responses on expectation and perception about the research module, the median expectations of the course were higher than perceptions. Students expected maximum improvement in their communication skills through this course. They also expected that this course will enhance their problem-solving abilities.

After attending the course, the statistical analysis skills of the students were improved; they learned about developing research questions and have developed an interest in research. They were also exposed to the domain of research ethics. Problem-solving abilities and communication skills improvement of the students were in line with their expectations. The students reported that the questionnaire did not bring out their thoughts as well—which was expected (Table 1).

Approximately, 46.9% of the participants reported that the module helped them to understand the basics of scientific research. Out of the remaining, 44.4% said the module helped them to a great or very great extent and that it helped

them in integrating their knowledge. No participants reported that it was not of any help (Table 1). The level of significance was used as 5%. A *P* value less than or equal to .05 will be considered as significant.

A statistically significant difference was observed in literature search ($P = .00$) and critical literature appraisal ($P = .00$) sections between the expectation and the perception of the students. Response of the students regarding their perceptions about participation in research, developing research questions, interest in research, and awareness about research ethics was significantly different from their expectation of the course. Change in scientific writing, problem-solving abilities, and communication skills was also significant from precourse expectations. Improvement in communication skills was statistically significant in expectation and perception (Table 2).

Discussions

Research work is quite intricate; its training is fundamental in undergraduate integrated medical curriculum, because research assignments are intellectual activities that augment learners' analytical skills, self-directed learning, and communication skills.² Therefore, the undergraduate medical curriculum must include scientific thinking and research methodology. In addition, it must include literature appraisal, understanding research study design, and extracting inferences from available scientific data.⁴ However, students' views have not been collected sufficiently to understand the requirements of designing research activities for students.¹⁴ Therefore, this study was planned to analyze the difference in precourse expectations and postcourse perceptions of students about learning about a mandatory research module. Significant differences between students' precourse expectations and postcourse perceptions of the research module were found. Students' expectations of

the research module were higher than their perceptions afterward.

Currently, Medical Research focuses on molecular and sub-molecular levels. Undoubtedly, the genetic basis of a research inquiry underpins a novel research problem. However, it does not facilitate its direct application in everyday life.¹⁵ However, learning the art of integrating existing research findings into real-life scenarios will help novices apply scientific knowledge to clinical practice. This integration requires functioning at a higher cognitive level and dealing with rational and philosophical expertise.¹⁶ Therefore, this research process not only refines critical thinking but also improves the apprentice doctor's higher-order skills (analysis and differential diagnosis).¹⁷ Engaging undergraduate students in research activities will enhance their research abilities and improve educational scholarship. Many would become physician-scientists by opting for research as a career.¹⁸

Literature search and critical appraisal of literature are considered as the core of EBM.¹⁹ Our participants' vital skills in these 2 areas have significantly improved by attending this research module, as a statistically significant difference ($P = .00$ and $.00$, respectively) is seen between expectations and perceptions of students. These results have been supported by a similar study where expectations were highest for literature search, critical appraisal of literature, and scientific writing.¹⁰

Students' perception of research has changed after their practical research experience; that is, by critically appraising the literature, formulating a hypothesis, study design, and data analysis.²⁰ Moreover, most of our students were eager to improve their communication skills by attending this course, and they have improved these skills. Collaborative work and presentations of research work to the supervisor's panel were the basis for this pleasant change. It definitively improved their higher-order thinking, resulting in better clinical care for patients. Subsequently, they will conduct population-based studies and influence global health policies in future endeavors.^{20,21} On the contrary, alternative research showed the deficiency of participants in oral communication and the ability to participate in scientific discussions.¹⁰

Similarly, students' problem-solving abilities improved after this module ($P = .00$). After attending this module, students were confident in their research ethics knowledge. The ERB approval process for their research projects helped participants to learn research ethics. As advocated by a previous study, the research module enhanced students' grip on research ethics, educational scholarship, career prospects in research, and critical thinking.²² Nevertheless, research ethics received low ratings before and after the course in a comparable research study.¹⁰

For many participants, the core skills of research work, such as literature searching, scientific writing, designing research questions, statistical data analysis, and integration of knowledge, were improved after attending the course, as anticipated. By attending similar research courses, students learn how to

generate ideas and develop procedural understanding. They also understand the implementation of research procedures by analyzing data and then conferring results.^{23,24} However, students' perceptions regarding participation in research, development of research questions, interest in research, and awareness of research ethics significantly differed from their expectations of the research module. This fact was revealed by a similar study that shows the difference in students' expectations and perception happens due to varying levels of interest and involvement of students in the research process.¹⁰

Likewise, biostatistics has a vital role in medical research and decision-making. Results revealed that participants had a sufficient understanding of research statistics ($P = .00$). Enhanced interest in writing a research proposal and analyzing and interpreting research results were also reported by a related study.²⁵

There is usually a lack of interpersonal communication between participants and a power relationship exists between their research supervisors. This power relationship between teacher and learner could be managed by training teachers to become research mentors. In addition, providing them with a facilitator manual to guide them in helping students develop skills and attributes in research.²⁶ Students' engagement in research is based on their previous research experiences, transferable skills, research process, and relations with their contemporaries and instructors, as revealed by a similar study.³

Participants' transferable skills, scientific writing, and research methodology improve after attending this short research module. Thus, short research courses are more beneficial for students' learning and performance, replacing longer ones.²⁷ These courses make the learner a critical thinker, problem-solver, and researcher who operate at one's metacognitive level.²⁸ Students' expectations and perspectives would provide valuable insight and innovation to the existing curriculum when gathered using dynamic strategies. As a result, the intended, implemented, and learned curricula could be integrated smartly for efficient learning.²⁹

There was limited time available to cover the vast expanse of research in the existing undergraduate medical curriculum. It was a single-center study, which limited its generalizability. Similarly, a dearth of funds and limited exposure to research laboratories were considered confounding factors. Many participants also noted that the 4-week duration of the course limited the amount of content that could be covered in the vast field of research. Some participants also reported inadequate mentoring by research facilitators.

Recommendations

At the undergraduate level, a conducive research environment should be created by promoting research events and arranging informal meetings. This is where research experts brief students about their work and offer participation in projects. The undergraduate curriculum should implement a tailored approach to research skills and attribute training. Highly motivated and innovative students must be mentored by highly motivated

staff. Researchers recommend that if research publications carry appropriate credit to an individual's career, future students would be motivated to engage in research work. Improving the attractiveness of a research career to students can be achieved by frequent exposure and communication with research faculty and activities.

Conclusion

There is a statistically significant difference between students' precourse expectations and postcourse perceptions about the knowledge and skill attained from the research module. Students had high expectations of the research module. Their communication skills, research abilities, scientific writing, and research aptitude have significantly improved after the course. However, the core curriculum must ensure that all graduates attain relevant and appropriate research expertise, which refines their critical thinking skills as well as higher-order skills (analysis and differential diagnosis). Engaging undergraduates in research activities would augment their research abilities and improve educational scholarship. Students' expectations and perspectives have provided an innovative dimension to the existing curriculum. Subsequently, the intended, implemented, and learned curricula could be integrated smartly for efficient learning.

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Authors' Note

The data generated through this study would remain confidential and anonymous.

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Supplemental Material

Supplemental material for this article is available online.

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