

Inculcating research methodology related skills and aptitude amongst medical undergraduates- An interventional study

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ABSTRACT

Introduction: The present project was carried out at Jawaharlal Nehru Medical College (JNMC), Datta Meghe Institute of Medical Sciences (DMIMS, deemed to be University), Wardha, Maharashtra, as part of the training programme as per the advanced course in medical educational research, the theme of the project was based on skill training. The project was titled “Inculcating research methodology related skill and aptitude amongst medical undergraduates”. **Aim:** The basic aim of the study was to make the medical undergraduates competent and apprised with certain basic research skills in research methodology and to develop aptitude amongst the undergraduates for research. **Material and Methods:** The present research project took Bachelor of Medicine and Bachelor of Surgery (MBBS) students from the 2016 batch, from the sixth and seventh term of their professionals and the project was conducted for 6 months duration from October 2018 to March 2019. From the batch of 200, a randomised selection of students was carried out and 57 students in total were selected. The study was carried out in three phases as follows: Phase one (assessment and sensitization); phase two (skill training/mentoring); phase three (research outcome/culmination). **Results:** In the primary endpoint, the assessment of pretest and posttest were tabulated as well as feedback was taken; in the secondary endpoint the research projects conducted were translated into publications and the student’s response were applied for funded research projects like the Indian Council of Medical Research (ICMR) that was evaluated. Pretest score of 1 out of 10 (average score of 57 responses), that is, 10% and a posttest score of 6.9 out of 10, that is, 69.1%, the absolute learning gain was 59.1% and relative learning gain was 59.1%, the classroom averaged learning gain was 0.59. In the present study, the learning gain score was 0.59 which is in medium range according to Hake’s learning gain criteria. **Conclusion:** The present study concluded that there was a lack of understanding amongst medical undergraduates pertaining to the basic nuances of the research and how to go about carrying out the same. An ideal environment, mentorship is necessary for inculcating interest for research.

Keywords: Absolute learning gain and relative learning gain, Indian Council of Medical Research, methodology, research

Introduction

Medicine is a fathomless ever evolving branch of science. Research stands at the strategic centre for bringing about renaissance in the medical world. Research is one of the key areas which promotes new developments, advancements in science through new breakthroughs. It “refreshes” and “updates” the

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Received: 09-09-2021

Revised: 16-12-2021

Accepted: 11-02-2022

Published: 22-07-2022

Access this article online

Quick Response Code:



Website:
www.jfmpc.com

DOI:
10.4103/jfmpc.jfmpc_1812_21

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How to cite this article: Shukla S, Acharya S, Acharya N, Singh S, Dolas P. Inculcating research methodology related skills and aptitude amongst medical undergraduates- an interventional study. J Family Med Prim Care 2022;11:3648-63.

whole knowledge of that subject and thus paves the path for further addition, improvement, up-gradation through discoveries and new innovations.^[1]

The medical schools need to take cognizance of this budding revolution as far as medical science and research are concerned, realizing the fact that the two (science and research) are inseparable ends of the same spectrum promoting, the concept of “evidence-based medicine”.^[1] The most important felt need for the project was an urgency to erudite the undergraduates with the various degrees of research workup and to get them acquainted to its relevance in their everyday interactions with patients; there are no existent guidelines in the curricula for the undergraduates as far as research is concerned in the Indian medical universities unlike its foreign counterparts, but it is the medical schools which require to help promote and augment research inclination amongst the undergraduates.^[2]

The undergraduates throughout their professionals are more or less focused on the subjects and specialties, while research taking a back seat. In India itself, the concept of research never seems to be very deep-rooted in the minds of medical undergraduates. Medical research amongst undergraduates in India does not portray an enriching scenario.

Physician–scientists can bridge the gap between research and practice. But the medical fraternity is in the shortage of physician–scientists. This emphasizes the importance of engaging medical students in research in the early phases of medical school.^[3]

The present study would like to assess the attitude and aptitude of young medical undergraduate students towards research and would sensitize them in a positive way to help them pursue short research as part of this research project and then assess their personal experience, outcome, and gain during the project.

Aim and Objectives

Aim

To make the medical undergraduates scientifically apprised and equipped with research skills during the graduation tenure.

Objectives

To assess the perception of undergraduates towards medical research during their graduation years.

To sensitize medical undergraduates on how to approach research methodology skills.

To mentor the undergraduates planning, implementation, and translation, during their perusal of research methodology projects.

Material and Methods

The present study was taken to promote a basic understanding regarding research amongst medical undergraduates. The study was an Analytical Experimental (Interventional study) with subjects being randomized. The study was carried out at rural care tertiary center. The study duration was for a period of 6 months (October 2018 to March 2019). The study included students during their third year MBBS of undergraduate. A total of 57 students were considered for the interventional study. Random sampling was carried out for student selection.

Inclusion criteria

Medical undergraduate students in their graduation.

Students not enrolled for any other research.

Exclusion criteria

Medical undergraduate students of third year MBBS who are not willing to participate. Students enrolled for intramural or extramural research projects (e.g., ICMR).

Informed consent from the concerned medical college and from the students and the institutional ethical clearance was obtained before the project.

The study was carried out in three phases

- **Phase one (assessment and sensitization)**
 - To assess the students’ understanding of research methodology through pretest.
 - Sensitize the students towards an approach to research methodology.
- **Phase two (skill training/mentoring)**
 - Allot research speciality, guide and type of research to student participants.
 - Help provide the logistics and intelligence required to carry research projects;
- **Phase three (research outcome/culmination)**
 - Student task culmination and publication of the research
 - Feedback of students’ experience and posttest (student learning gain) during the project.
 - Students participation in ICMR STS project.

Pretest and posttest questionnaire were based on research methodology, the questionnaire were the same for pretest and posttest student assessment after and before the sensitization process. The questionnaire was set, approved and validated by the post doctorate professionals at the Institutional School of Health Professional Education and Research (stands as Nodal Centre, National Medical Commission [NMC]). Pretest questionnaire for the pre-sensitization phase and similarly posttest questionnaire as well as a feedback form for the post-sensitization phase was utilized as assessment tools. The student pretest and posttest

responses were assessed and they were graded as per their responses and subsequently the learning gains were calculated.

Statistical analysis

Learning gain has been described as “the distance travelled” or “the difference between the skills, competencies, content knowledge and personal development demonstrated by students at two points in time”.

Absolute learning gain = (post-assessment (%) to pre-assessment (%))

Classroom averaged learning gain (i.e., when an individual student scores higher on their posttest than on their pretest):

$$\text{Classroom Averaged learning gain} = \frac{\text{Post-assessment (\%)} - \text{Pre-assessment (\%)}}{(100\% - \text{Pre-assessment})}$$

$$\text{Relative learning gain} = \frac{\text{Post-assessment (\%)} - \text{Pre-assessment (\%)}}{\text{Pre-assessment (\%)}}$$

Data analysis was carried out based on the questionnaire responses as well as feedback analysis. The relative, absolute and class room averaged learning gains were calculated as per the Pretest and Posttest questionnaire responses by the students. Once the interventional study was completed the entire batch was also exposed to the same process of sensitization for research methodology.

Results

The results were analyzed keeping in context two major endpoints: the primary, and secondary endpoints. Further, under primary endpoint, the assessment of pretest and posttest were tabulated as well as feedback was taken, in secondary endpoint the research projects conducted were translated into publications and the student’s response applied for funded research projects like the ICMR was evaluated.

Primary endpoint

Assessment through pretest and posttest feedback about research experience.

Secondary end point

Publications

ICMR research projects taken up.

Assessment Pretest and Posttest

The mean pretest score was 1.00 and the posttest score was 6.91, the mean difference was 5.91 ± 1.69 . The standard deviation of

pretest score was 0.73 and the posttest score was 1.84, standard error mean was 0.09 for pretest and 0.24 for posttest. When the pretest and posttest scores were tabulated the Absolute Learning Gain was = 591. The *t* value was 26.54 and the *P* value came out to be 0.0001, which is significant.

The formula for classroom averaged learning gain (i.e., when an individual student scores higher on their posttest than on their pre test):

$$\text{Classroom Averaged learning gain} = \frac{\text{Post-assessment (\%)} - \text{Pre-assessment (\%)}}{\text{Pre-assessment (\%)}}$$

The classroom averaged learning gain in the present project was 0.5

Absolute learning gain = (Post-assessment (%) – Pre-assessment (%))

The absolute learning gain in the present project was 59.1%

$$\text{Relative learning gain} = \frac{\text{Post-assessment (\%)} - \text{Pre-assessment (\%)}}{\text{Pre-assessment (\%)}}$$

The relative learning gain in the present project was 59.1%

Pretest score of 1 out of 10 (average score of 57 responses), that is, 10% and a posttest score of 6.9 out of 10, that is, 69.1%, the absolute learning gain was 59.1% and relative learning gain was 59.1%, the classroom averaged learning gain was 0.59. Learning to gain scores can be estimated according to Hakes-based reasoning of learning gain that is high gain (*g*) scores are ($g > 0.7$), medium *g* ($0.7 > g > 0.3$), and low *g* scores ($g < 0.3$). In the present study, the learning gain score was 0.59 which is in medium range according to Hake’s learning gain criteria.^[4]

The normalized gain, introduced by Hake 1998 “as a rough measure of the effectiveness of a course in promoting conceptual understanding,” has become the standard measure for reporting scores on research-based concept inventories. Hake defined the average normalized gain as:

$$\langle g \rangle = \frac{\langle \text{post} \rangle - \langle \text{pre} \rangle}{100 - \langle \text{pre} \rangle}$$

where brackets indicate class averages. This measure is commonly described as “the amount students learned divided by the amount they could have learned.”

Discussion

Research is the backbone of medicine and plays a pivotal role in improving the quality of care offered to the general population.

The future medical practitioners and primary care physicians should be competent enough to meet the health-related needs of the community. Interventions should be undertaken to fulfil this social accountability.^[5]

In India more health professionals need to be exposed to research. So interventions should be made to develop interest in research.^[6]

The present study was carried out to assess the aptitude and attitude of final year medical students in regard to their approach towards research. The students pretest average score was 1 out of 10, pretest assessment percentage was 10% [Table 1]. Significantly after the project, the posttest assessment score was carried out which was 6.91 out of 10, the posttest assessment percentage was 69.1% [Table 2]; the classroom averaged learning gain was 0.59, whereas the relative and absolute learning gain was 59.1%.

As per feedback taken at the culmination of the research project, Majority of undergraduates 72% of students found the entire experience enriching and conducive to carry out research. A total of 89% of students were absolutely inspired by the research project. A total of 90% students agreed on the same that the basic understanding pre and post carrying out the research project has definitely improved their understanding and skills of research methodology. Out of 57 students who sent their scientific manuscript for publication; 54% were accepted, 31% were in review, 7% in process and 7% were rejected. Other significant impediments and logistic hurdles which were there related to research project included data assimilation, sample size and collection process, formulating a write up, statistic logistics, journal selection.

The global statistics in regard to research and development (R&D) expenditure in proportion to the gross domestic product (GDP) of various countries as per 2016 world scenario shows that North America and Canada spent 2.7% and 1.6% of GDP on R&D, respectively. In comparison to the developed nations, India spends only 0.62% of its GDP on R&D.^[7]

Pertaining to the researches generated in 2016 per million population, the figures for the indicator “Researchers per million inhabitants” follow a similar pattern, as the trend in R&D expenditure, but there are differences. The United States

along with most of Europe, Australia and Japan have much higher research paper generated per million inhabitants. India stands short with 216.2 per million inhabitants, despite having a population of over a billion.^[8]

Another research study suggests that there are about 1,00,000 undergraduate medical students in India at a given point of time, only 0.9% of the students have shown research aptitude.^[9]

Amongst the Indian medical schools and colleges: the All India Institute of Medical Sciences (AIIMS), New Delhi; Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh; and Christian Medical College (CMC), Vellore produce a substantial number. The findings of publications in these esteemed medical schools of India were in complete contrast to the majority of the Indian colleges around 332 of 572 which had no publications to their credit.^[10]

A major concept which lacks in Indian medical schools is the concept of mentorship. A well-structured mentorship programme can go a long way in guiding the student to understand the basic nuances associated with research methodology as well as an approach to research methodology. The majority of the undergraduate students 61% agreed that the mentorship programme should be included as a compulsory part of the MBBS programme and curriculum.^[11,12]

Studies suggest that one of the most important hurdles which the students face is the routine work of their training period. The students more than often are overtly engrossed in their lecture schedules, practical’s, ward postings, clinics, ward leave exams and term end exams (periodicals). According to the survey and study carried out by Henzi, the lack of research aptitude amongst students was mainly due to basic lack of interest for research in 18.98%. In 8.5% of students the reason for lack of research was because their basic curriculum did not have research as a part of it.^[13] Another study carried out in Iran found out that if the undergraduates were appreciated and bestowed with certificates, letter of appreciation for their contribution to the field of research, the undergraduates will develop interest in research.^[14]

We as an evolving nation need to fine-tune our priorities in terms of medical research concerned, understand the significance of research as members of the medical fraternity and inculcate the culture amongst the young budding researchers. The aptitude towards research amongst medical undergraduates needs to be augmented.^[15]

Many studies have shown that bringing research as part of the medical undergraduate curriculum has made better undergraduate researchers, boosting their confidence and understanding of

Table 1: Comparison of pretest and posttest score by Student’s paired t-test

	Mean	n	Std. deviation	Std. error mean	Mean difference	t
Pretest	1.00	58	0.73	0.09	5.91±1.69	26.54,
Posttest	6.91	58	1.84	0.24		P=0.0001, S

Table 2: Pretest and posttest score after sensitization

Tests and gain	% Pretest score	% posttest score	Absolute learning gain	Relative learning gain	Classroom averaged learning gain
Scores	10	69.1	59.1	59.1	0.59

research.^[16] Universities of Stanford and Duke^[17] and also University of Reading and Auckland have made research as an integral part of their medical curriculum for the young budding undergraduate aspirants. The studies carried out to understand research aptitude at the above universities suggested that 84.65% of students suggested that hands-on training and workshops were extremely beneficial to help them have a much clear and better understanding of the research.^[18,19]

Existing Opportunities for Medical Undergraduate for Research

There is an extreme paucity at present in the country with regard to large research bodies funding and supporting research for medical undergraduates. Only a handful of the research bodies exist the most important amongst them being (ICMR), this agency is most important and probably the only government medical agency funding research for the medical undergraduate students, through the – short term studentship (STS) research project.^[20] Other agencies which support research are the Central Paramilitary Forces under the Ministry of Home Affairs, Government of India, The Kishore Vaigyanik Protsahan Yojana (KVPY); and Indian Oil Corporation (IOC); however, these agencies do not support medical undergraduate research rather they promote scholarship programmes for students who are socio-economically weaker and are interested in pursuing medical science as their carrier and want to join various medical courses.^[21-23]

Besides various initiatives taken by the government to support research amongst medical undergraduates through funding; there are certain agencies like the group created in 2009 by the All India Medical Students' Body called INFORMER; which helps the medical undergraduates to promote their research, encouraging them and funding them to help pursue their research at the national level.^[24]

There are certain possible solutions and suggestions which may help in a major way to promote research amongst undergraduates. The suggestions are as follows: research methodology as part of the medical curriculum; promoting faculty support as guides and mentors; creation of supportive platform for conducive research propagation; providing funding opportunities; providing research credit.

On a global stage the contribution of India in medical research is still meagre. As a second populated country in the world India still comes under developing category. The primary care physician in India caters to the majority of the rural population. They are exposed to the challenges of health care delivery as well as the common diseases prevalent in population. The primary care physician can play a role of the first guide, and inculcate the knowledge and attitude of primary prevention in the community and for becoming the real educator, today's primary care physician ought to be a good researcher. Inculcating the true attributes of research methodology and skills in the young nascent medical

students from the very beginning of their medical carrier would meet the demands of future primary care medical physician cum researchers in India because many of these young medical scientists will become primary care physician in future. As researchers they will formulate the most authentic research questions addressing the health care scenario of rural India. In this way, the real problems of rural India as far as health care system is concerned would be addressed and given due justice by the health care providers.

Summary and Conclusion

The present study through a short-term study concluded that there was a lack of understanding amongst medical undergraduates pertaining to the basic nuances of research. After sensitization, most of the students were more aware about research methodology and found themselves more self-indulgent and interested to pursue research. The students not only opted for carrying out scientific research but also got their research published in well-recognized index journals.

The study in simplest terms not only measured the students' aptitude and interest towards research pre and post-exposure to their sensitization lecture but also helped the students profoundly develop an interest in research. The present study enhanced the inquisitiveness and learning skills of the students pertaining to research. The outlook of the students towards research changed dramatically from being a rather boring and uncharted and intimidating territory to becoming more friendly and thought provoking platform.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Murdoch-Eaton D, Drewery S, Elton S, Emmerson C, Marshall M, Smith JA, *et al.* What do medical students understand by research and research skills? Identifying research opportunities within undergraduate projects. *Med Teach* 2010;32:e152-60.
2. Pruskil S, Burgwinkel P, Georg W, Keil T, Kiessling C. Medical students' attitudes towards science and involvement in research activities: A comparative study with students

- from a reformed and a traditional curriculum. *Med Teach* 2009;31:e254-9.
3. Ommerring BW, Wijnen-Meijer M, Dolmans DH, Dekker FW, van Blankenstein FM. Promoting positive perceptions of and motivation for research among undergraduate medical students to stimulate future research involvement: A grounded theory study. *BMC Med Educ* 2020;20:1-2. doi: 10.1186/s12909-020-02112-6.
 4. Hake RR. Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *Am J Phys* 1998;66:64-74.
 5. Shrivastava SR, Shrivastava PS. Inculcating research skills among medical students during their training. *Curr Med Issues* 2021;19:115.
 6. Moraes DW, Jotz M, Menegazzo WR, Menegazzo MS, Veloso S, Machry MC, *et al.* Interest in research among medical students: Challenges for the undergraduate education. *Rev Assoc Méd Bras* 2016;62:652-8.
 7. Researchers R&D investment (as percentage of GDP), Data by the UNESCO Institute for Statistics. Available from: <http://uis.unesco.org/en/news/rd-data-release>.
 8. Researchers (in full time) per 1 million inhabitants, Data by the UNESCO Institute for Statistics. Available from: <http://uis.unesco.org/en/news/rd-data-release>.
 9. Deo MG. Undergraduate medical students' research in India. *J Postgrad Med* 2008;54:176-9.
 10. Ray S, Shah I, Nundy S. The research output from Indian medical institutions between 2005 and 2014. *Curr Med Res Pract* 2016;6:49-58.
 11. Abraham D, Swamy RS. Perspectives in mentorship and mentoring programs in post-graduate medical education and beyond: An Indian viewpoint. *J Educ Res Med Teach* 2015;3:1-4.
 12. Kasulkar AA, Gupta M, Chari S, Kanade HT. Assessment of medical students' interest in research in central India. *J Evolution Medi Dent Sci* 2013;2:5375-81.
 13. Henzi D, Davis E, Jasinevicius R, Hendricson W. In the students' own words: what are the strengths and weaknesses of the dental school curriculum? *J Dent Educ* 2007;71:632-45.
 14. Mowla A, Nabavizadeh SA, Bajestan MN, Tavakoli A, Seifi A, Tavakoli A, *et al.* Payment as motivator in Iranian medical students' attitudes toward research. *South Med J* 2016;99:1403. doi: 10.1097/01.smj.0000251418.96951.b0.
 15. Gupta BM, Bala A. A scientometric analysis of Indian research output in medicine during 1999–2008. *J Nat Sci Biol Med* 2011;2:87.
 16. Houlden RL, Raja JB, Collier CP, Clark AF, Waugh JM. Medical students' perceptions of an undergraduate research elective. *Med Teach* 2004;26:659-61.
 17. Laskowitz DT, Drucker RP, Parsonnet J, Cross PC, Gesundheit N. Engaging students in dedicated research and scholarship during medical school: The long-term experiences at Duke and Stanford. *Acad Med* 2010;85:419-28.
 18. Burgoyne LN, O'Flynn S, Boylan GB. Undergraduate medical research: The student perspective. *Med Educ Online* 2010;15:5212. doi: 10.3402/meo.v15i0.5212.
 19. Park SJ, McGhee CN, Sherwin T. Medical students' attitudes towards research and a career in research: An Auckland, New Zealand study. *NZ Med J* 2010;123:34-42.
 20. The Indian Council of Medical Research. Grant Schemes. Short Term Studentship. Available from: <http://www.icmr.nic.in/Grants/Grants.html>. [Last accessed on 2016 May 26].
 21. National Defence Fund. Salient Features of "PM's Scholarship Scheme" being implemented out of National Defence Fund. PMINDIA. Available from: <http://pmindia.gov.in/en/national-defence-fund/>. [Last accessed on 2016 May 26].
 22. Kishore Vaigyanik Protsahan Yojana (KVPY). Government of India. Available from: <http://kvpvy.iisc.ernet.in/main/eligibility.htm>. [Last accessed on 2016 May 18].
 23. Indian Oil for Society. Indian Oil Educational Scholarship Scheme 2014. Available from: <https://iocl.com/aboutus/scholarships.aspx>. [Last accessed on 2016 May 26].
 24. The Forum for Medical Students' Research. INFORMER- Observation beyond Vision. Available from: <http://www.informer.org.in/about-us/vision>. [Last accessed on 2016 May 26].