

Views on Scientific Research Methods: A Study of North Indian Engineering Faculty Members

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Abstract

Scientific research is a significant component in the field of education. It is a systematic effort not only to get proficiency in teaching but also to stimulate independent search for new knowledge, to unravel scientific issues and to identify how to study the information. This study aimed to investigate the views of North Indian engineering faculty members on the scientific research methods (SRM). The research data was collected through a structured questionnaire and interviews. The faculty members were asked questions about scientific research methods and their opinion about how to improve the effectiveness of engineering faculty in teaching and research. To this aim, the main effects of the scientific research methods on academics and research have been studied. The research work data was collected from more than five hundred faculty members and was analysed with the descriptive method. The findings indicate a positive relationship between teaching pedagogy and scientific research methods. The results also revealed that the engineering faculty members lacked knowledge about scientific research methods which further impedes the systematic teaching-learning process.

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Introduction: Teaching is a highly complex scientific-academic process which involves imparting knowledge in a structured scientific way. It is a constant progression of scientific research. Research conducted for the purpose of contributing towards science by the systematic collection, interpretation and evaluation of data and that, too, in a planned manner is called scientific research. It is a tool to develop knowledge and facilitate learning with objectives of to inform action, gather evidence for the theories, and add to the progression of expertise. There is an urgent need to embed systematic Scientific Research Methods design of teaching with learning environment. The idea of bringing scientific research methods into teaching is not new and researchers have already pointed out the benefits of such practice (Brew, 2006; Clark, 1997), with the particular emphasis on scholarly knowledge-building community. Using scientific research methods enables a deep understanding of the concepts; it allows students to develop their individual competencies, supports them in critical and creative thinking and also increases students' engagement in class.

Hyland (1998) states research as an ongoing process that improves innovative thoughts and understanding capacity. The level of scientific research knowledge is essential for the overall growth

of students and teachers both (Sampson and Blanchard 2012). Right now scientific research methods are one of the best processes for getting efficient strategies in business organizations as well as improvement in teaching skills in faculty members and understanding about subject in students (Glesne 2016). The importance of scientific research methodology indicates the innovation and improvement in teaching skills (Choi et al. 2019). There is a vital significance of Scientific Research Methods for engineering education research as well as for development of this scholarly field. The teacher's subjectivity and classroom situations interact in dialectic fashion to shape the nature of classroom teaching. (Sharma; 2021) Scientific research methods are crucial for researchers in order for the quality and scope of research. Methods have received substantial attention in the engineering education literature (Borrega, Doughlas & Amelink, 2009; Koro-Ljungberg & Douglas, 2008; Olsa, Moskal, & Miller, 2005). Research-led teaching involves exploiting the teacher's own research to benefit student learning and outcomes (Trowler & Wareham, 2008).

Scientific research methods are based on the study of mathematics and statistics which is also important in the teaching, marketing, entrepreneurship skills (Malik et al. 2016). According to (Tsai 2007) the most important factors in scientific research is learning of innovative idea with practice and testing with different conditions of scientific knowledge, which shapes the scientific research idea and approach. The present study is related to the assessment, participating, and investigates the improvement in engineering faculty members through scientific research-based survey. Mostly scientific research method-based study focused on the academic from research point of view Liang et al. (2009). Many similar studies (Wilson, 1990; Hull, 2010; Lederman 2019; Cigdemoglu and Koseoglu, 2019; Eliyahu et al., 2020) studied the base of a higher level of knowledge about academic papers and scientific research. The importance of operations research in quality education generates the responsibility of teachers in the teaching and learning process (Malik and Malik 2016). Regarding this outcome, the scientific research method examines the relationships between academic and research skills improvement of the faculty members. Harland and Stainforth (2000) find that the hurdles that prevent the academics from engaging include academics perceiving research as a time-consuming activity and themselves as having already completed their professional learning. Roth et al. (1998) suggested various levels for better performance in academic and research of teachers through scientific research.

Scientific research methods play a very vital role in organizing and communication information to students innovative and research skills. Here, in this study scientific research is a key factor in both academic and research affecting overall performance of faculty members. This research study was examined through a literature review in which we use systematic methods to obtain the relevant data analysis, selection and research.

A multitude of research has been done on the theory, process and the use of scientific research methods as a learning tool but relatively limited attention has been given to study the assessment of engineering faculty members on scientific research methods. The present study attempts to explore the knowledge of engineering faculty members about scientific research methods and discusses various aspects related to it in a more specific way. It mainly focuses on the application of SRM in the overall performance of North Indian engineering faculty members and investigates the significant relationship between the application of scientific research methods and teaching-learning process.

Methodology

The scientific research method is a very important tool for solving many engineering, science, and technological problem. To examine the assessment of engineering faculties on scientific research method in depth, we used qualitative study that involves semi-structured interviews and survey. Qualitative methods play an essential role in understanding user needs and behaviours as more formally seen tools such as quantitative studies (Mann et al., 2012). This study is based on qualitative observation of the engineering faculty in which finding the participant group, data collection, and data analysis methods are considered according to the nature of qualitative research. The study attempts to answer two major questions:

1. How effective are the Scientific Research Methods to enhance student learning?
2. How to integrate Scientific Research Methods to improve student learning/engagement?

To answer the above mentioned questions, a questionnaire was prepared and administered into Engineering Faculty members of North India region. The goal of this study was to understand the knowledge of teaching faculty about SRM and the implementation of SRM in their teaching pedagogy. The study also attempts to investigate the effectiveness of using SRM for academic and research purposes. The main questions used in this study are as follows

1. Do you know about Scientific Research Methods?

2. Have you collected data for Scientific Research Methods?
3. Have you done any experimental work for Scientific Research Methods?
4. Up to what level have you used or is using/ may use Scientific Research Methods in completing your Ph.D.
5. Do you use Scientific Research Methods as a research Supervisor or in any research or research-oriented pursuit?
6. Are you using Scientific Research Methods in teaching?
7. Do you think Scientific Research Methods is effective for academic purpose?

Based on the objectives the following hypotheses were formed:

H1: There is a significant relationship between Scientific Research Methods and teaching.

H2: There is a significant relationship between Scientific Research Methods and research-oriented pursuit.

Conceptual model

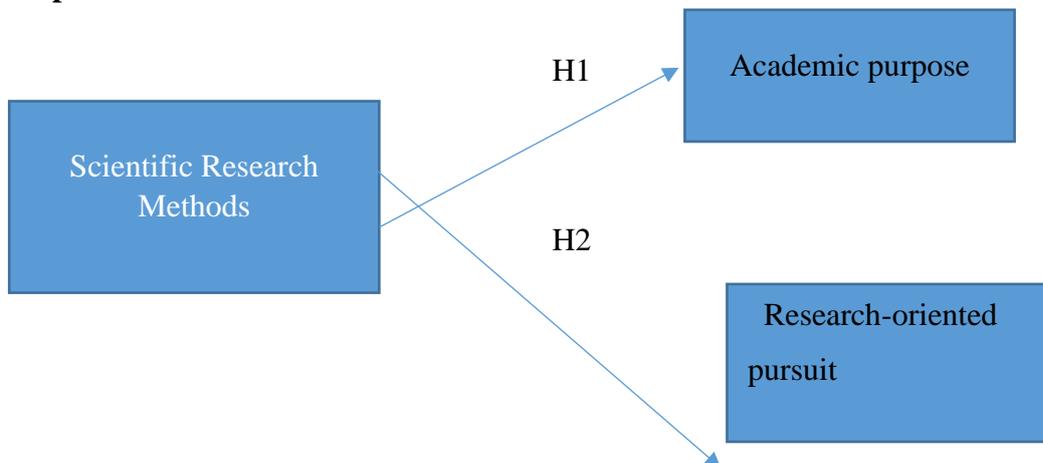


Figure 1 Conceptual Model

Pilot Research: The pilot study was carried out to assess the reliability and validity of the questionnaire for the main study, so as to develop a better instrument, as well as to provide a preliminary glance at the implementation of SRM by North Indian engineering faculty.

Data Collection:

To evaluate the assessment of engineering faculties on scientific research methods, the data was collected in two stages. In the first stage, an online survey of Assessment of Scientific Research Methods (SRM) Questionnaire was constructed. Scales based on previous research were used to assess implementation of SRM in the engineering classroom. The e-questionnaire utilized included two sections, one with demographic information and the other with seven key items on the assessment of North Indian Engineering faculty about SRM pertaining to the primary variables under research. The google form was emailed and also shared on the WhatsApp group and Telegram group of the engineering faculty members, and the participants were asked to fill it out. While analysing the forms, the information of some participants were found insufficient. In this regard, those participants were interviewed using semi-structured interview. The interview was conducted on video call. After getting more than five hundred engineering faculty members' data, we try to clarify the collected data through the assessment on the scientific research method questionnaire and confirm the correct information.

Data Analysis:

The process of data analysis was carried in two stages: the analysis of the Assessment of North Indian Engineering faculty on SRM Questionnaire and the analysis of the interview data. Both analyses were combined in the finding section. Rating scales using a four point Likert-type scale (1= No response; 2= Slightly; 3=Mostly; 4=Completely) were used for all the survey. The researchers gathered information from participants by integrating these tools into a single one consolidated survey Google form to allow participants to express how much they agree or disagree with a particular question. At this point the answers given by the participants were analysed and classified under these four points. In the second stage, the interview data were analysed. These data were also classified under the headings mentioned above. The whole data were analysed through a descriptive analysis. The descriptive analysis includes performing the analysis process within the scope of predetermined themes (Glesne, 2016). As the theme was predetermined so the descriptive analysis was used.

Result and findings

The main aim of the current study is to examine the implementation of SRM by North Indian Engineering Faculty. It also attempts to analyse components of various factors of SRM and their correlation between these and implementation of SRM in an engineering classroom. To address the research questions, assessment of engineering faculties on scientific research method was done under (No response, slightly, mostly, completely) in the following table.

Questions	No response (%)	Slightly (%)	Mostly (%)	Completely (%)	Total
1. Do you know about Scientific Research Methods?	5.8	7.7	9.6	76.9	100
2. Have you collected data for Scientific Research Methods?	36.5	11.6	15.4	36.5	100
3. Have you done any experimental work for Scientific Research Methods?	53.8	7.7	11.6	26.9	100
4. Up to what level have you used or is using/ may use Scientific Research Methods in completing your Ph.D.	9.6	26.9	48.1	15.4	100
5. Do you use Scientific Research Methods as a research Supervisor or in any research or research-oriented pursuit?	7.7	38.4	36.5	17.3	100
6. Are you using Scientific Research Methods in teaching?	23.1	15.4	44.2	17.3	100
7. Do you think Scientific Research Methods is effective for academic purpose?	7.7	7.7	38.4	46.2	100

Data were collected from a google form sample of more than 500, in which 40.4% faculty members were found as not completed their research work and 59.6% faculties completed their Ph.D. degree; 28.8% faculties were found as a research supervisor of the research work where 71.2% faculties were not working as research supervisor.

Regarding Q.1, the mainstream of the faculty members (76.9%) stated the views by saying “completely knowledge about SRM”; some faculties (9.6%) expressed views by saying mostly used SRM; some faculties (7.7%) expressed their views as “slightly” used SRM; and some faculties (5.8%) discussed that there was “no use” of SRM.

In Q.2, some faculty members (36.5%) expressed the views by saying “collected data for SRM”; (15.4%) faculties stated views by saying “mostly” collected data for SRM; (11.6%) faculties expressed their views as “slightly” collected data for SRM; and some faculties (36.5%) discussed that “never” collected data for SRM.

For Q.3, some faculty members (26.9%) communicated the views by saying “done experimental work for SRM”; (11.6%) faculties stated views by saying “mostly” done experimental work for SRM; (7.7%) faculties expressed their views as “slightly” done experimental work for SRM; and the mainstream of the faculty members (53.8%) discussed that “never” done experimental work for SRM.

Regarding Q.4, (15.4%) faculty members expressed the views by saying “used SRM for completing Ph.D.”; and the mainstream of the faculty members (48.1%) stated views by saying “mostly” used SRM for completing Ph.D; some faculties (26.9%) expressed their views as “slightly” used SRM for completing Ph.D; and some faculties (9.6%) discussed that there was no use of SRM for completing Ph.D.

In Q.5, the faculty members (17.3%) stated the views by saying “Used SRM as a research supervisor”; (36.5%) faculties stated views by saying “mostly” collected data for SRM; in mainstream (38.4%) faculties expressed their views as “slightly” collected data for SRM; and (7.7%) faculties discussed that never collected data for SRM.

For Q.6, the faculty members (17.3%) expressed the views by saying “used SRM in teaching”; (44.2%) faculties in mainstream stated views by saying “mostly” used SRM in teaching; (15.4%) faculties expressed their views as “slightly” used SRM in teaching; and (23.1%) faculties discussed that “never” used SRM in teaching.

Regarding Q.7, the mainstream of the faculty members (46.2%) stated the views by saying “SRM effective in academic”; (38.4%) faculties expressed the views by saying “mostly” SRM effective in academic; (7.7%) faculties expressed their views as “slightly” SRM effective in academic; and (7.7%) faculties discussed that SRM is “not effective” for academic purpose.

The result have several practical implications. The findings provide an understanding that most engineering faculty know the general information about the concept of Scientific Research Methods and its use in teaching but when it comes to the second question on collection of data by the teachers for the research purposes, half of the faculty remains in the category of never collecting data for SRM. It indicates even after gaining knowledge about Scientific Research Methods, many faculty do not use it for data collection. All faculty know the importance of SRM and Data collection as important tools for any research work but nearly half of the faculty have never done any experimental work for SRM. The responses to the fourth question reveal that out of 59.4% faculty who have completed their Ph D, only 15.4% are using SRM in their teaching work. It further brings to fore that in spite of attaining a Ph D and knowledge about SRM, only 15.4% agree for using SRM in class. It was also found that 59.6% faculties completed their Ph.D. degree; and 28.8% faculties are found as a research supervisor but only 17.3% are completely using SRM as a research supervisor. The data also indicate that 46.2% faculty strongly believe that Scientific Research Methods is effective for academic purpose but only 17.3% is using Scientific Research Methods in teaching. It shows a vast difference in their understanding of the effectiveness of SRM for Academic purposes and the implementation of SRM in their teaching work.

A closer inspection of the aforementioned responses stresses on the focal point of implementation of SRM in engineering. It is observed that the key objectives of modern engineering is not only to impart technical education to the emerging engineers but also to develop their critical, creative and inquisitive attitude. It becomes necessary to inculcate in them the scientific research skills with scientific attitude and scientific competencies.

The present study identifies engineering faculty’s scientific research methods competencies and their attitudes towards scientific research methods and the effect of using SRM for teaching purposes. It has been detected that the selected faculty mostly exhibited the kind of knowledge indicative of SRM “do you know about research methods” was in “completely” level. But on the other hand teachers lacked adequate knowledge for SRM process skill which shows “No” for the use of SRM for collection of data and experimental work for research pursuits. This incongruity between the knowledge of SRM and use of SRM for research purposes indicates lack of motivation and resources for implementation of SRM in classroom practices.

Another finding of current study is that in terms of level of use of SRM in completing your Ph.D. most faculty’s response reach to “mostly” level but using SRM as a research Supervisor or in any

research or research-oriented pursuit they stretch to “slightly” level only. This manifests that faculty is very positive about using SRM for their Ph D degree work but lacked high levels of skills in developing their or research-oriented pursuit using SRM.

Another finding of the study is the difference between using Scientific Research Methods in teaching, the faculty agreed to “mostly” level but when the effectiveness of Scientific Research Methods for academic purpose” was asked, they showed “completely” level. This finding indicates that faculty’s awareness of effectiveness of SRM for academic purposes but lacked in the implementation part in teaching work.

The findings from this study provide a better insight into the assessments of North Indian Engineering Faculty members on Scientific Research Methods and identifies that implementation of SRM in teaching has substantial effect on teaching and research work. The findings also reveal use of SRM in classroom environment influences the teachers’ pedagogical approach and sharpens learner’s research attitude and competencies. The benefits of SRM can also be well-understood by the figure.

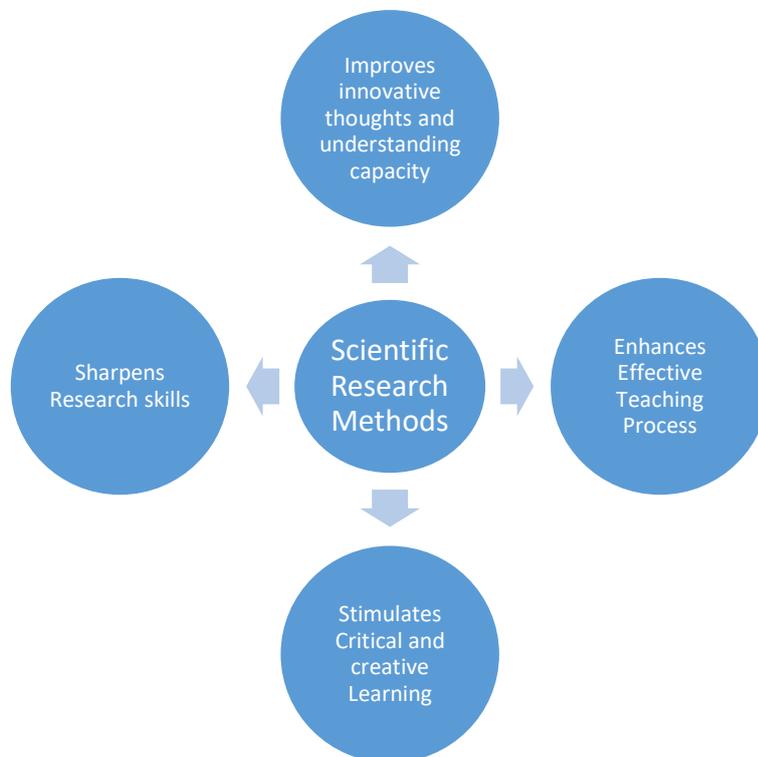


Figure 2 Benefits of SRM

Recommendations:

After the investigation, the researcher studies the assessment of engineering faculties on scientific research to reach the point that the faculty member has sufficient knowledge of the subject but less knowledge of scientific research methods. Nearly half of the participants have insufficient knowledge about scientific research methods as a result lack information of innovative ideas and entrepreneurship skills. The present research work finding recommends the following suggestions for engineering faculty members:

- (i) The engineering faculty members should adopt scientific research methods in day-to-day activity with students in teaching.
- (ii) Whenever discussing the new topic in class, faculty is advised to discuss the importance, application, and purpose behind studying SRM.
- (iii) Students can also be given some project work using scientific research methods.
- (iv) Faculty can also motivate students to write a research paper of their field with scientific research methods for data collection, analysis and interpretation.

Recommendations for Management Committee:

According to this research work finding the following recommendations for management and higher authorities are as follows:

- (i) Provide a research-based environment and motivate the faculty members to do research with some incentive and increment in the facility, in which they can utilize their maximum effort to teach their students with full of confidence and energy.
- (ii) Provide the leave and finance facility for engineering faculty members for doing new research work and arrange training for new research techniques.
- (iii) Give equal importance to research as well as class work for all engineering faculty members and include this topic as a subject, as compulsory for all students.

Limitation and Future Scope

A limitation of this research is the nature of the sample, by covering only North Indian Engineering Faculty, so forthcoming may include other faculties also. The present study sheds some light on the importance of Scientific Research Methods-led teaching in an engineering teaching context. However, our results could be dependent from the context in which we operated and which may further have impacted the outcomes. The study limits itself to North Indian Engineering faculty and their use of Scientific Research Methods in teaching. Further studies related to quantify the impact of teaching staff, curriculum design and implications of SRM in other academics fields can also be done. The challenges in applying SRM in teaching can also be studied at length. Furthermore, the same study may be carried out with variety of questions and by using bigger sample size.

Conclusions

In this work, it was planned to find the knowledge of engineering faculty about scientific research methods and identify the effect of scientific research methods in the improvement of engineering faculty teaching and research. This work-study was planned in qualitative research design and questionnaire to collect data from more than five hundred faculty members. Through an observational analysis various issues emerged from the use of Scientific Research Methods-led Teaching, particularly in case of North Indian Engineering faculty. It was observed that the engineering faculty members lacked knowledge about scientific research methods. The results of this research work data analysis suggest that the management and higher authorities should provide the facilities and encouragement to staff for participation and conduction of the scientific research activities. Our findings also indicate that implementation of scientific research methods in teaching is the need of the hour and higher education sector need to rethink the way teaching content is delivered to face the evolution of education. There is a need of seamless integration of scientific research methods into

teaching. Thematic analysis and the present study suggest better integration of scientific research methods in teaching to pique students' inquisitiveness, stimulate their interest and motivate them for creative and critical learning.

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