

## Research Methodology in Undergraduate Students

**Dr. Pradip Kumar Das**

*Formerly J. K. College, Purulia, India, S. K. B. University, Purulia, India*

DOI: [10.5281/zenodo.10807100](https://doi.org/10.5281/zenodo.10807100)

**Abstract:** Developing and succoring undergraduate research vigor gladden academic institutions, faculty mentors and students. As the world progresses, further research is coercive to accelerate knowledge and novelty in all domains. Introduction of research methodology in undergraduate curriculum has been a trending topic since long. But, trivial effort has been oriented towards achieving this dream. Research experience at undergraduate level is capped to doing research project under the supervision of faculty. It is imperative that undergraduate students must be prepared for current knowledge-intensive world. Undergraduate research basically teaches students research methods and help them knowledge acquisition that they can employ beyond academe. Sparse information is available about pedagogical approaches to ennoble undergraduates literacy of research methods. Research methodology in routine curriculum lends groundwork and inculcates stimulus for research among undergraduate students and introduces them with reasoning capabilities. Key to successful undergraduate research participation is to sense substance of rigor, academic ideals and responsible research conduct. Capacitance in research has a lasting dent on valued cognitive growth as undergraduate students prepare for professional service. This paper discusses values and benefits of undergraduate students participating in research and scientific publishing as well as challenges they face. The present paper discusses challenges and benefits of learning research methodology at undergraduate level. Few suggestions have also been proffered to embolden undergraduates to venture on research.

**Keywords:** Undergraduate research, scientific publishing, research methods, project based learning, research methodology

### 1. INTRODUCTION

As the world progresses, necessity for research bides a cause of growing emphasis in spawning contemporary knowledge society and driving novelty in all genres (Choong, 2022). Research methodology figures prominently in reasoning to live challenges and revelation of veracity. By integrating research into academic courses, students can strengthen their independent holistic perspective dexterity as well as their communication skills, among others. Research is not just for academics but also for inquisitive and breakthrough. Development and innovation en masse stands on research. This suggests that there is core requirement to propel knowledge evolution and appositeness. Undergraduate research methodology impacts literacy pursuits developing through competitive, methodized institutional enrichment opportunities,

honors programs or faculty mentoring (Blanton, 2008). Flowering undergraduate students research potential is a sovereign intercession to decipher this challenge. Undergraduate students' cognizance in research has assumed importance (Knight et al., 2021). Faculty abetment strengthens potentiality of undergraduate students' study and resolute involvement in research. Incorporation of research methodology in undergraduate course has been a big issue since 1970s (Johnson, 1973) but little is contemplated thriving pedagogical approaches. Students absorb knowledge and dexterity to comprehend research design, paraphrase data and primary literature (Lopatto, 2004; Seymour et al., 2004). Research project develops skills (Adedokun et al., 2014). Undergraduate research experiences expatiate awareness; bolster, explicate, or accommodate career and graduate school ideals; and boost professional qualifications (Adedokun et al., 2012; Russell et al., 2007; Villarejo et al., 2008; Willis et al.,

2013). Teaching and learning strategies in research methodology afford ground for undergraduate research and execute corresponding boons for students participating in extracurricular research. This paper involves discussion of challenges and benefits of research methodology for executing and bracing undergraduate research nexus. Techniques are included for course design, development and facilitation escalating constructivist learning strategies and collaborative modules.

## **2.OBJECTIVE OF THE STUDY**

The objective of the paper is to discuss the challenges and benefits of teaching research methodology to undergraduate students.

## **3.MATERIALS AND METHODS**

The study is descriptive in nature and conducted by variety literatures. Descriptive study has been preferred for developing better profundity of knowledge. Thus, this study purely reckons gobs of secondary sources accessed through Internet and academic databases viz. literature reviews, website, books, journals, etc. for the study of research methodology in undergraduate students. Editing and classification of the data have been done as per requirement of the study. This study aims at describing the benefits and challenges of research in undergraduates in a systematic and actual on facts and the nature of the research object. The corpus of this paper is limited to establish, in the first place, values of undergraduate research. In the second place, an assessment on the foremost mission endeavoring the essence of research methodology in undergraduate classes has been delineated. The author has fascinated this one of the most challenging aspects of research methodology in undergraduates as this is ballooning and revamping the students endeavoring further study. Mechanism of analysis is worthwhile for contemplating research methodology.

## **4.RESULTS AND DISCUSSIONS**

### **4.1. Teaching Research Methods**

Research is congenitally methodical study seeking information through existential approach. Knowledge of research process is fundamental for both researcher and beneficiary to be benefitted by the conclusions drawn from research. Knowledge garnered from practicing research methods to realistic challenges serves students in future. Research work is earth-shaking for revelation of veracity and also for intuiting previously unexplored. Data interpretation to resolve problem for which no cogent response has disclosed

previously is breathtaking and illuminating. Students grasping through critiquing problems have opportunity for chef-d'oeuvre and credence (Leedy, 2010). Students seek for quick responses to dilemma and reconceptualize. Research methodology courses are booming widespread in degree fulfillments (Crooks et al., 2010). However, modest attention has been footed to built-in conundrums in keeping the courses which are typically relived as tricky to educate (Crooks et al., 2010). Research methods courses are challenging because technical complications of study material is crucial while students' enthusiasm is lacking (Ball & Pelco, 2006). Students usually whine that research methods courses are stodgy and inapposite to their mundane. Since students show vexation about research methods courses, teaching program through coordinating research methodology with other approaches are favored (Dion et al., 2011).

### **4.2. Research Methodology-Concept**

Research methodology insinuates clocklike and conceptual appraisal of research methods exercised in a sphere that connects strategies of the tools applied for scientific research. Researchers, thus, cognize to collect actual evidence, infer and develop extant knowledge consortium. So, research methodology is a damn intellectualistic society applied in investigation of social phenomena, nature and matter. As mainspring, it constitutes framework for the whole venture. Confusion between "methodology" and "methods" in research is universal phenomenon, occasionally utilized connately. Goulding (2002) claimed that the choice of methodology must be bottomed on researcher's interests, beliefs and convictions. Research methodology encompasses macro-level strategy or application wielded in research while research methods are particular mechanisms operated to gather, evaluate and interpret data within blanket approach. Research process involves a series of steps researchers follow to conduct their studies systematically. These steps typically include: i) Problem Definition; ii) Literature Review; iii) Research Design; iv) Data Collection; v) Data Analysis and vi) Results & Interpretation. Based on elite research methodology, researcher can utilize quantitative approach, qualitative approach or mixed methodology approach. To author research methodology quantitatively, researcher exacts to accrete and assess numerical data via quantitative technique like survey. To author research methodology qualitatively, researcher quests to make observations, delineates research themes and undertakes interviews. Research methodology feeds roadmap to researchers cinching that their studies are definitive, existential

and recreatable. With discreetly adjudging research methodology, researchers spawn excellent espials for betterment of society. Precise course trailed in research methodology unearths truth to researchers for conniving modus operandi to discern phenomenon. Successful research conduction requires proper planning and execution. Since research dictates kinds of approaches followed, it is crucial to choose research methodology to corroborate recipe adopted for database. Axioms for adjudicating research methodology contemplate research goals and challenges. According to Somekh and Lewin (2005), research methodology is collection of methods or rules applied to research as well as principles, theories and values abetting research approach. Methodology part must illuminate on how researcher initiates data and demonstrates how researcher analyzes them (SHU Library, 2020). For novice researchers, writing research methodology can be overwhelming process especially considering the intricate elements covered by this segment (Ellis & Levy, 2009). Essentially, research methodology is blueprint of research study (Murthy & Bhojanna, 2009). Best practices in research methodology embrace: i)Clearly Define Research Objectives; ii)Literature Review; iii)Ethical Considerations; iv)Pilot Study; v)Data Collection, Quality and Reliability; vi)Data Interpretation and Reporting; vii)Replicability and Reproducibility; viii)Holistic Learning and Improvement. Research methodology substitutes backbone of any scientific investigation. Perceiving factors and kinds of methodology empower researchers to make savvy decisions about research design, documentation modus and data interpretation practices. By espousing to etiquette of ethical decision-making frameworks of observations, researchers enhance validity, solidity and implication of their inquisitions. As research methodology excogitates and novel approaches dawn, researchers must embrace double-loop education and breakthrough to contribute to upgrading knowledge in their defined areas.

#### **4.3. Values of Undergraduate Research**

Research is a meticulous process of inquisition that incorporates data collection, analysis and interpretation as per protocols defined by specific academic and professional disciplines (Çaparlar & Dönmez, 2016). There are varied benefits to enthralling students in research at undergraduate level. Research betters students efficiency to problem-solving throughout their career. Problem-solving focuses on identifying

and resolving issues. Early exposure is a critical strategy for sprouting students' engrossment and department in research.

Research methodology and hypothesis-driven scientific process stimulate independent critical thinking of undergraduates. Critical thinking entails insightful research and critiquing solutions. Besides, this invigorates to extrapolate created on available substantiation. Undergraduate students' pursuing research undertakings will embed brawny momentum and montessori. Research process impacts positively on preparation of undergraduates' own pursuit.

Students participating in research master room to meliorate writing proficiency for publication and communication (Shivni, et al., 2021). There is wee leeway for institutional culture on expository writing. Students encounter constraints for expressivity in their own words amid academic appraisal. Enriching students' rhetorical aptitude becomes smooth if adequate prominence is yolden to strengthen their adeptness towards research process.

Students' participation with their research works in conferences, etc. grabs possibility to collaborate more with savants causing fun experience and boosting confidence with demonstration aptitude. Contribution to research should not be relegated to acknowledgement section of paper but should be admitted as co-authors. Moreover, students should not be negated first authorship because of powered strength. This definitely heels their better attitude towards research.

Research culture among students through academic institution facilitates learnedness. Students developing explicit knowledge and reasoning imbibe to correlate theory and practice. Further, undergraduates in research diagnose and cultivate relevance in other walks. Engrossment and generic familiarity in undergraduate involvement rhapsodize quality of research at higher level.

Research experiences foster students craving for knowledge (Ditta et al., 2020). Student-faculty research mentoring relationships develop over time. Faculty research mentors are excellent source of guidance to students seeking employment. Students also garner esprit de corps experience that builds pleasant relations between colleagues and savants. Key to effectual undergraduates research participation is to digest insight of meticulousness, probity and responsible conduct of (RCB) research for students.

An arête of students' research participation is prospect of publication in peer-reviewed journals that espouses their early

exposure to process and concept of publishing. Conning from reviewers' comments, students can better their quality of papers. Publishing demonstrates that undergraduate students are enthusiastic about research.

Research as learning-by-doing process requires students to frame questions, devise strategy for testing hypotheses and detail precisely their findings. Pilot study heartens students to undertake secondary research e.g. reviews, correspondence, viewpoints, book chapters, etc. Research evolves cognitive reasoning, enhances usage of scientific databases for corroboration and lessons.

Academic institutions also descry benefit from engaging undergraduates in research (Eagan et al., 2011). Teams researching reap worth from enthusiastic students. Students oft investigate quite perceptively and ameliorate output from institutions.

Undergraduates students contribution to peer-reviewed publications and research presentations in conferences, etc. gladdens institutions recognitions in society and also the students with the right support systems. Undergraduate research initiatives are sleeping golden goose if they are illumined and backed passably.

#### 4.4. Challenges Facing Undergraduate Students

- i. The most significant challenge is students' philosophy that they are incognizant and inept about research process.
- ii. Unhappy faculty support, mentorship, funding and motivation for undergraduates to participate in research.
- iii. Material restraints like time constraints for overburdened curriculum fetter students' involvement in research.
- iv. Absence of major plans and strategies for undergraduate research.
- v. Difficulty in choosing topic, collecting data and time management amidst academic activities.
- vi. Lacking biostatistics curriculum and equipped laboratory facilities, sketchy training in research methodology and geniality with statistical analysis.
- vii. Priority of traditional education over research, subpar collaboration between academic departments and research centers, insufficient research space, inequitable faculty input, inquisitiveness, etc.

- viii. Supervisors often under elevated strain might not have time to extend fairish guidance for undergraduate students to work beyond minimum teaching hours.
- ix. Another challenge is that supervisors may be beholden to meet students working on areas where they are amateurish escalating suspense in supervisor-student relationship. Furthermore, some supervisors might be oblivious with research methodology students thirst to innovate.
- x. Typically courses on research methodology appear donnishly prodigious, academic challenging and rigid to individual future. Pedagogical modalities of many research method courses disentangled from practical issues are yet undoable at cognitive level.

Major challenges in teaching research methods count students' weak potential to (a) build study establishing projections with conflicting hypotheses; and (b) think clearly through key issues like randomization, control conditions, double-blind testing, counterbalancing, experimentalism, demand attributions, etc. A crucial issue relates to getting recommendation from institutional research board for timespan and scrutiny in the factualism. Problems of writing proficiency, correct citation and reference format are also ubiquitous.

#### 5. SUGGESTIONS

There is an overriding need for stakeholders multiculturally to lucubrate the issues and devise acclimated strategies to balloon participation of undergraduate students in research. Here are few suggestions to precipitate such participation:

1. Some institutions approve research methodology in final year, it is cardinal to incorporate it as mandatory throughout the academic program. Undergraduate teaching curricula and approaches should promote inquiry-based learning. Academic curricula might arrange regular discussions of new advances and academic departments might be assigned to organize conversations. This practice fosters research aptitude in undergraduate students and stimulates their minds.
2. Amid academic program, students should be assessed for their research-focused curiosity. Credit points should be awarded for each peer-reviewed publication to encourage faculty-student research collaboration and stimulate them to suffice as mentors for undergraduates.



3. Undergraduate students should have opportunity to participate in more research trainings, internships and placements. This strengthens their research skills and experience.
4. Students should be encouraged to publish papers in peer-reviewed journals before graduation. Besides, final year dissertation must be published on topic with the potential to drive impact.
5. Undergraduate students should be emboldened to participate and present their project in conferences, seminars, etc. to share their work with others, gain experiences from others and improve institutional collaboration. This is worthwhile investment towards knowledge-creation and utilization.
6. Arrangement can be made to celebrate and provide incentives to undergraduates for contribution to scientific knowledge. Funding should be made more accessible to students for evidencing illustrious devotion in knowledge-creation. More students will, thus, be prompted to participate in research across academic institutions to better understand challenges.
7. Providing students opportunity to learn and practice by incorporating research methods into undergraduate courses are research-supported ways to abet diversity in higher education for future studies ventures.
8. Strategies like constructive participation in research processes, appreciation in piloting research projects and course-based research experiences strengthen undergraduates knowledge and confidence with research methods.
9. Strategies for incorporating research methods into undergraduate courses focus on teaching methods as also equip students with experiences for practicing and reflecting on them as part of inclusive and comprehensive pedagogy.
10. Providing training in basic skills and knowledge builds students' competent to undertake course-based research at the outset of the course. Early exposure of students, thus, can successfully participate in future (Kilburn et al., 2014).
11. Students should be backed to conduct research in real-world contexts and use extensive examples and exercises to demonstrate steps in research process with their relevance (Kilburn et al., 2014).
12. Research knowledge helps students involve in skills transfer and prepare to become discerning consumers of scholarly articles and clear insight to buttress endgame.
13. Master time-table of teaching curriculum is prepared as per directions of regulatory authority. There is usually no separate teaching hours allotted for research. Teaching staffs have to devote extra time for this. Management should sponsor to use resources and infrastructure during extra time.
14. Working together with supervisors yields research training and develops portable skills integral to researcher career.
15. Institutions and supervisors may extend benefaction to undergraduate students for their development of confidence. Further, institutions should produce propitious research environment.
16. Knowledge and skills learnt from research methodology help students perpetrate better research projects like any other subject of science, etc.
17. Courses on research methodology feed students with the possibility of reaping theoretical and methodical skills to appreciate domain-specific knowledge and engross meetly research developed in their areas.
18. Attribute of supervision and other institutional factors ameliorate undergraduates experience briefly educating high students submission and completion rates (Spronken-Smith et al., 2017; Wisker, 2012).
19. Access to courses on research methodology can enrich undergraduate research experience to meet research career and benefits of employment opportunities during their candidacy (Lopatto, 2010).
20. Besides supporting enhanced undergraduate experience, institutions need to consider offering discipline-specific methodological skills to gain broad employability and diverse research career paths.
21. Teaching research methodology demands canorous blending of theoretical understanding, procedural knowledge and skills competence for development in framing, collecting, analyzing, presenting, interpreting data and communicating results.
22. Design of research methodology programs should be systematic to underpin students to adapt inexplicability of the subject and to swot how to beseem professional researchers (Coronel & Boza, 2011).

## 6. IMPLICATION OF THE STUDY

This paper furthers pullulating substantiveness of studying undergraduate research experience phenomenon and introduces brains of research methodology in tailoring students for research careers within and outside academia. The study reconnoiters how educational centres can resolutely build decisive and cohesive research cultures by teaching research methodology to undergraduate researchers.

## 7. CONCLUSION

Undergraduate research is a wellspring that has yet to be consummately evanesced. Core premise of research methodology in undergraduates is to teach students how to research and develop must-have skills that can be practiced outside the ivory tower. Intriguing undergraduates in publication process though built on sand, but never-ending heartwarming students in doing so may yield fruition. Bolstering undergraduate research will decorate tertiary education beyond discordance. Besides invigorating ongoing drives, there is crying need to develop bottom-up and top-down initiatives to further encourage undergraduate students for participation in research publication.

## 8. RESEARCH SCOPE

The study built on students percipience and author's exclusive experience are contemplated by undergraduate program. The researcher glimpses the research gap eulogized for essence that the inquisitive study sculptured on distinct author with explicit analysis staying uncouth erstwhile may you be blossomed addressing a collocation among manifold authors of disparate stratum ripened on their opinions and thoughts on the topic to mushroom inference. Future study, therefore, needs to accentuate in-depth analysis of idea sharing amidst more authors and undergraduates. The author cogitates that the prospect in this arena stipulates sweeping study to glisten more fructuous upshot and ideates that other inchoate atmosphere anent relevancy of research methodology ideology in undergraduates will be extricated by future studies.

## 9. RECOGNITION

The author has received no fund from any source.

## 10. ACKNOWLEDGEMENT

*This paper is dedicated to ALMIGHTY GOD who bestows HIS blessings in all walks of my life.*

## REFERENCES

1. Adedokun, O. A., Parker, L. C., Childress, A., Burgess, W., Adams, R., Agnew, C. R., . . . Teegarden, D. (2014). Effect of time on perceived gains from an undergraduate research program. *CBE Life Sciences Education*, 13(1), 139-148. doi:10.1187/cbe.13-03-0045
2. Adedokun, O. A., Zhang, D., Parker, L. C., Bessenbacher, A., Childress, A., & Burgess, W. D. (2012). Research and teaching: Understanding how undergraduate research experiences influence student aspirations for research careers and graduate education. *Journal of College Science Teaching*, 42(1), 82-90.
3. Ball, C.T., & Pelco, L.E. (2006). Teaching Research methods to undergraduate psychology students using an active cooperative learning approach. *International Journal of Teaching and Learning in Higher Education*, 17( 2), 147-154. <http://www.isetl.org/ijtlhe/>
4. Blanton, R. L. (2008). A brief history of undergraduate research, with considerations of its alternative futures. In R. Taraban, & R. L. Blanton (Eds.), *Creating effective undergraduate research programs in science*, (pp. 233-246). Teachers College Press.
5. Çaparlar C.Ö.,& Dönmez A. ( 2016). What is scientific research and how can it be done? *Turk J Anaesthesiol Reanim*, 44(4),212–218. doi: 10.5152/TJAR.2016.34711.
6. Choong K.K.,& Leung P.W. (2022). A critical review of the precursors of the knowledge economy and their contemporary research: implications for the computerized new economy. *Journal of the Knowledge Economy*, 13(2),1573–1610. doi: 10.1007/s13132-021-00734-9.
7. Coronel Llamas, J. M.,& Boza, Á. (2011). Teaching research methods for doctoral students in education: Learning to enquire in the university. *International Journal of Social Research Methodology*, 14(1),77-90. <https://doi.org/10.1080/13645579.2010.492>
8. Crooks, V.A., Castleden, H., & Tromp-van Meerveld, I. (2010). Teaching research methods courses in Human Geography: Critical Reflections. *Journal of Geography in Higher Education*, 34(2), 155-171. doi: 10.1080/03098260903093646
9. Dion, M., Coxe, L.M., & Carne, M. (2011). Track Four: Teaching Methods, *The American Political Science Association*, 34(2), 155-171.
10. Ditta A.S., Strickland-Hughes C.M., Cheung C., & Wu R. (2020). Exposure to information increases

- motivation to learn more. *Learning and Motivation*, 72, doi={<https://doi.org/10.1016/j.lmot.2020.101668>}
11. Eagan M.K., Jr., Sharkness J., Hurtado S., Mosqueda C.M., & Chang M.J. (2011). Engaging undergraduates in science research: not just about faculty willingness. *Res. High. Educ.*, 52(2), 151–177. doi: 10.1007/s11162-010-9189-9.
  12. Ellis, J. T., & Levy, Y. (2009). Towards a guide for novice researchers on research methodology: Review and proposed methods. *Issues in Informing Science and Information Technology*, 6, 323-337. <https://doi.org/10.28945/1062>
  13. Goulding, C. (2002). *Grounded Theory: A Practical Guide for Management, Business and Market Researchers*. Thousand Oaks, SAGE Publications Ltd. <https://doi.org/10.4135/9781849209236>
  14. Johnson, C. A. (1973). The development of a practical research method for the improvement of selected health science curriculum. *Journal of Allied Health*, 2, 168-172.
  15. Kilburn, D., Nind, M., & Wiles, R. (2014). Learning as researchers and teachers: The development of a pedagogical culture for social science research methods? *British Journal of Educational Studies*, 62(2), 191-207. doi: 10.1080/00071005.2014.918576
  16. Knight, S., Hale, R., Chisholm, L., Moss, P., Rolf, C. & Wenner, L. (2021). Increasing student involvement in research: a collaborative approach between faculty and students. *International Journal of Nursing Education Scholarship*, 18(1), 20210047. <https://doi.org/10.1515/ijnes-2021-0047>
  17. Leedy, P.D., & Ormrod, J. E. (2010). *Practical Research (9th ed)*. Pearson.
  18. Lopatto, D. (2010). Undergraduate research as a high-impact student experience. *Peer Review*, 12(2), 27-30.
  19. Lopatto, D. 2004. Survey of undergraduate research experiences (SURE): First findings. *Cell biology education*, 3(4), 270-277. doi: 10.1187/cbe.04-07-0045
  20. Moursund, D. (1999). *Project-based learning using information technology*. International Society for Technology in Education.
  21. Murthy, S. N., & Bhojanna, U. (2009). *Business Research Methods (2nd ed.)*. Excel Books India.
  22. Russell, S. H., Hancock, M. P., & McCullough, J. (2007). Benefits of undergraduate research experiences. *Science*, 316(5824), 548-549. doi:10.1126/science.1140384
  23. Seymour, E., Hunter, A.-B., Laursen, S., & DeAntoni, T. (2007). Establishing the benefits of research experiences for undergraduates in the sciences: First findings from a three-year study. *Science Education*, 88(4), 493-534. doi: 10.1002/sce.10131
  24. Shivni R., Cline C., Newport M., Yuan S., & Bergan-Roller H.E. (2021). Establishing a baseline of science communication skills in an undergraduate environmental science course. *Int. J. STEM Educ.*, 8(1), 47. doi: 10.1186/s40594-021-00304-0.
  25. SHU Library (2020). January 28). Research guides: Organizing academic research papers: 6. The methodology. *SHU Library Research Guides* Fairfield, CT: Sacred Heart University.
  26. Somekh, B., & Lewin, C. (2005). *Research methods in social sciences*. Sage Publications Ltd.
  27. Spronken-Smith, R., Cameron, C. and Quigg, R. (2017). Factors contributing to high PhD completion rates: a case study in a research-intensive university in New Zealand. *Assessment & Evaluation in Higher Education*, 1-16.
  28. Villarejo, M., Barlow, A. E. L., Kogan, D., Veazey, B. D., & Sweeney, J. K. (2008). Encouraging minority undergraduates to choose science careers: Career paths survey results. *CBE-Life Sciences Education*, 7(4), 394-409. doi: 10.1187/cbe.08-04-0018
  29. Willis, D. A., Krueger, P. S., & Kendrick, A. (2013). The influence of a research experiences for undergraduates program on student perceptions and desire to attend graduate school. *Journal of STEM Education: Innovations and Research*, 14(2), 21-28.
  30. Wisker, G. (2012). *The good supervisor: Supervising postgraduate and undergraduate research for doctoral theses and dissertations (2nd ed.)*. Palgrave Macmillan.