CHAPTER 7

Undergraduate Research from Three Asian Countries

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Introduction

Undergraduate research (UR) research is the process of conducting original academic research on a specific topic by an undergraduate student. Although the institutionalization of UR is a relatively recent phenomenon, its roots can be traced back to the nineteenth century with the Humboldtian model of higher education (i.e., the integration of research and teaching) and the founding of the University of Berlin. The creation of MIT's Undergraduate Research Opportunities Program in 1969 is considered one of the first UR programs in the world. Undergraduate research provides opportunities for students to gain in-depth knowledge to learn and to conduct hands-on experiments and sharpen their problem-solving abilities.

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Typically, during the undergraduate program, students are seldom exposed to academic research projects and wait until they reach their final year and then complete, for example, a capstone project or an internship program. As Evans (2010) pointed out, undergraduate students often lack the maturity and discipline to undertake and complete experimental work on their own. They need a certain amount of hand-holding by a research advisor—typically a faculty member or graduate research assistant who guides and mentors the student to complete the project. The mentoring process involves developing and understanding the research methodology, analyzing data, and effectively communicating their work in the form of written reports and presentations.

Wenderholm (2014) argues that it is difficult to assess the success rate of undergraduate research and to measure the positive impact on a student's life. According to Wenderholm (2014), the main challenge is to have motivated students with an adequate level of training who are interested in being involved in such projects. First-year students may have sufficient time, but their involvement also includes having a base level of knowledge. Thus, starting with second-year students could be more appropriate when involving them in undergraduate research.

Planning the project with measurable goals is another critical challenge. Wenderholm (2014) suggested that a second-year student could be involved in research so that they can learn from their mistakes and gain proficiency by the time they reach their final year. In their last term, students can have more time to be mentored by the faculty.

Boniak (2013) found that undergraduate research helps in generating self-motivation and self-directed learning and gaining new skills. Student research also helps enhance creativity among students. Faculty members, while dealing with students on a one-to-one basis, can dedicate more time to mentoring students. Mentors can vary their approaches and adopt research-informed, inquiry-based, and problem-based knowledge to apply it effectively. Mapolisa and Mafa (2012) also reported that undergraduate research eventually helps in improving the level of research in graduate students. They identified three levels of challenges faced by students, namely, mentor–student, student-related, and institution-related.

The mentor–student challenge involves engagement between the advisor and student, the time dedicated by the advisor and his/her availability, and student interest in the topic. Student challenges relate to personal issues in students' lives, such as time dedicated to research activities, financial matters, their level of motivation/commitment, and lack of

knowledge. Lastly, institutional challenges involve overcoming hurdles like lack of research material, books, online resources that a student can tap into to enhance their experience. In most cases, students are willing to be involved in research if they receive incentives often based on credits offered for such projects, help in enhancing their GPA scores, or possibilities of financial reward or jobs.

The integration of undergraduates into the research process enables the faculty to break the monotony of classroom teaching and foster excitement in a project. Students are more inclined to become motivated learners as they realize that this kind of involvement will be beneficial to them in preparing them for their careers. While designing the study plan, the research component needs to be incorporated so that they do not clash with the existing course load or even the workload of the faculty members. The transition of being a mentee to the owner of the research project is a complicated process and may not have a required set of qualifying parameters. The research conducted by the student depends on the advisor's assessment of the student's capability to perform the tasks assigned to them successfully.

Literature Review

In 2005, the Council on Undergraduate Research, Washington, D. C., and the National Conference on Undergraduate Research jointly issued a statement recognizing undergraduate research as "the pedagogy for the twenty-first century", based on an inquiry-based model developed under a collaborative effort between mentee and mentor. Healey and Jenkins (2009, p. 3) argue: "All undergraduate students in all higher education institutions should experience learning through, and about, research and inquiry". Incorporating research into the curriculum exposes more students to such experiences (Jenkins and Healey 2012). Healey et al. (2014) proposed different roles that students undertake while being in a university, which was viewed as the concept of students as partners. Four such areas include: learning, teaching and assessment, pedagogic advice and consultancy, scholarship of teaching and learning, and subject-based research and inquiry.

The concept of students as researchers in a higher education context is an educational approach to support students in their engagement with undergraduate research to enhance their knowledge base and gain a more in-depth understanding of the subject. There are several definitions of

undergraduate research, which are both informal and formal. A generally accepted definition, developed by the Council on Undergraduate Research, defines undergraduate research as "an active form of inquiry or investigation conducted by an undergraduate in collaboration with a faculty mentor that ultimately results in an original intellectual contribution to a larger body of knowledge" (Wenzel 1997). This definition is all-encompassing in nature. It includes research in both disciplinary and interdisciplinary fields, recognizing a teacher–scholar model that ensures that both students and faculty mentors have a mutual interest in the research experience.

The interpretation of undergraduate research tends to differ from discipline to discipline. Creative arts and design practice itself may constitute research (Yorke 2005), whereas the concept may vary in arts-based subjects with performances and exhibitions becoming a part of active research. In the sciences, the focus is based on experimentation and observation to generate data. Hence, Beckham and Hensel (2009) suggested that departments and institutions define undergraduate research based on the campus mission and disciplines.

Kuh (2008) recognized ten high-impact practices relating to undergraduate research based on the paradigm of students as researchers. The first-year course teaches students how to frame a research question and involves them in gathering data. Learning communities developed with students and faculty mentors can engage students in group research projects, and at a later stage, introducing writing-intensive courses embedded into the curriculum to help students practice writing of the research report. Collaborative assignments foster community practice among students. Working groups provide support to each other and enhance the research output. Service-learning opportunities and internships are various ways in which students can be inducted into research practices. These practices ultimately culminate in capstone projects and for some disciplines, may replace traditional program theses or reports.

Students-as-researchers is an active pedagogy that promotes students' appreciation for research as a discipline. The research process can be stimulated through assignments and giving students firsthand experience through live projects (Anderson and Priest 2014). Faculty members can develop higher-level thinking skills and critical judgment ability by examining how students gather and interpret data in light of their understanding. Faculty members encourage critical thinking skills and involvement in research, need to create time and space in the existing curriculum and assessment parameters that don't depend on rote learning methods but

experiential, hands-on practices to encourage critical thinking skills and involvement in research, (Hodge 2011).

Awareness of students' willingness to participate in such research-based programs is essential for faculty members. Research Skill Development Framework of Willison and O'Regan (2013) provides a framework that contains six facets of research, enlisting the research process from initially clarifying a question, through to dissemination of the understanding generated by the inquiry. The research process links to the spiral curriculum (Bruner 1977), which states that the research process applies to each level of education, and the degree of rigor keeps elevating as students progress up the ladder of higher education.

Methodology

Faculty members of three countries, namely, India, Iraq, and Malaysia, where one of the authors has taught at the undergraduate level, participated in the study. Faculty members were chosen randomly from the author's past acquaintance. Twelve faculty members involved in teaching undergraduate students received a structured questionnaire. Ten of these faculty members were teaching undergraduates in the management department, and two of them belonged to the education department. Secondary data from documents available online belonging to the ministries of higher education in these countries added to the study. Answers were analyzed to form the narrative inquiry for the chapter. Through a thorough review of existing literature and qualitative studies, the benefits and impacts of undergraduate research on scholarly traits in students, as well as its effect on institutions, were studied.

Undergraduate Research in India

India's education system has been maintaining its status quo for over a few decades and with no real changes to the existing system (Altbach 2012). In most cases, the efforts have been fragmented and regional without creating an overall impact in significantly improving the current educational scenario. No institution is solely responsible for the lack of significant change. Students have graduated without being involved in a single research project, and as a result, these graduates lack the skills needed for their employability (Aspiring Minds 2018). With a population of 1.3 billion, there are only 216 researchers per million (UNESCO 2018), and

research and development receive minimal support. In higher education, India's research expenditure is only 4% of GDP (UNESCO 2018). Estimates in 2018 suggest a relatively small number of the 161,412 students enrolled in doctoral research programs. Less than 0.5% of the total student enrollment in higher educational institutions, consisting of both public and private institutions, is pursuing graduate degrees (AISHE 2018).

Damini Saini of the University of Lucknow stated that "there is a considerate emphasis upon research for undergraduates in science area in India. All India Council for Technical Education (AICTE) is one of the Indian institutions which supports and funds the technical educational institutions for their conferences and research projects for life sciences, physical sciences, and chemical sciences, etc. The ministry of the government of India department of science and technology is providing fellowships for young researchers like start-up research grants for young scientists (e.g., early-career research award). Other than these, the Indian Space Research Organization (ISRO) also offers scholarships to young undergraduate scientists as projects and various training and development programmers at the undergraduate level like Bachelors of Engineering, Bachelors of Technology, and post-graduate levels like Masters in Engineering and Masters in Technology".

In March 2018, India launched the Prime Minister's Research Fellowship with an initial budget allocation of 16.5 billion Indian Rupees. Under the scheme, undergraduate and postgraduate students with a cumulative grade point average (CGPA) of at least 8.0 from elite Indian institutes such as the Indian Institute of Science (IISc), Indian Institutes of Technology (IITs), National Institutes of Technology (NITs), Indian Institutes of Science Education and Research (IISERs), and Indian Institutes of Information Technology (IIITs) will be eligible for direct admission in PhD programs of IITs and IISc.

Assistant Professor, Narendra Singh Chaudhary, Symbiosis Centre For Management Studies, echoed Saini's thoughts when he added that, "in India, there are funding agencies like the university grants commission and Ministry of Higher Education where a student can create a research proposal and get funding. The funding is specifically applicable to undergraduate studies. In every university or institution, internal funding supports undergraduate research but nothing specifically. Like, in my university, we get grants for minor research projects".

The Council on Undergraduate Research (CUR) defines undergraduate research (UR) as "an inquiry or investigation conducted by an

undergraduate student that makes an original intellectual or creative contribution to the discipline". CUR is the apex body that oversees and affiliates institutes to perform undergraduate research on campuses. In an undergraduate study, students assist a faculty researcher, graduate student, and other undergraduates in researching areas of similar interests. Undergraduate students work as a support for collaborative research projects by either pursuing their research ideas or joining established (MIT 2018) research projects. Chaudhury clarified that, to his knowledge, no such definition had been coined in India to explain undergraduate research, "I don't feel there is any such consensus. The major focus of undergraduate studies is more on teaching, not research. Even the Ministry of Higher Education focus is the same. The undergraduate faculties are now asked to focus more on teaching than research".

Undergraduate research in India suffers to a great extent due to the system of affiliation (Sengupta 2019). As many as 500 colleges affiliated to a single university makes the entire system ungovernable (Altbach 2012). The system is a logistical nightmare leaving the colleges to function in isolation with no direct contact among each other. It defeats the very purpose of a university exchanging ideas, thoughts, and progress in the arena of research (Chandra 2007). Research is generally conducted in specialized institutes rather than in the colleges or universities in India (Sengupta 2019). Apart from working in isolation, there is little inter-disciplinary interaction when it comes to undergraduate research. Most colleges initiate undergraduate research only in the third year of study, reeling under the shortage of staff and unequal distribution of workload. Faculty workloads have not been adjusted to accommodate faculty time to supervise undergraduate research, nor undergraduate research valued in the promotion and tenure evaluation of faculty. Also, faculty and students do not coauthor papers at the undergraduate level.

Generally, in the case of research scholars, faculty write papers with them. "Our university doesn't have campus undergraduate research celebration days, and neither is the undergraduate research presented to political and government leaders. So generally, we do not have much support for the undergraduate students in social sciences in India in public universities", added Saini. While talking about faculty workload and undergraduate research, Chaudhury also added, "it is part of the job with no special accommodation or adjustments in the timetable. Faculties have to take out time from their normal working hours".

With a rich demographic dividend, India needs to chalk out a real concrete approach toward undergraduate research programs and initiate and motivate young learners to get actively involved in research studies at the very onset of their foundation course toward undergraduate studies. To tackle the dwindling number of researchers and the problems associated with low research output, it becomes imperative for both central and state governments in India to replicate a concept that has proven results in many other places across the world. The Indian education system has about 20 million first-generation learners, who will need systematic induction in research methods to use the vehicle of education as a tool to tackle real-world challenges. Moreover, the focus should remain on girls who need particular attention to encourage them to pursue fields in STEM (Science, Technology, Engineering, and Mathematics) (World Bank Brief 2015).

Undergraduate Research in Iraq

In the field of higher education, Iraq had played a vital role in the Middle East as one of the pioneers in this region before war ravaged the country's economy, along with its rich tradition in higher education. Data received from UNESCO (2004) postwar period showed that the country has more than 20 universities and over 50 technical institutes. With peace prevailing in the country, this number has grown and under the Ministry of Higher Education and Scientific Research (MHESR). The universities and several private colleges are offering courses in computer science, economics, and business management.

Iraq's first and largest university, Baghdad University, was founded in 1957, uniting several colleges that had been established earlier, including the College of Law (founded 1908), the Higher Teachers' Training College (1923), the College of Medicine (1927), the College of Pharmacy (1936), and the College of Engineering (1942). In the 1970s, the country showed a sudden growth of technical institutes, which were created to support the booming oil industry. These institutes were initially a part of the University of Baghdad but soon received their independent status. Every province was deemed to have their university to support higher education, which led to a further rise in the number of universities. The growth was necessitated to support equitable distribution of higher education in different geographical locations; however, the quality control and assessment of these universities were a cause of concern.

The Ministry of Higher Education plays a crucial role in determining the policy framework for research in universities. As early as 2003, a National Committee for Science and Technology, composed of university presidents, was formed that oversaw coordinating research activities. However, this committee did not have any significant impact in coordinating countrywide research activities, and such endeavors were shouldered individually by institutions. Industry partnerships and interactions with the economic sector of the country were handled personally by individuals based on their contacts (UNESCO 2004). "Unfortunately, neither the Ministry of Education nor the Ministry of Higher Education in the Kurdistan Region of Iraq has developed any policies to embed the undergraduate research into the curriculum. Ministry of Higher Education has taken a limited number of initiatives to incentivize research activities among scholars and graduate students. Still, more attention should be given to the undergraduate research since it would eventually build student capacity in developing critical thinking at an early age", as mentioned by Honar Issa, Secretary Board of Trustee, The American University of Kurdistan.

The thoughts of Karwan Sherwani, Head of Business and Management Department, Tishk International University, reflected the lack of any real coordinated effort. He commented that "No, our government is not very active in research at the undergraduate level and no reports or initiatives encourage innovation to support economic development available in record". Honar Issa further commented that "policies should be defined to make the process a necessity. There should be a strategic plan with set-up goals as well as a realistic timeframe to initiate the process of undergraduate research. In line with the policies that ministries develop, institutions should create a culture of research among undergraduate students by holding seminars and workshops that can address the significance of the process in the future career of students. Faculty members play effective roles in guiding and engaging students in research activities while highlighting needs and expectations". Fahrettin Sumer, Chair, Department of Business Administration American University of Iraq, Sulaimani, also stated, "I work for the American University of Iraq, Sulaimani (AUIS). Both the Kurdistan Regional Government (KRG) and the Iraqi central government have higher education ministries that regulate universities, but I have not heard of their support for undergraduate research".

Research centers had received generous financial support in the 1970s when the oil industry was booming, but the situation changed in the

1980s because of the conflict with Iran. The lack of funding, materials, equipment, and literature became even more evident in the 1990s when international sanctions prohibited the import of materials and equipment with possible dual-use. Given the budget shortages, research activities relied mainly on postgraduate students. They were often undertaken in cooperation with partners from the economic or military sector, which funded specific projects (UNESCO 2004). Mainstream education and primary research at the undergraduate level were not a priority of the war-torn country. Lack of funding and adequate resources restricted the presentation of papers.

The situation has now considerably improved. Universities are encouraging both undergraduate and postgraduate students to engage in active research projects, "In my institution, most classes require some research papers, but these are mostly based on library and online research. To a degree, they also engage the community by interviewing people outside the campus to prepare video projects and to do the assignments. Also, they are encouraged to do internships outside the campus", added Sumer. "Most of the universities and institutions advocate the undergraduate research, and some are implementing them and thinking very seriously of making it mandatory with regulation and credits. At the same time, some institutions are unable to implement very sound research projects due to the students' poor understanding, lack of infrastructure, and management support". He further added, "we have a student conference, and staff conference, in both we have students and lecturers co-authoring papers and presenting the paper in the international/national conference together".

University faculty members are encouraged to pursue research activities that might help in solving practical problems that beset society. Research had played a vital role in the Iraqi higher education system in the past. The effort needs to revive in a direction that supports the sustainable development of the country. Iraqis are now feeling the impact of globalization and the rapid growth of information and communication. Thus, research needs to be redefined in an Iraqi context supporting new and innovative approaches toward progress. The emphasis at the undergraduate level needs to be on faculty members as mentors and initiating young learners towards a research-oriented pedagogy instead of restricting the entire research agenda to a few scientific and dedicated centers.

Undergraduate Research in Malaysia

In the recent past, Malaysian higher education witnessed unprecedented growth. The last ten years saw a significant increase in the enrollment of students, an influx of international students, as well as growth in research publication, patents, and improving the standards and institutional quality. The drive and expertise of the Malaysian academic community government investments to stimulate research and innovation contributed to the growth. The Ministry of Higher Education realizes that the field of higher education is ever-growing, and further encouragement of robotics, internet, artificial intelligence, and disruptive technologies is needed. The Ministry is keen to prepare Malaysian youth to keep abreast of the latest developments and global trends, advocating research preparedness among students from the foundation and undergraduate levels. According to a faculty member who chooses to remain anonymous, "most institutions of higher learning in Malaysia offer undergraduate research as a compulsory module within undergraduate programs, and it is usually in the final year of the undergraduate program. In the university I teach at, XYZ University, it is usually taken by students in their final year of study. The module is called Final Year Project (FYP) and is completed over two semesters". In 2013, the Ministry of Higher Education in Malaysia prepared a Malaysia Education Blueprint 2015–2025 (Higher Education) or the MEB (HE), which showed research publication has increased threefold from 2007 to 2012; 70% of these articles have been contributed by the five Malaysian Research Universities (MRU) (MBE—HE 2015–2025). The number of patents filed also grew by 11% during this period, and universities have been successful in generating revenues through their research and consulting services. The anonymous faculty member added that "the Malaysia Plan framework charts the path for the nation's economic development. Innovation features as an important measure in the country's economic development. However, to my knowledge, there may not be a direct link between innovation to support economic development and undergraduate research".

Even though the country is excelling in its effort in promoting research and showcasing significant growth in the higher education sector, the ride to the path is not altogether smooth. Faculty members have often complained about the lack of enthusiasm, especially among undergraduates, lacking in critical thinking and communication skills. Students also lack in their ability to comprehend English or communicate in English, which

hampers their ability to research in a field. Institutions that contributed data are trying to overcome such challenges and encourage students to come forward. “At my institution, we carry out research exhibitions and competitions to celebrate the innovations produced via undergraduate research. These exhibitions are sometimes open to the general public. We do share our innovation and research findings with government agencies, but this is primarily for research conducted by staff and postgraduate researchers”.

Budgetary constraints and the rising cost of education have put a strain on many innovative projects and research work, especially encouraging research activities at an undergraduate level. Employers are looking at graduates with requisite knowledge, skills, and attitudes, and bridging the gap between market demand and the existing education system is becoming an arduous task. In Educational Inquiry (Extended Project), Module code: EDUC3028, offered by University of Nottingham, School of Education, Malaysia Campus (2018), the module has been “designed to enable students to learn critical thinking skills, where they will be taught some techniques for evaluating arguments rather than accepting what they read as the truth. Students can seek evidence, and by using their critical thinking skills, they would be able to judge the authenticity of the evidence. Learning how to do research should help sharpen their critical thinking skills. The module also should help in providing the skills to students to understand research articles written by eminent educators and other related relevant academic writings. This would enable them to gain knowledge from primary sources”. Efforts are being made by universities to orient students toward a research-based curriculum from the very beginning of their undergraduate course so that they can move from a world of job seekers to a world of job creators (MBE—HE 2015–2025).

Recommendations

The emergence of the social sciences as a relatively new field of study, the refinement of educational research methods, and advances in brain research and learning science provide educators a broader set of tools and knowledge. Now they can determine the soundness of educational philosophies, teaching methods, and learning theories. Given the considerable potential for research of all types to enhance learning outcomes, higher education can benefit from integrating student research activities into curricula at all levels across all domains.

Research occurs along a broad spectrum, from scientific research to humanistic research to art-based research. This spectrum of research activities allows for considerable flexibility in integrating research into a variety of courses. By using both critical and creative thinking, students are better able to evaluate issues and problems from a more comprehensive set of perspectives. Principles and concepts from one domain or discipline are integrated with other domains or disciplines. All domains have the potential to inform and benefit other domains (Blessinger 2017).

Conclusion

As mentioned at the beginning of the chapter, the path to undergraduate research is not an easy task. Along with students' enthusiasm, time management, and faculty workload, there are issues of ownership, ethical practices, equality of opportunity, quality of supervision, and other resource constraints. The benefits of undergraduate research enhance the student–teacher relationship, the entire learning experience, and the culture of inclusion and openness. Undergraduate research should be encountered early in the student learning experience (Walkington et al. 2011).

Data revealed that little had been done to promote undergraduate research, mainly in the field of social science. Government funding in most countries is available to support research in science and engineering studies at the postgraduate level. In most cases, the curriculum does not include undergraduate research, and both students and faculty struggle to find a space for them. Faculty members teaching undergraduate students are overworked and often, no credits are given to them to accommodate undergraduate research or mentor students.

Undergraduate research should be embedded in the curriculum and can be scaled up to be inclusive. When universities adopt the pedagogical approach of student researchers, they assist students in preparing for their future careers. Students can inculcate a sense of ownership toward these projects. A research-based approach toward teaching will result in breaking the long-standing disconnect between teachers and students, providing rewards and recognition in support of the method.

References

AISHE. (2018). *All India survey on higher education 2017–18*. Ministry of Human Resource Development.

Altbach, P. (2012). The permanent crisis of Indian higher education. In P. Agarwal (Ed.), *A half-century of Indian higher education*. New Delhi: Sage Publications India.

Anderson, J., & Priest, C. (2014). Developing an inclusive definition, typological analysis and online resource for Live Projects. In H. Harriss & L. Widder (Eds.), *Architecture live projects. Pedagogy into practice*. Oxford: Routledge.

Aspiring Minds. (2018). *National employability report engineers – Annual report 2016*. Aspiring Minds, 2016.

Beckham, M., & Hensel, N. (2009). Making explicit the implicit: Defining undergraduate research. *Council for Undergraduate Research Quarterly, 29*(4), 40–44.

Blessinger, P (2017). Transforming learning through student research. *University World News*. Retrieved on 28th June 2019 https://www.universityworldnews.com/post.php?story=20170530085248669

Boniak, R. (2013). Overcoming challenges in field research for non-science majors. In F. Wilson & J. Thomas (Eds.), *Handbook for undergraduate research advisors* (pp. 123–129). Lanham: Rowman and Littlefield. 5 T.

Bruner, J. (1977). *The process of education* (2nd ed.). Cambridge: Harvard University Press.

Chandra, P. (2007). The decay of the campus. In *Building universities that matter* (p. 222). Hyderabad: Orient Blackswan.

Evans, D. (2010). The challenge of undergraduate research. *Association of American Colleges and Universities, Peer Review, 12*(2).

Healey, M., & Jenkins, A. (2009). *Developing undergraduate research and inquiry*. Higher Education Academy. Available at: http://www.heacademy.ac.uk/assets/documents/resources/publications/DevelopingUndergraduate_Final.pdf

Healey, M., Flint, A., & Harrington, K. (2014). *Engagement through partnership: Students as partners in learning and teaching in higher education*. York: HEA. http://www.heacademy.ac.uk/assets/York/documents/resources/publications/DevelopingUndergraduate_Final.pdf

Hodge, P. (2011). Revisiting 'how we learn' in academia: Practice-based learning exchanges in three Australian universities. *Studies in Higher Education, 36*(2), 167–183.

Jenkins, A., & Healey, M. (2012). Research-led or research-based undergraduate curricula. In D. Chalmers & L. Hunt (Eds.), *University teaching in focus: A learning centred approach* (pp. 128–144). Camberwell: Acer.

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. Washington, DC: AAC&U. 34 pp.

Malaysia Education Blueprint 2015–2025 (Higher Education). Ministry of Education, Malaysia.

Mapolisa, T., & Mafa, O. (2012). Challenges being experienced by undergraduate students conducting research in open and distance learning. *International Journal of Asian and Social Science, 2*(10), 1672–1684.

MIT News: MIT's much-imitated UROP turns 30. Massachusetts Institute of Technology, 2018., http://news.mit.edu/2000/urop-0202

Sengupta, A. (2019). *Improving research in India: Introducing undergraduate research in higher education.* ORF Issue Brief No. 277, February 2019, Observer Research Foundation.

UNESCO. (2018). *R&D data release.* UNESCO Institute for Statistics.

Walkington, H., Griffin, A. L., Keys-Mathews, L., Metoyer, S., Miller, W., Baker, R., & France, D. (2011). Embedding research-based learning early in the undergraduate geography curriculum. *Journal of Geography in Higher Education, 35*, 1–16.

Wenderholm, E. (2014). Challenges and the elements of success in undergraduate research. *Inroads, The SIGCSE Bulletin, 36*(4).

Wenzel, T. J. (1997). What is undergraduate research? *CUR Quarterly, 17*, 163.

Willison, J., & O'Regan, K. (2013). *Research skill development framework.* Retrieved 10 December 2013 http://www.adelaide.edu.au/rsd/framework/

World Bank Brief. (2015). *Educating India's children.* World Bank.

Yorke, M. (2005). *Issues in the assessment of practice-based professional learning.* http://surreyprofessionaltraining.pbworks.com/f/Assessment+of+Practice+Based+Learning+Mantz+Yorke.pdf