

Article

## Exploring Engineering Students' Perception on the Effectiveness of Community Projects

Boon Yih Mah<sup>1</sup>, Farhana Shukor<sup>2,\*</sup>, & Ahmad Zia Ul-Saufie<sup>3</sup>

<sup>1</sup>Academy of Language Studies, Universiti Teknologi MARA, Cawangan Pulau Pinang, 13500 Pulau Pinang, Malaysia

<sup>2</sup>Centre of Foundation Studies, Universiti Teknologi MARA, Cawangan Selangor, 43800 Kampus Dengkil, Malaysia

<sup>3</sup>School of Mathematical Sciences, College of Computing, Informatics & Mathematics, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

\*Corresponding Author: [farhana.shukor@uitm.edu.my](mailto:farhana.shukor@uitm.edu.my)

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**Abstract:** In this endemic phase, it is more common to have more online classes as students and advisors worldwide are more prone to choose several technology aids to teach and learn at Higher Education institutions. In this study, Entrepreneurially Minded Learning through university-community engagement in Engineering education worked as the base for students to prepare in an English course for completing their community projects. This study investigated the perceptions of 24 second-semester foundation students in applying engineering knowledge. Consultation with their advisors about their plans is crucial for students to execute their projects throughout the 12 weeks of the semester. In this study, a working methodology on community project execution involved Phase 1 (Planning and Design), Phase 2 (Analysis, Monitoring, and Delivery), and Phase 3 (Evaluation). Semi-structured interview sessions elicit responses from the students. The benefits of community projects are an increased sense of social responsibility, awareness of future avenues, more recent platforms fully utilised for documentation purposes, and increased engagement. The challenges include the limitation to conducting community projects online, lack of skills in working in online groups, and low community engagement. Students' engagement with the community via community projects will assist them in applying their academic knowledge to solving challenges from the actual world. Students needed support from the advisors to complete the task assigned successfully to nurture their skills to apply knowledge gained from their community projects at their future workplaces.

**Keywords:** Entrepreneurially Minded Learning; university-community engagement; community projects; engineering students; semi-structured interview

### Introduction

Technologies are used widely in all aspects of our lives, inclusive of the education field. It helps to develop students' ability for life-long learning. Engineering education requires students to understand the role of engineering in the communities and the complex interactions of engineering designs with the environment, people, organizations, and communities (Jamieson & Shaw, 2019). It agrees with Wong (2022) as the focus of graduate attributes is the concern of Higher Education Institutions to have more online group projects with the ability to solve problems while applying their knowledge in the engineering field. It calls for some engineering programs at many Higher Education institutions, including Malaysia, to make it a core or elective stand-alone course with more preference to be part of existing courses (Amaya-Gómez et al., 2019). Such

community project execution in an engineering context gives students a voice to choose what project they want to complete and calls for the attention of all community partners to collaborate more to motivate students to gain the best learning outcomes and experience. This integration helps to strengthen and equip students to work in different contexts. Mackenzie et al. (2019) further assert that service-learning strategies prepare a sustainable environment for cooperation between the university and community. Hence, significant efforts geared toward the ideal execution of community projects within the academic curriculum.

It is a common practice for most group work in Higher Education Institutions before the pandemic hits to be face-to-face communication. However, since then, there has been a tremendous change of learning direction towards online learning (Rapanta et al., 2020) as students learn through accessing advisors, peers and content via the internet. In engineering, community projects are a tool to help students improve their related skills to the prolonged professional practice of engineering while promoting civic responsibility (Ruth et al., 2019). In line with this effort, some universities in the country have also created specific service-learning guidelines to match it with their specified context. As a result, the Ministry of Higher Education in Malaysia has launched Learning Service Malaysia University for Society (eSULAM) as a set of national guidelines for services in the online learning platform (Department of Higher Education Malaysia, (2019). In light of the Covid-19 pandemic, online classes force students and advisors worldwide to engage with various technology aids to continue the teaching and learning. Integrating engineering education with the more recent usage of technology aids are then viewed to be a necessity at this point of time. In addressing real world engineering challenges, students are able to focus on collaborative forms of community service, practical application and project-based learning. Thus, the main objective of this study is to examine the challenges and strategies to improve those challenges of community projects from the students' perspectives.

- i. How do students perceive the effectiveness of the community projects?
- ii. What are some suggested improvements by the learners?

## Literature Review

### 1. Past Studies on Benefits and Challenges of Community Projects in University

With respect to benefits of teaching-service-community integration recognised for engineering contexts, as Wang et al. (2020) discovered leadership skills acquired through community projects earned by the first-year female engineering students. Increasingly, they learn to identify the community's challenges and cooperate with co-partners, for instance, communities themselves, authorities or industrial participants, in order to solve these problems (Felten, 2016). Other valuable outcomes relating to real work-life experiences might include resolving conflicts through critical thinking and deep-thinking abilities. It is an immersive learning experience that promotes high impact practices in a curriculum that caters for the development of critical thinking skills, people skills, innovativeness, entrepreneurial mindset, resilience with cognitive flexibility, emotional and contextual intelligence, and passion for lifelong learning (Awang-Hashim et al., 2019). As a result, diversity and multiple perspectives have become more readily available to students participating in community projects (Nishimura & Yokote, 2020). It is because the experiential learning in preparing community projects gives opportunities for students to interact with people from different backgrounds and needs. Therefore, community projects offer opportunities to develop life skills and enhance academic attainment and civic responsibilities among students.

There are still many challenges faced by students conducting online group work. According to Pease et al. (2015), projects that focus only on the short term often lead to broken and unused projects which do not serve their communities. Meanwhile, Caniglia et al. (2017) reviewed for a need to consider the students' readiness and the crucial support required from the institutions. One issue that plagues both student projects and development engineering in general is that projects are often designed, implemented, and then left without implementing long-term plans to continue the project or ensure long-term sustainability (Armstrong et al., 2021). Yusof et al. (2020) highlighted the views of advisors and students on the challenges they had encountered in their participation in community projects and testified that the challenges were due to the lack of understanding of theory and practice, the lack of cognitive autonomy, and the lack of structural support. Another study by LaPorte et al. (2017) observed many students lack understanding of the affected community

and their cultural and social needs leading to ineffective projects. Overcoming such challenges is the first move in ensuring successful community projects execution at the Higher Education Institutions.

Despite all of these challenges, literature suggests to opt for more strategies to form more online group community projects. Mendes et al. (2020) observed that due to the inequalities and contradictions in this relationship calls for joint community projects, shared responsibilities, periods of mutually supportive dialogue and negotiation. Moreover, in order to train professionals with a generalist profile that meets the social needs, university training must extend beyond the walls of the institution itself and requires the establishment of an educational model for the development of technical competences and the implementation of social skills and critical and reflective actions to support the contextualisation of issues related to citizenship. Universities must promote and place more value on interdisciplinary and multi-professional activities to overcome fragmentation of care and the emphasis on specializations calling for training with a generalist profile geared toward social demands. In order to continue to encourage students to take advantage of all the opportunities to learn about community projects in order to foster curiosity, creativity and values, academic advisors need to assist in any possible way.

## 2. Conceptual Framework

This study originated from The KEEN framework (2019), emphasising the Entrepreneurial Mindset coupled with Engineering Thought and Action, Expressed Through Collaboration and Communication, and founded on Character with Elements of university-community engagement (Bringle & Hatcher, 1999).

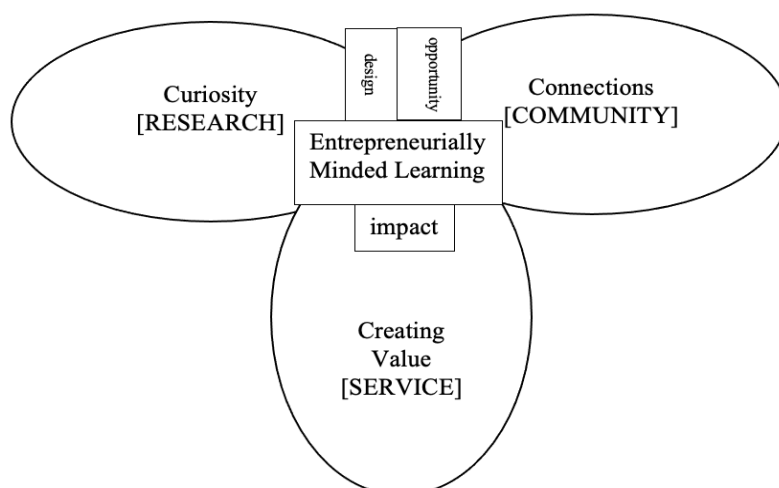


Figure 1. The KEEN Framework (2019) with the adaptation of the Elements of university-community engagement  
Source: Bringle & Hatcher (1999)

## Methodology

### 1. Context of Research Study

The course chosen for the study is English for Foundation Studies II aims to equip students with the necessary skills to present opinions and arguments effectively in oral and written forms through the integration of all the language skills. The students met the language advisor twice for two hours-session per week per semester (14 weeks). It is required for the students to prepare a 5–7 minute video of a community project with six team members each and to be submitted in week 12 to allow their work to be accessed by their language advisors. Appropriate consideration to higher-level grammatical construction, vocabulary expansion and appropriate activities intended to increase students' lexical density.

The project aims to demonstrate social communication and responsibility when engaging with selected crafted verbal and written texts on contemporary issues. There are two Learning Outcome Domains (LOD) of this project task; communication and social responsibility. For social communication, the students will be able to have Interactions with others and will get themselves to nurture relationships. Meanwhile for social responsibility, the students are expected to have a rational attitude towards multicultural society and make any

relevant contribution to the communities based on their expertise which will be on engineering expertise. For the flow of this project, the students are to determine the target group for their community projects like single mother, school pupils, siblings, friends, general public or people with disabilities. By having such ideas on where to start, it is to assist students to focus on the activities before getting approval from their advisors as to avoid redundancy of types of activities. Some examples of activities include giving the needy food, giving tuition to siblings/neighbour’s kid, creating awareness/campaigns on issues relating to the community.

## 2. Research Design

This paper focuses on how such preparation of community projects of engineering students at a public Higher Education institution is to enhance tertiary level students to have Entrepreneurially Minded Learning and to be engaged directly in community projects. The flow of this research formulated into phases shown below:

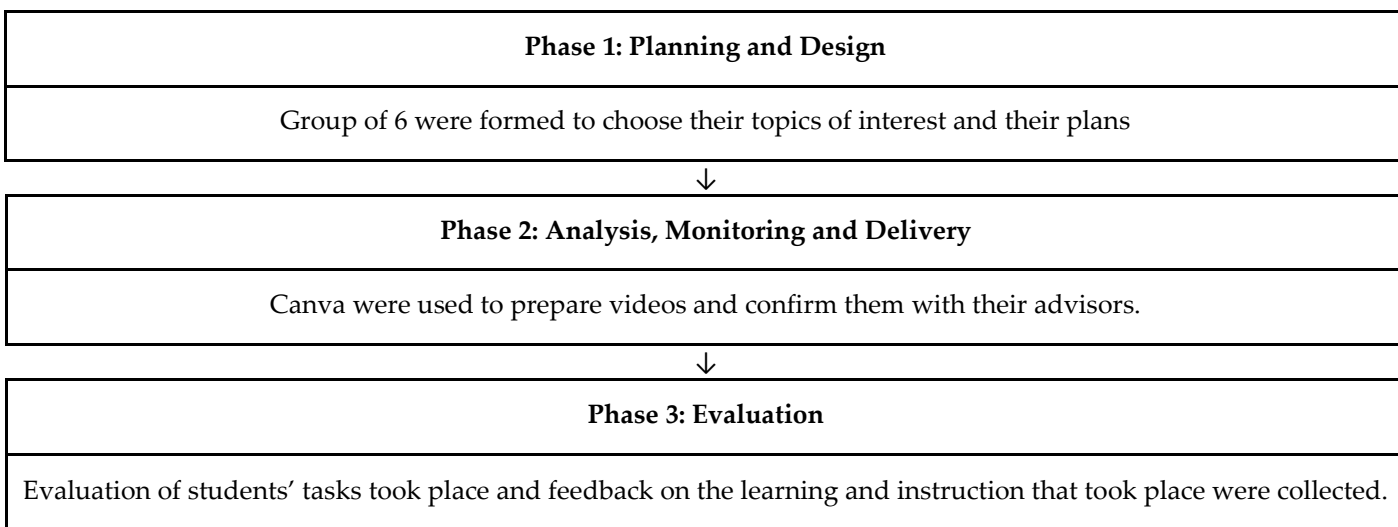


Figure 2. Three phases of community project execution

The advisor, one of the co-authors, implemented the 3Cs (Curiosity, Creativity and creating values) model-based course for the participants for 12 weeks. At each phase, instructional strategies are used to scaffold the learning and thus guide them to complete the goals of each stage. In Phase 1 is the phase of planning and design, the students are grouped into six followed by choosing their topics of interest and their plans to prepare materials for their community project, and also a briefing on the description of the requirements for completing this task and how course evaluation will be taking place. In Phase 2, the phase of analysis, monitoring and delivery, students were given briefing about applications like Canva to prepare videos and confirm them with their advisors the following week of the semester. Phase 3 is the evaluation phase by advisors for their tasks and receiving feedback from the students on the learning and instruction. Throughout these three phases, they became aware of the nature of engineering knowledge and its application. There are four engineering based community projects that the students have prepared: 'EcoBricks', 'Anti-Drowning Floating Belt', 'Smart Trash Can' and 'De Help'. 'EcoBricks' project is about how to typically mix with natural building methods like cob, adobe, or wattle & daub. 'Anti-Drowning Floating Belt' project benefits those who do not know how to swim. Other than that, 'Smart Trash Can' project features hands-free technology that lets users to open and close the lid with a hand wave, making them a mess-free choice when cooking and as for the final project, 'De Help', it is to develop a prototype mobile app for learning sign language that offers video-based lessons and exercises crucial to an individual development.

## 3. Learning Environment and Its Intervention

Google Meet was the platform used by the advisor to explain about community projects with a briefing on how to proceed on their own project. Besides that, the students were given advice in groups to support them in completing their projects. Students used a workspace on the Google Classroom. This workspace is designed for students to complete the project following the steps. Each step consisted of several activities which

scaffolded them to fulfill each step effectively. In setting up the online learning environment for the students, Engagement theory by Kearsley & Shneiderman (1998) is adapted for students involved and enmeshed intellectually, socially, and behaviourally leads to enhanced learning. By being part of the engaged learning, activities involve active cognitive processes such as creating, problem-solving, reasoning, decision-making, and evaluation. Plus, students will be more intrinsically motivated to learn due to the meaningful nature of the learning environment and activities. The engagement theory (Relate-Create-Donate) holds the idea of creating successful collaborative teams that work on ambitious projects that are meaningful to someone outside the classroom. Thus, such a learning platform like Google Classroom used by the advisors will be handy for students to refer to elements of community projects with feedback collected. They are somewhat engaged in every other community project to get them all accomplished. It is because these community projects participated in an innovation competition (e-SULAM) held by the Ministry of Education.

In facilitating students to complete their projects involving the community, language advisors recorded perceptions of hardship faced and suggestions on how to advise them on their community projects. This study employed a qualitative approach in data collection by conducting semi-structured online interviews regarding the engagement, perceptions on community engagement, the challenges they have experienced, lessons they have learned, and their recommendations for improving these experiences. This method was applied as it is an exploratory interview used most frequently in the social sciences for qualitative research purposes (Magaldi & Berler, 2020). In qualitative research, the researchers engaged themselves to gather rich insights about the phenomenon under investigation in a natural setting, understanding feelings and analysing words and where a researcher conducts a research study in a natural environment (Creswell, 2014).

#### 4. Sample

There were 24 undergraduate students majoring in Engineering enrolled in the same class who participated in this study. In total, there were 24 classes of Engineering students registered for the course. The age range of participants was 18 to 21 years old, with most not having experience creating a video or less exposure to it, especially using the Canva application. The method used to select the respondents for this study was based on two main criteria: 1) they have undergone at least one cycle of community projects organised at the university level, and 2) they have prepared their community projects using the Canva application for assessment purposes in their courses. The students were selected based on the advisor's recommendation of active involvement in their online community projects. The students came from 24 classes, representing the entire number of Engineering students enrolled in the course.

#### 5. Data collection

After the study's execution (weeks 10 and 11), each of the four groups of six team members was called upon and given a time slot between 15 and 30 minutes for their interview sessions. The session's inspiration came from inquiries based on the subject matters developed from the goal of this qualitative study. The researcher made notes and recorded them during that period. The researchers conducted the session with the recommendations from Krueger & Casey (2009) to get the participants' honest opinions about their experiences carrying out community projects. In collecting the data, responses were captured verbatim on audiotape and afterward transcribed for analysis. The researcher and participants dwell on the topic from the stimulus questions to a more thorough and convincing debate. The researcher attempted to understand the interpretation underlying the analyses and perspectives from the participative respondents.

#### 5. Data Analysis

Individually reading the transcripts was done by each researcher. Each researcher independently read and conducted line-by-line content analysis to analyse the qualitative data of the responses. It minimised the amount of data and found repetitive patterns. Researchers thoroughly analysed the participant responses to the semi-structured interview questions to discover connections in the data before properly coding them. The results were then condensed and organized into themes by the researcher. According to Creswell (2014), coding is "Organising the material into chunks or segments of text before bringing meaning to information". Sub-codes, codes, and themes are the three coding levels that help categorise the data on various levels of

abstraction and provide labels to the data to help derive meaning from the data. Prevalent themes emerged from the data analysis, later examined by the researchers in light of the earlier investigations. As a result, a smaller set of final categories made up the common themes.

## Findings

In this section, students' views about benefits and challenges they encountered while executing their community projects are shared.

### 1. Benefits of Community Projects

Thematic analysis of the data outlined four themes of the benefits the students gained in conducting their community projects from the participants:

#### *Increased Sense of Social Responsibility*

The first theme emerged from their interview sessions that was notably rewarding and valued the most is for them to become more responsible citizens and contribute to their communities. It is evident as one of them responded:

*“This course gives me the chance to enhance my skills to be a more responsible citizen as to help those in need. The most valuable moment that I could never forget is to see the happy face of those I helped and managed to capture those moments in pictures and videos and compiled in our group video to submit to our class lecturer. I am glad to get this chance to learn new things and experience moments like this.” [S8]*

It is also apparent that the students had that positive feeling to make an immersive difference after contributing to the communities. They have level up their sense of social responsibility from getting involved in such community projects. They also noted that they valued the reflection and feedback given by their language advisor the most to sustain that positive mindset and believing to receive outcome from their noble action.

*“Our advisor helped us a lot whenever we encounter any stumbling block and needed solutions to solve our problems related to our community projects. She has a very impressive attitude and the way the instructor approach us by using the interesting way of learning and also giving a lot of advices and life lessons make us enjoy this course very much.” [S12]*

#### *Awareness of Future Avenues*

Students also responded that such programs increased their sense of awareness to become more creative, making connections with the communities and offering service to contribute more for the benefit of all.

*“It helped me a lot to think out of the box and be a creative learner. By being part of this program, I get to see that more opportunities lie for me out there and I could offer my help for the benefits of others after I managed to learn and apply more engineering knowledge that I have learned at the university.” [S7]*

In another instance, it is also worth mentioning a student's response about how he noticed he has better equipped himself with practising self-awareness while completing the community project.

*“I think I have practised self-awareness as I am better at reacting to situations or people who might set me off, which is a good skill for becoming a leader in the future. I am aware of my emotions and how I handle them, getting to know the process and working through those emotions, avoiding unnecessary conflict.” [S1]*

#### *Recent Platforms and Application for Documentation Purposes*

In another instance, other students added that they might make full use of future avenues with the help of some applications learned and used throughout their learning period at the university. One of the participants responded that:

*“The Canva application has many accessible features that ease our way of completing any work such as the inserting videos online while collaborating with others, microphone function for speaking practices. The best thing is to have this all done freely without any charge imposed.” [S20]*

Another response noted that she had never expected many Google applications to be available for free. She only knew Google Meet as she used it often during the pandemic. She claimed:

*“I had once been familiar with Google Meet, but now I know that I can do so much work using Google Sites, Google Slides, Google Sheets, Google Voice, Google Chat, Google Calendar, and Google Drive.” [S5].*

### *Engaged More in Online Learning*

Majority of the students in this study exposed they realised they became more engaged with their learning even though it is in online mode and some of them might not prefer that so much. This is being acknowledged by one of the respondents when some of the applications used in their learning mentioned by her:

*“The platform used for communication purposes to give out tasks like Google Classroom, Classkick, and Google Meet was easier for us to use. So many and applications were introduced to assist us to communicate with our team mates online.” [S11]*

*‘The Google Sites enables us to stay in contact and not left with any important learning materials because our advisor put all the worksheet and tasks that we need to complete and easy to refer to.’ [S2]*

It is obvious that such community projects that they have involved are crucial for life-long learning as to be able to communicate well in an online platform, becoming aware of some issues taking place in the communities while applying some of the engineering concepts.

## 2. Challenges of Community Projects

Thematic analysis recorded three themes arose from the views of the obstacles the students faced in conducting their community projects:

### *Limitation to Conduct Community Project Online*

The first challenge that most of the students faced is due to the practical situation to conduct their projects online. They claimed they would appreciate it more if they could apply face-to-face.

*“I believe that the course has been taught the best way it could overall considering the fact that the activities were limited to online only interaction, it would be much better to be able to conduct face-to-face interactions as it would help us receive more information and get a better understanding of the context of our community projects.” [S19]*

### *Lack of Skills in Working in Online Groups*

One of the respondents in this study shared her disappointment in getting in touch with other team members to call for the first meeting in executing their community projects.

*“To be honest, I did face some problems at the beginning to work as a group as I failed to contact one of our team members but we managed to get him join us after our advisor contacted him and asked about his reasons for not joining our discussion. I am so thankful that our advisor helped us to reach him as we were unable to contact him.” [S22]*

Additionally, some students spoke about their difficulty deciding at some point of time during their project implementation. They agreed that initiating any online discussion was not easy for them at first, but after several attempts to see eye to eye about most of the matters. One of them suggested using a more recent platform that she discovered herself. “I would want to recommend for the lecturer to try and use the platform Gather to make online discussion more interactive and effective.” [S21]

### *Difficulty in Creating Rapport with The Community*

Final theme that students encounter problems involves the stage of building relationships with the people in their communities. He mentioned that;

*“Convincing some groups of people like the elderly was more challenging to be done as they were not really tech-savvy even to have online meeting using application like “Google Meet” or any other video conferencing. We only managed to have video call but limited to those who have excellent internet connection for the purpose of persuading them to agree to participate in our community project.” [S4]*

### **Discussion**

The results of this study demonstrate the potential benefits to both students and advisors from community projects that incorporate entrepreneurially-minded learning and university-community involvement. It agrees with Wang et al. (2020), who found that first-year female engineering students developed leadership abilities while participating in community projects. It confirms Nishimura & Yokote's (2020) ideas of providing students involved in community projects with various perspectives. Students would stand a greater chance of being academically and psychologically prepared for future careers as engineers by advising the advisors of such community initiatives methodically and rigorously. By emphasizing the relevance of offering new educational experiences as the components for the effective execution of any community initiative, Caruso (2014) has highlighted the significance of giving students additional opportunities to participate actively in education. The fact that one of the participants mentioned his responsibility for contributing something to society related to their engineering profession is apparent from this study. It is aimed in engineering education to improve individual and collective lives of the communities (Sunder, 2018). Acknowledging engineering education will enable immersive influence at the local and global levels to solve communities' problems.

Based on the student's point of view, they responded to systematic guidance from their advisors to be crucial for the execution of community projects. Caniglia et al. (2017) reviewed the need to consider the readiness and the support required from higher education institutions. Furthermore, it was noticeable that advisors possess in-depth knowledge of the fundamental ideas guiding students' concepts for engineering-related community initiatives. Additionally, advisors must be familiar with the Engagement theory by Kearsley & Shneiderman (1998) and the philosophy of community projects to help students transition from practice to identifying community needs and problems using such an approach. Additionally, advisors must foster self-confidence when leading community projects to increase commitment and engagement. Mendes et al. (2020) confirmed that failure to do it will result in the non-fulfilment of joint community projects, shared responsibilities, and periods of mutually supportive dialogue and negotiation. According to Brookfield (2013), advisors can support students in becoming self-directed learners by boosting their self-esteem, helping them become aware of their learning preferences and habits, promoting information literacy, and creating projects that teach them how to manage their learning environment. They will eventually get involved in community projects when they can handle their learning and the project. The community would be more committed to the project and could address the urgent problems of the students.

Some difficulties faced by the students hampered the completion of the community projects. Thus, a claim made by Pease et al. (2015) on projects commonly focused only on the short term often leads to broken and unused projects that do not serve their communities. However, there is a need for specific aspects at the planning stage. The results of this study have brought to light the particular difficulties that advisers and students encountered during the implementation stage. When figuring out how to carry out community projects successfully, it is crucial to consider views and perceptions. Student involvement in community projects can aid in developing their leadership abilities. The most important thing to do to elevate their abilities is to help and give guidance in their first years of university to prepare students for the difficulties they may encounter when implementing community projects. LaPorte et al. (2017) observed many students who lack understanding of the affected community and their cultural and social needs, leading to the ineffectiveness of the projects later concurred with this idea. As a component of the curricula for all disciplines, the university has been offering and extending the breadth of community service activities. Community initiatives may help foster the development of skills and knowledge at the tertiary level, according to Newman et al. (2015). It opens opportunities to acquire the knowledge, abilities, and values necessary to contribute to progress. Giving



back to the needy community allows students to receive practice-oriented education and encourages advisers to pursue research projects. Students have the chance to apply their academic knowledge to solve challenges from the actual world. As a result, through engaging with the community, the university can achieve its objectives for community-based teaching and learning and assure the quality of education.

### Conclusion

Such community initiatives increase the opportunities for students to participate in a teaching and learning strategy that involves working with the community to address problems. Most significantly, the students can benefit from this chance for community engagement and gain a deeper understanding of the numerous concerns. The management of higher education institutions, students, advisers, and the entire institution must fully commit to and support the completion of community initiatives (Bennett et al., 2016). Successful community projects, curation of more practical subjects, course designs, assessment and evaluation, a supportive institutional culture, ongoing and updated staff training and development, rewards and incentives for more achievement unlocked, and infrastructure that supports community projects in higher institutions are all contributing factors.

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