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Socially appropriate projects based on Termite Mound for the assistance of low-income clusters of rural societies

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***Abstract*— In this Century, there has been tremendous development in applying the principles of engineering for the well-being of society because of advancements made in science, innovation, and technology. Science and innovation are helping us to answer for the upliftment of society. Engineering students of our institution undertook a 6-month-long project and addressed the issues faced by people from marginalized economic backgrounds. The study included farmers,women, and diabetic patients. The students conducted a review of this population by undertaking a survey. The students developed low-cost and easily affordable products developed from Termite mounds such as biofertilizers, biocontrol, mosquito repellant, and natural face cream. Due to the introduction of this Project course into the curriculum of the university, there has been tremendous improvement in the livelihood of the study population. The products developed by the students were provided to the study population and it has shown improvement in the daily life of the study population. The initiatives taken by the students and their faculty mentors have helped to improve the factors in the fields of agriculture, health, and the environment. Thus, this project course can be applied by every engineering institution for the assistance of low-income clusters of rural societies.**

***Keywords*— Biofertilizer; community service project; mosquito repellent; natural face cream**

***JEET Category*—Practice**

I. INTRODUCTION

The progressions in science, innovation, and advancement have assumed an indispensable part in advancing engineering and technology education in our organization and elsewhere. Such projects have been incorporated into teaching learning process by Engineering education institutions in India and elsewhere [Tharakan,2012; Sharma *et. al.* 2018]. Local area administrations play a vital role in implementing socially relevant outcome-based community service projects [Kumari *et. al.* 2018; Oakes *et. al.* 2014]. Faculty of Engineering and Technology institutions assume a crucial part in tutoring the students to participate [Adi *et. al.* 2017] with a plan-based reasoning methodology [Irfan *et. al.* 2018]. Such outcome-based community service projects have been executed in the educational programs of the main instruction establishments as a part of the actual B. Tech. program [Hinds *et. al.* 2020] for tending to the various requirements of the rural people [Kulkarni, 2016]. Numerous projects have been implemented worldwide by Engineering education institutions through local area administration to address the issues faced by farmers andagriculture practitioners [Paz *et. al.* 2013, Sarkar and Uddin, 2013; Trisurat, 2006; Arcilla and Ocampo, 2011; Lukuyu *et. al.* 2019]. We have addressed issues faced by the rural men, women, and in particular farmers residing in the neighborhood of Kalasalingam Academy of Research and Education (KARE). Number, average income per annum per hectare, type of crops cultivated, type of agro-climatic condition, type of soil, deficiencies in soil, water management, fertilizers used, cost of cultivation per hectare, yield, type of biofertilizers needed, side effects due to pests and problems faced in marketing are the key factors determining the success rate of farmers of Virudhunagar district. We applied scientific and technological principles to provide practical solutions to difficulties confronting the rural residents of Virudhunagar District, located near KARE. The current methodology used in several poor and impoverished nations is predominantly classroom or laboratory-based learning, with no opportunity for pupils to experiment with real-world or real-life concerns and difficulties. The fundamental disadvantage of traditional teaching pedagogies is that students are deprived of building personally relevant skill projects and are only exposed to basic subject information. The information on the collection tool used by the students to identify the problem, the use of service projects to discuss and create acceptable prototypes, and lastly field testing of the prototypes are described by us. This ensures that students receive increased learning by participating in community service projects while meeting the qualities established by the National Board of Accreditation in India and the Accreditation Board of Engineering and Technology in the United States to ensure the quality of engineering education. Our research project work addresses the issue of achieving transformational education through community service projects, with the goal of assisting institutions in replicating the process in order to develop new scenarios more appropriate to local societal problems and to look beyond conventional teaching strategies such as classroom discussion, laboratory studies, audios, and videos. The primary goal of this paper is to illustrate the successof the service-learning program and its implications for giving a reasonable solution to challenges encountered in a rural districtof Southern India.

II. LITERATURE REVIEW

Project-based learning is energized by accreditation bodies like the National Board of Accreditation (India) and the Accreditation Board for Engineering and Technology (USA) [Patange *et. al.* 2019]. Numerous instances of prototype models and products created by the students of Engineering and Technology as a result of socially relevant outcome-based projects has become a benefit of low-income group of people

[Sharanya *et. al.* 2018,Orsak *et. al.* 2019,Mey *et. al.* 2018]. The significant parts of local area-based ventures such as socially relevant outcome-based projects include the positive reliance among the partners (students, local body institutions, and beneficiaries), and up close and personal association with local area individuals [Ahrumugam, 2015]. The maintainability of such socially relevant outcome-based projects has been tried by numerous organizations [Sy, 2013; Young and Goodman, 2015]. Hence, socially relevant outcome-based projects give sufficient freedom to students to acquire initiatives and complete group-based project learning and give manageable solutions for the genuine issues confronted the rural men and women [Tan, 2010]. Numerous socially helpful products have been created by the students of KARE and delivered to the local area. Accreditation agencies all throughout the world value community project-based learning [Bewoor *et. al.* 2019]. Several times, prototype models and things produced by students have resulted in socially meaningful result-based companies that have aided rural people [Buch *et. al.* 2020]. Critical components of such community-based programmes, for example, include socially relevant outcome-based activities that have incorporated positive dependability among stakeholders (students, adjacent community associations, and rural folk) [Ahrumugam, 2015]. Various organizations have attempted to test the feasibility of such community service initiatives [Sy, 2011]. As a result, service-learning activities provide ample possibilities for students to complete venture-based community service learning and provide realistic solutions to the genuine difficulties encountered by rural people. KARE students created and distributed several socially beneficial prototypes to the community.

The KARE curriculum of 2018 for B.Tech graduates was created to develop scenarios targeted at addressing neighboring communities by providing solutions to real-time challenges. Educators [Arunajanani *et. al.* 2021] demonstrated the effective use of community service projects (CSPs) to offer prototype versions of robotic arms for amputees, sanitary napkins for rural women, natural bio-fertilizers, and zero energy low-cost refrigerators for local farmers. This highlights the ability of young brains to actively participate in generating solutions to local concerns while gaining the skills required by certification authorities. One of the most important aspects is to keep the students motivated and enthusiastic about failing and learning from mistakes. Throughout the study, characteristics such as student engagement in the project, need for the service, and student fear of local concerns were monitored. These variables may assist experiential learning and appear to provide practical features of innovationsthrough student interaction. The greater emphasis was placed on maintaining student engagement in the project and the student approach to local problems. Such community-based participation is now common in industrialized nations, and Anju Dahiya [Anju Dahiya, 2020] provided case studies on solid waste management in a locality in Haiti as a waste-to-energy service.

It is possible to conclude that community-based learning improves students' engineering abilities while they solve local real-world challenges. Such creative pedagogies would not only engage students actively but also develop the initial practical aspects of many relevant social challenges. The authors used socio-technical theoriesto help younger prospective researchers connect with real-world challenges and gain competence in areas other than academia, such as leadership, communication, and organization.

III METHODOLOGY

Community projects are hands-on learning approaches that combine learning and service while emphasizing student growth with social responsibility and delivering first-hand technical solutions to pressing local challenges through public participation. As previously said, the primary purpose of this service-based research learning is to execute community initiatives at the local level in the classroom setting. To create the projects, we employed a service-based learning methodological framework. On a micro level, the projects contain a wide range of data and approaches. The students rationally decided on the various options and came up with a solution based on the inputs and data supplied by the community student, thereby reinstating their technical knowledge. 6 months socially relevant outcome-based community project course was undertaken by the students of B. Tech. Biotechnology of KARE.

The community service project was designed as a socially relevant outcome-based project performed with the guidance of a faculty guide. The students met the individuals from the local area in the chosen rural area and completed the field visit. During the field visit, the students conducted the survey by asking relevant questions related to social well-being, financial, and problems related status of the individuals from the local villagers. Afterward, the students distinguished the study subjects such as women, men, and farmers. At that point, the students distinguished the needs and issues of the villagers. Afterward, the students incorporated scholarly skills for the distinguished need and issues of the villagers based on three components: educational plan, local area need, and revenue. The students were teamed up with the local area office i.e. village panchayath and village leaders. At that point, the students were given the task of developing products to address the problems faced by rural women, men, and farmers which is reasonable as far as science, innovation, and advancement. Afterwards, the students submitted a report based on the survey, need investigation review and proposed prototypes. The students planned and fostered the proposed prototype model through mentoring by faculty adviser. The community project progresses through the following nine stages: (i) survey analysis (ii) problem statement identification (iii), discussion with community beneficiaries (iv), acquisition of academic expertise (v), development of prototypes (vi), design and fabrication (vii), testing and evaluation (viii), implementation (ix), and result analysis (Fig.1).

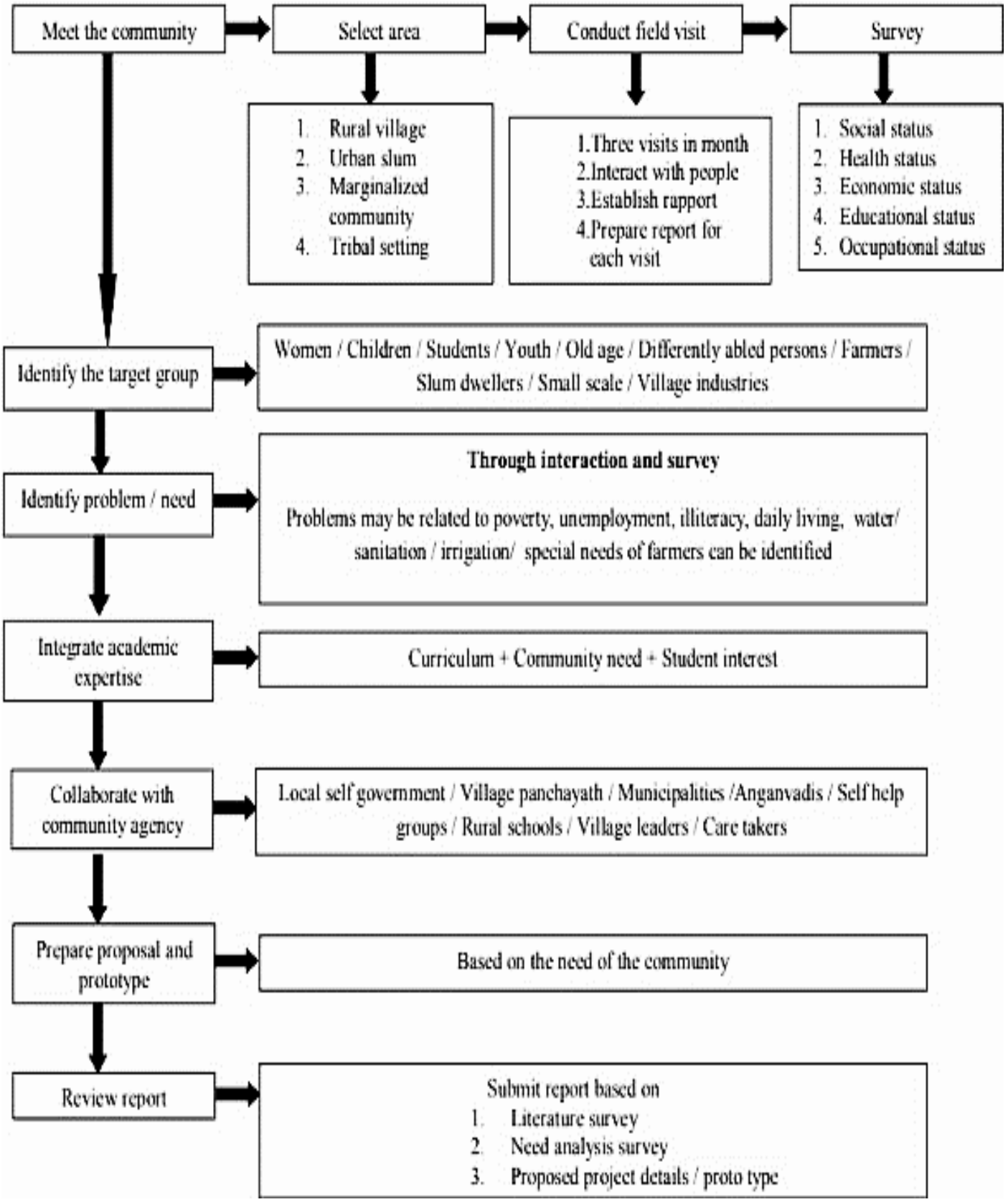

Fig. 1 The research methodology of the community service project

IV. RESULT AND DISCUSSION

A. Mosquito repellant for safeguarding health of low low-income group

A 6-month long project implemented by the students mentored by the faculty of Department of Biotechnology, KARE dealt with the development of low cost eco friendly mosquito repellant as shown in Fig.2. The students used readily available Peppermint oil, Camphor oil and Lemon oil mix with Termite saliva for the development of mosquito repellant which was distributed to ruralhouseholds (Fig.3). The students used Peppermint oil, Camphor oil and Lemon oil to make a 10% (V/V%) Termite saliva extract containing ethanol solutions. The students combined 0.3 ml of Peppermint oil, Camphor oil, and Lemon oil with 3 drops of Tween 80. Then, until the liquid reached 3 ml, ethanol was added. The students independently made a 20% (V/V%) extract comprising ethanol solutions utilizing Peppermint oil, Camphor oil, and Lemon oil. Peppermint oil, Camphor oil, and Lemon oil were combined with 0.6ml of Tween 80. The ethanol was then added until the volume reached 3ml.

Fig. 2 A low-cost eco-friendly mosquito repellant developed from termite mound saliva by the students

Fig. 3 A student distributing low-cost eco-friendly repellant to a rural women

B. Eco friendly biofertilizer using phosphate solubilizing bacteria from Termite mound

A project involving the development and distribution of eco-friendly fluorescent Pseudomonas-based biofertilizer (Fig.4) has proven to be successful among rural farmers (Fig.5). The students created a Termite mound suspension in order to isolate phosphate-solubilizing bacteria. 10 g of soil were suspended in 100 mL of sterile phosphate-buffered saline solution and shaken for 45 minutes at 190 rpm. On NBRIP agar plates, 100 microlitres of each dilution was added. NBRIP agar plates were incubated at 28°C for 6 days. Clear zones of solubilization encircling the colony allowed the detection of phosphate-solubilizing bacteria throughout this incubation. This project was implemented by a group of students studying B. Tech. Biotechnology in KARE (Fig.6).

Fig.4 A Student preparing eco-friendly biofertilizer

Fig. 5 Biofertilizer product developed by the students

Fig. 6 Students distributing biofertilizers to the farmers

C. Eco-friendly biofertilizer using nitrogen-fixing bacteria from Termite mound

A project involving the development and distribution of eco-friendly Rhizobium-based biofertilizer (Fig.7) has proven to be successful among rural farmers. The inoculator device was soaked in ethanol, flame-sterilized, placed in the microtiter plate wells, and gently rocked by the students to crush the nodules. Individual nodules that were missed by the device were smashed with a flame-sterilized aluminum rod. The crusher device was then dipped into the wells and the students-streaked droplets of bacterial suspension onto a YM agar plate. The transfers were then repeated onto plates containing the indicator Congo red dye. This project was implemented by a student studying B. Tech. Biotechnology in KARE (Fig.8).

Fig. 7 Biofertilizer product developed by the students

Fig. 8 A Student distributing biofertilizers to a farmer

Fig. 9 Termite mound saliva face cream product developed by thestudents

Fig. 10 A Student distributing face cream to a beneficiary

D. Termite mound saliva for face cream

Traditionally, Termite mounds are used for skin disease, because several actinobacterial, and actinomyces expressed in extracellular metabolite in the termite soil act as controlling skin disorder, and including the combination with Kasturi turmeric benefits. Kasturi turmeric may be used as an antioxidant and may deactivate the free radicals (harmful molecules present in the body) and protect the body from various damages. It may reduce inflammation, inhibit cancer-causing cells, and lower blood glucose levels. This project was implemented by a student studying B. Tech. and Ph.D. Biotechnology (Fig.9, Fig.10).

V. CONCLUSION

Socially relevant outcome-based projects done by B. Tech. Biotechnology students of KARE assume a fundamental part in the upliftment of the well-being of the people affected by vector borne diseases like Dengue, Chikungunya and Malaria. Numerous Engineering and Technology institutions have implemented community-based projects as a way for addressing the issues faced by common rural folk with the assistance of progressions made in science and innovation. The innovation utilized by the students of KARE helped for development of products.

In a nation like India, horticulture and agriculture frames the foundation of the economy. Consequently, farmers assume an essential part in the everyday monetary possibilities of the country. Farmers deal with various issues like dry spell, bugs, pesticides. Students of B. Tech. Biotechnology students of KARE have created products like biofertilizer to address the above issues. Due to this initiative, enormous cost was saved due to biofertilizers. Method of manufacturing bio-fertilizers, raw materials required for this, rate of application per hectare, validation of production process were taught to the farmers by the students.

The principal challenge of executing any socially relevant outcome-based project is in supporting the eagerness of students to work past the term of the project to accomplish a definitive objective of creating products/ prototypes / processes that will assist to the various necessities of the rural folk like wellbeing, agriculture, water supply and strong waste administration. This was accomplished in KARE by creating sympathy in the minds of B. Tech. Biotechnology students for the rural folk. Thus, it is suggested that all the Engineering and Technology institutions to make inroads in their under graduate curriculum to include socially relevant outcome based projects.

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