

The Journey of Engineering Service-Learning: Preparing an Engineering Student with 21st century Skills

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Abstract — Service-learning is a credit-bearing educational experience which students learn and gain both hard and soft skill sets while participating in an organized service activity [1]. Since 2010, service-learning has been rolled out in The Hong Kong Polytechnic University. Among various nature of service-learning projects, engineering-based projects have embodied their importance through bringing tangible impact to communities with engineering solution as many developing communities are lacking in basic access to necessities and infrastructures [2]. Along with community impact, engineering service-learning also provides positive outcomes to students [2]. Thus, engineering-based projects have been one of the school's main implementations.

The 21st century has a huge leap in growth and development of technology and hence the 21st century skills are identified and emphasized for student in order to well adapt and prepare for their future career and life success [3]. Table 1 shown the common qualities included in the studies 21st century skills.

21 st Century Skills	Ability
Academic Learning	To apply STEM knowledge in engineering design to fulfill needs within realistic constraints
Creativity and Innovation	To understand and design the impact of engineering solutions in a global and societal context
Critical Thinking and Problem Solving	To identify, formulate, and solve engineering problems
Communication	To communicate effectively
Multidisciplinary Collaboration	To function on multidiscipline teams
Effective Use of Technology	To use engineering techniques, skills, and tools necessary for practice
Career and Life Skills	To engage in life-long learning
Cultural Awareness	To understand cross-cultural and global issue
Ethical Responsibility	To understand professional and ethical responsibility

It is observed that discipline-based training could only partly equip students with 21st-century skills. Therefore, different pedagogical elements, such as internship or exchange programme, are integrated into higher education. However, through my personal experience, I believe the engineering service-learning programme would be an effective and unique component, particularly in the areas of

multidisciplinary collaboration, cultural awareness, critical thinking and problem solving, and ethical responsibility.

In this abstract, I will use my personal experience to explain how engineering service-learning impact on students positively, leading to SDG#4 Quality Education.

Phase 1: Service-Learning Course

I have joined a structured service-learning course in 2018. While it is an engineering service-learning project, the team constitutes students from different faculty instead of pure engineering students. Being more expertise of our own academic area, new perspective and knowledge are constantly introduced by teammates during the solution development stage. Through this, I learned to **collaborate and communicate in a multi-disciplinary team**, which is commonly required in future workplace. During the on-site service, I also gained first-hand experience of interacting with local culture, which directly impact on my **culture awareness**.

Phase 2: Student as a Teaching Assistant

After completing my service-learning course, I took up the role as teaching assistant to provide guidance for the juniors in 2019. Throughout the process of delivering services to the community, I am constantly stimulated to reflect and react on my decision making and act as I will receive instant concrete feedback from the service environment and recipients. This helps to refine my **critical thinking and problem-solving skills**.

Phase 3: Student-initiated Project

After solving real world problems, I have gained a deep understanding of my **professional and ethical responsibility**. To connect my discipline knowledge to existing social issues, starting a student-initiated project will be the next step. As for me, continuous contribution is the key of civic responsibility.

Keywords—*engineering service-learning, quality education, 21st century skills*

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