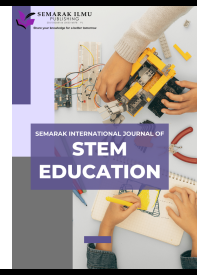




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# Work in Progress: Inculcating Empathy through Team-Based Problem Solving in Cooperative Problem Based Learning Classroom

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### ABSTRACT

The role of empathy as a major part of emotional intelligence is widely explored in engineering education research. Despite numbers of research on empathy development during classroom, the link between empathy and cooperative problem-based learning classroom are not highlighted. Thus, in this paper, an attempt of first step in covering this gap emphasis on the qualitative data of their reflective thinking towards their difficulties in solving the problem and seeking help. The right meaning of empathy in the context of team working is developed and conceptual framework based on social learning theory for future qualitative method was presented.

## 1. Introduction

Social competency is much needed in the emerging industry, which requires employee to manifest themselves in self-management and relationship management skills, both founded on emotional intelligence [1]. Prosocial behavior, empathy had been recognized as skill needed in engineering, regardless of non-human-centric field compared to medical, nursing, counseling and psychology fields [2,3]. In engineering education research, empathy was discussed through the perception of engineering students, faculty and practitioners [4] and pedagogical approach underpinning empathy enhancement among engineering students [5-7]. Our previous study focused on the characteristics of empathy in CPBL classroom using affective and cognitive empathy constructs by Davis [8].

However, empathy was not yet explored in the perspective of behaviorism which was proposed by Bandura's social learning empathy [9] which involves social interaction. In social interaction, team

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working plays a big role in the development of empathy as CPBL introduces face-to-face positive interaction using as one of Cooperative Learning's pillars. Luca and Tarricone [10] explored five emotional and social skills in emotional intelligence: self-awareness, self-regulation, motivation, empathy and social skills that make successful teamwork [10]. This behaviorism empathy would be fully objective and observable in this study.

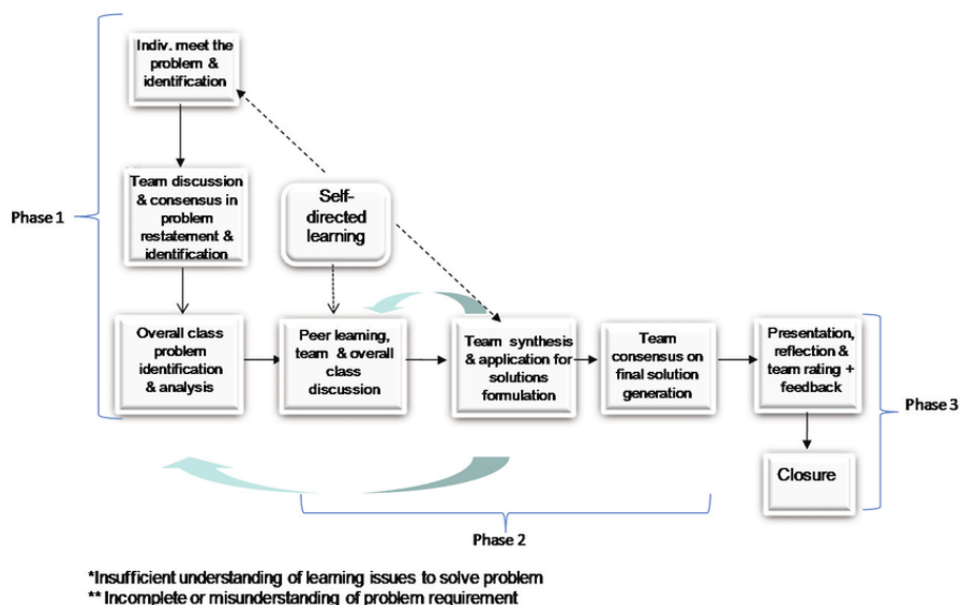
This study explored the possibility of developing empathy in Cooperative Problem Based Learning (CPBL) classroom through promotive interaction using social learning theory. This study was conducted on 38 engineering students enrolled in the Process Control and Instrumentation course during Semester 2 of 2019/2020 academic session.

### *1.1 Cooperative Problem Based Learning (CPBL)*

In Universiti Teknologi Malaysia (UTM), the Process Control and Instrumentation course was embedded in the chemical engineering programme and use Cooperative Problem Based Learning (CPBL) approach, aiming to instill skills and knowledge to be an engineer by solving the problem based on cooperative learning [11]. The course consists of a short project on overview of engineering, basic engineering calculation, engineering ethic and 3-stages case study on real problem regarding process control and instrumentation syllabus. The students went through all the contents in the designed homogenous team, especially in the main 3-stages case study project.

The CPBL was implemented in three phases. In Phase 1 of CPBL, students need to do problem restatement and problem identification from the given case study problem. Students need to restate the core problem to be solved, while identifying their current knowledge and information, necessary information, and subject matter to learn in order to solve the problem. In Phase 2, understanding the knowledge or concept took place through self-directed learning. Peer teaching in the team and overall classroom are conducted to close their knowledge gap identified learning issues in Phase 1. Students prepare their notes individually and have a discussion in the team to improve the notes to be more critical and solve the misunderstanding concept. In the classroom, students will have an overall class discussion to get a mutual understanding of the concepts. For students to learn correctly, students are guided through the learning process by providing the potential resources, reading guide, and reviewing their notes and understanding in overall class discussion. They should have a clear understanding to solve the problem of the case study. From their understanding, they start to work on the solution by applying the knowledge or concepts learned. In Phase 3, the outcomes of the problem are presented in the oral and report form. Students reflected on their learning process and skill and personal development by writing reflection journals. In-class discussion is conducted for the closure on teamworking, knowledge learned, and learning process.

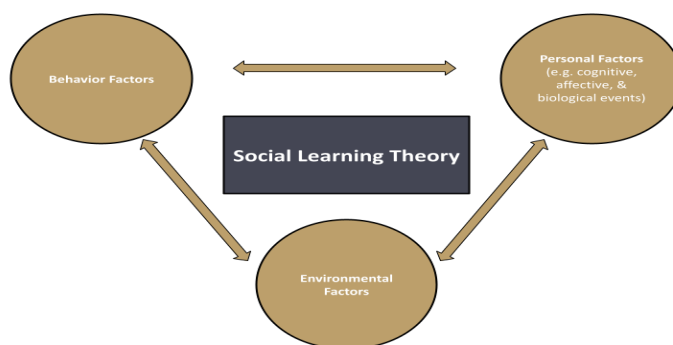
The CPBL cycle is designed with teaching and learning activities by employing five pillars of cooperative learning, namely individual accountability, promotive interdependence, face-to-face interaction, interpersonal skills, and regular group functioning [12].



**Fig. 1.** Cycle of Cooperative Problem Based Learning

### 1.2 Social Learning Theory in Understanding Empathy through Team-based Problem Solving

Bandura [13] developed social learning theory by combining elements of cognitive learning theory and behavioral learning theory [13]. Empathy which defined by Bandura suggested that people can cultivate their empathy capability through modeling and experiencing empathy from others [9]. According to social learning theory and specifically the concept of communities of practice [14], individuals are likely to make sense of emotional abilities and negotiate their meanings through participation in workplace social structures. It is through participation in these learning communities, particularly in joint problem solving, that opportunities are provided for experiential learning relating to emotional experiences, and these occur far more frequently in the workplace than in training programs.



**Fig. 2.** Framework of Social Learning Theory [13]

Face to face interaction, one of the pillars in cooperative learning has a close connection with social learning theory, where behavior factor and environmental factor could be connected by learning environment and learners' interaction through cooperative learning.

## 2. Method Development

A qualitative method research was employed in this study to achieve research objectives. Qualitative data was collected from their comments in their peer rating assessment along the 3-stages CPBL case studies. This study was conducted on 38 third year chemical engineering students enrolled in academic session of 2019/2020 for Process Control and Instrumentation course.

Team feedback was assigned at the end of every stage that the students encountered in CPBL class of Introduction to Engineering course. In this phase, students are able to reflect on themselves and their team by ranking their teammates performance and giving comments on them. Since CPBL was designed to emphasize and promoted the five cooperative learning principle [12], it encourages a collaborative rather than a competitive environment through the fifth principle, regular group function assessment [15].

From our previous study, data obtained from structured questions constructed in their peer evaluation form [16]. For this study, two questions were added in the peer evaluation form in purpose of analyzing emerging context of empathy through expressing one's difficulties and seeking help.

What are the difficulties that you faced in Stage 1? What kind of help do you need and how can you get it?

What are the difficulties your teammates faced? How can you help your teammates to overcome the difficulties?

Following this, interview sessions will be conducted for upcoming academic session referring to the preliminary data. The proposed conceptual framework will be used in constructing empathy instrument and enhancement of CPBL implementation purposing in instilling empathic capability among students undergoing CPBL.

## 4. Preliminary Result and Discussion

The data gained from students' comments were presented in this section as qualitative interpretation. The proper qualitative analysis did not employ yet, since we aim to see the connection between positive face-to-face interaction underlying cooperative learning and social learning theory for future progress.

The cooperative learning's pillar, face to face interaction is introduced in CPBL classroom by promoting substantial interaction in which students facilitate learning and contributions by each other [15]. Students were given spaces to seeks for help and giving support to team members to achieve their mutual goals through peer and team evaluation in every stages.

Student's comment from structured empathy's question shows team interaction:

"My teammates faced time constraints to attend meeting and complete the task. We fix meeting time by discussing and agreeing with one time. We avoid holding long hours meeting due to other subject tasks and we divide our work. We ask doubts to other member and discuss to solve." – Student A (Peer Assessment Stage 2)

"Initially they have problems with the linearization part were using the Taylor series and mainly in identifying the non-linear terms. I can help my teammates by having several discussions in explaining my understanding on the parts to them and finding for any videos that related to that topic and sent to them." – Student B (Peer Assessment Stage 3)

The activities and supports given in the class able to create learning environment for student in such a way enhance them to transform their team performance for a better team as they are cooperatively working together to perform the task. During completing the task in their team, activities and supports were designed to let them experience forms of recognition, social visibility, and respect as the foundation of empathy [17].

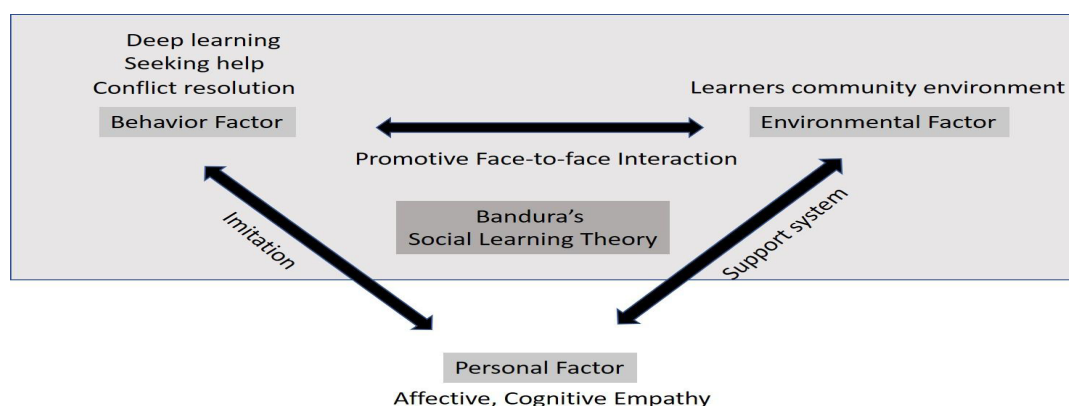
"I was so confused on how to do the mathematical modelling. I really don't know how to extract the information from the given diagram/sentences. Not only that, but I was also puzzled too when I was deriving the conservation balances. (mass balance, energy balance and component balance). I really needed help on how to derive the mathematical modelling because that is what case study 2a is all about. Luckily, my teammates were there for me to help to solve my problem."- Student C (Peer Assessment Stage 2).

Empathy in to develop in the CPBL classroom by learning environment involving these elements:

Conflict resolution – Giving problem with high level of difficulty do not only challenge their technical capability, but also their emotional resilience.

Helping behaviour – Peer assessment and team reflection promotes students to express their difficulties and theirs needs for others' support as well as recognizes others situation and providing helps.

Social Interdependence – Deep learning through peer teaching provides support and learning community to reach understanding.



**Fig. 3.** Conceptual Framework of Behaviorism Empathy through Promotive Face-to-face Interaction in CPBL classroom.

## 5. Summary and Future Work

The themes that could be relate in future data collection were constructed from the preliminary results. Grounded by the data obtained, possible themes to map to construct conceptual framework for strategizing CPBL implementation and data collection for future research progress. Ongoing and future work consists of further analyses and possible supports and instrument preparation for next cycle of data collection in upcoming academic session.

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