

***Team Based Learning of the Mercato Project to Nurture Criticism, Creativity and Problem Solving during Orientation Camp of ESC-KMUTT***

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**Abstract**

Team-based learning (TBL) is a learning practice supporting small group for powerful instructional effect. There are four essential elements of TBL including groups, accountability, feedback and assignment design. The objectives of this study were to use team based learning for instructing "The Mercato Project" and nurture soft skills such as criticism, creativity and problem solving to freshman students during orientation camp. The project was organized to nurture 70 new students of Engineering Science Classroom, King Mongkut's University of Technology Thonburi (ESC-KMUTT). They were divided into 2 rooms of different feedback teacher's team receiving the same team assignment. Data were collected form 34 questionnaires, 6 open-ended questions and model evaluation. The result showed the most of students agreed that Mercato activity made them learning substantially ( $4.41 \pm 0.58$ ), working as a part of Mercato team to be a valuable experience ( $4.41 \pm 0.69$ ) and working in team helped to learn better than working alone ( $4.41 \pm 0.81$ ). Quantitative analyses confirmed that although the construction of Mercato model was built differently, there was no significantly difference of overall student TBL self-evaluation by using independent sample t-test ( $p < 0.05$ ). In addition, we also found that they used criticism, creativity and problem solving much more during working in Mercato team. In conclusion, the Mercato project was accomplished using TBL to expose students and help them improve their soft skills for applying course content during orientation camp.

Keywords: Creativity, Criticism, Problem solving, Team based learning (TBL)

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## **Introduction**

ESC-KMUTT's students batch number 10 were recruited to attend an orientation camp before enrolled the academic year of 2017. Many soft skills were nurtured to our students during the camp including critical thinking, creative thinking, visual thinking, problem solving and teamwork skill. The main hands-on project during this camp was called "The Mercato" which aim to create a model of innovative market center. The last 3 days of orientation camp, students need to apply their contents and soft skills to construct the mercato model. Therefore, the objectives of this study were to use team based learning for instructing "The Mercato Project" and nurture soft skills such as criticism, creativity and problem solving to freshman students during orientation camp.

Team-based learning (TBL) is a learning practice supporting small group (5-7 members) for powerful instructional effect. There are four essential elements of TBL including groups, accountability, feedback and assignment design. Group require time to cultivate into high-performance team because enough time helps developing cohesive to grow into self-managed and actually effective learning teams (Michaelsen & Sweet, 2008). The task of members to teams is essential for this use of TBL. Students' capability in some characteristics should be spread throughout the small groups. The instructor should plan the composition of the teams with this in mind instead of letting students to basically self-assign themselves to groups (McMahon, 2010). The constructing of good problems is one of the keys to achieve in team-based learning. Problem solving skills were developed by increasing difficulty into problems or inputting serial problems which could not solve individually. TBL makes chances to develop these skills supported by the frequent feedback from their coworkers and the teacher (Sibley & Parmelee, 2007). A first time of TBL was implemented to medical education since late 1990s (McMahon, 2010). Later on, TBL was applied in many fields. For Science, TBL with challenging projects enhanced the undergraduate students' comprehension and long term retention, critical thinking, creativity and attitudes about the Microbial Physiology course and concentrated student-instructor collaborations on learning rather than grades (McInerney & Fink, 2003). For Engineering, First-Year Engineering Projects (FYEP) course at the University of Colorado at Boulder was introduced to freshman which is the design/build hands-on process in a team-based setting, supported by experimental testing. It was indicated that the engineering students were significantly more likely to be retained at the third, fifth, and seventh semesters than their peers who did not join the FYEP (Knight, Carlson, & Sullivan, 2003, 2007).

## **Methods**

### **1. Participants**

The project was organized to nurture 70 new students of Engineering Science Classroom, King Mongkut's University of Technology Thonburi (ESC-KMUTT). The students were divided into 2 rooms which the activities were run parallel by different feedback teacher's teams.

## 2. Learning process

Each room had 2 groups of students received different assignments, A and B. One group composed of 3 small teams containing 5-6 members. Team coding used “1A1, 1A2, 1A3” that 1A1 stands for room1, assignment A and team 1. The main assignments were given to group 1A, 1B and 2A, 2B and assignments were defined to the concept of “The Mercato”. During the orientation camp, there were also another activities including “Ask is Free”, “Teamwork Concept Learning” and “Da’Vinci Bridge” provided with knowledge of critical thinking, teamwork skill and creative thinking. Then, field trip activity was designed to let them exploring the real market atmosphere at Amphawa floating market, seeing the architecture of Buddhist temple at Wat Bang Kung, in Samut Songkhram province, Thailand. After came back from the field trip, the students in each group had to the design and sketching under their main assignments. When the sketching was done, the students had to present it to the teacher team. Until the draft was approved by the teacher, then the model could be made. At this step, 3 small teams working separately to build the city in their parts. Finally, 3 parts of the model were assembled and the prototype was completed.

### Assignment A:

One day morning, a small boat arrived at the port of the city of world trade center, Mercato, the city where various cultures have met. A young artist sailed along all the night because he wish to see how beautiful Mercato is. In Mercato, there is a famous fountain where is the meeting point of the teenager from everywhere. There is sacred place nearby where many people come to worship and pray. Although time has passed, Mercato has changed little at a time, this sacred place is still the same. After the young artist go ashore from his boat, he walked around, bought some local sweet, found a small lovely bouquet used as a brooch and pinned on the shirt, and wrote the poetry in his mind. Among the crowd, he met his friend who was a merchant coming from the northern city. He friend was unloading the precious cargo of which came from the deep sea and the North Pole, including the fresh food which was due to the modern train, which allowed for a shorter transportation time, as if the northern city was close to this market. The village in the northern city was composed of the Mediterranean architecture and design, while the cathedral's castles were built in Ottoman style. It was such a cold and colorful territory. While he was talking to the merchant, he saw a beautiful young woman walking in a beautiful cotton dress. She would have come from a famous and largest cotton-cloth production village where was surrounded by cotton plantations and wheat fields. In the center of northern territorial, there was an ancient 800-year-old castle, the current owner of this castle descended directly to the Lord who was famous in the battle with the giant dragon in the Middle Ages. People were still using the carriage for most of their transportation, even if there were cars. On a journey by carriage from the village to Mercato had to enter the tunnels of several high mountain. There were many famous waterfalls where the young artist used to paint the landscape but he had never been visited to the village of Spinning. Just like he had never seen this beautiful girl before. It attracted him to want to go there once. He imagined that if he had known and intimately acquainted with this beautiful girl. He wanted to take her by cruise to a nearby city of Mercato in the eastern. The eastern city was surrounded by the sea but there was a large road connecting Mercato to this city. This city was amazing because many canals were cut through. It seemed to be complicated but it was well organized. The

bridge across of each canal had a legendary love inscribed. If he go cruising and singing to her, it would be great. The city landmark was a very steep tower. If you went up that tower in the evening, you would see the sun shining through Mercato on the horizon. The hot color of water surface in the canal gave the canal network a more beautiful appearance. There were many wealthy men in this city so the city was filled with luxurious mansions and modern architects. We could say that Mercato was flourishing by the purchasing power of people in this eastern city. Before that beautiful woman would walk away, the young artist thought that he should follow her and introduce himself to her.

#### Assignment B:

In the early Sunday morning, “May” a little girl who travelled from the far away city ride on the overnight train to the port city named Mercato. Along the way going to this city, May could see the scenery through the train’s window such as the fisherman on the boat seeking for fish, squid, and shrimp. Then she saw the mountain and the green forest, the field covered with the yellow of the ear of paddy, many villages located along the railway. Finally, she had arrived at the terminal station which was the center of this city’s transportation. After May got off from the train with many travelers, she saw many merchants selling various foods and goods at the platform. Then she walked around and found the local market aside the old railway which was built across the main river. On the other bank of the river, there was a large temple where the large status of Buddha located. The Buddha status was created in the Sukhothai period and the pose is the attitude of persuading the relatives not to quarrel. We could see this Buddha status from everywhere in Mercato. May was fascinated with this city because the market was opened since 5 am till midnight and had various goods came from far and wide for supplying of million residents of this city. In addition, the market also sold the local products for the travelers. While May was shopping at the market, a group of travelers had approached to her asking the way to the palace, museum, temple and ancient remains. So May suggested them buying one-day trip package for travelling around the city guide by the local people and going by boat and tricycle. After that, May planned to visit her relatives by getting on a ferry boat to a large-sized village located along the river. This main river was the heart of Mercato. The agriculture was the way of life of citizen in Mercato, we could found the cultivated areas wherever, including low land, highland, and on the mountain. May walked through the folk arts and crafts center, met the villager were making the handicraft from local materials. May felt curious about what was the product that they were making, so she asked the villager. The villager smiled happily and answered her “It was the unique good which you could only buy here, in Mercato”.

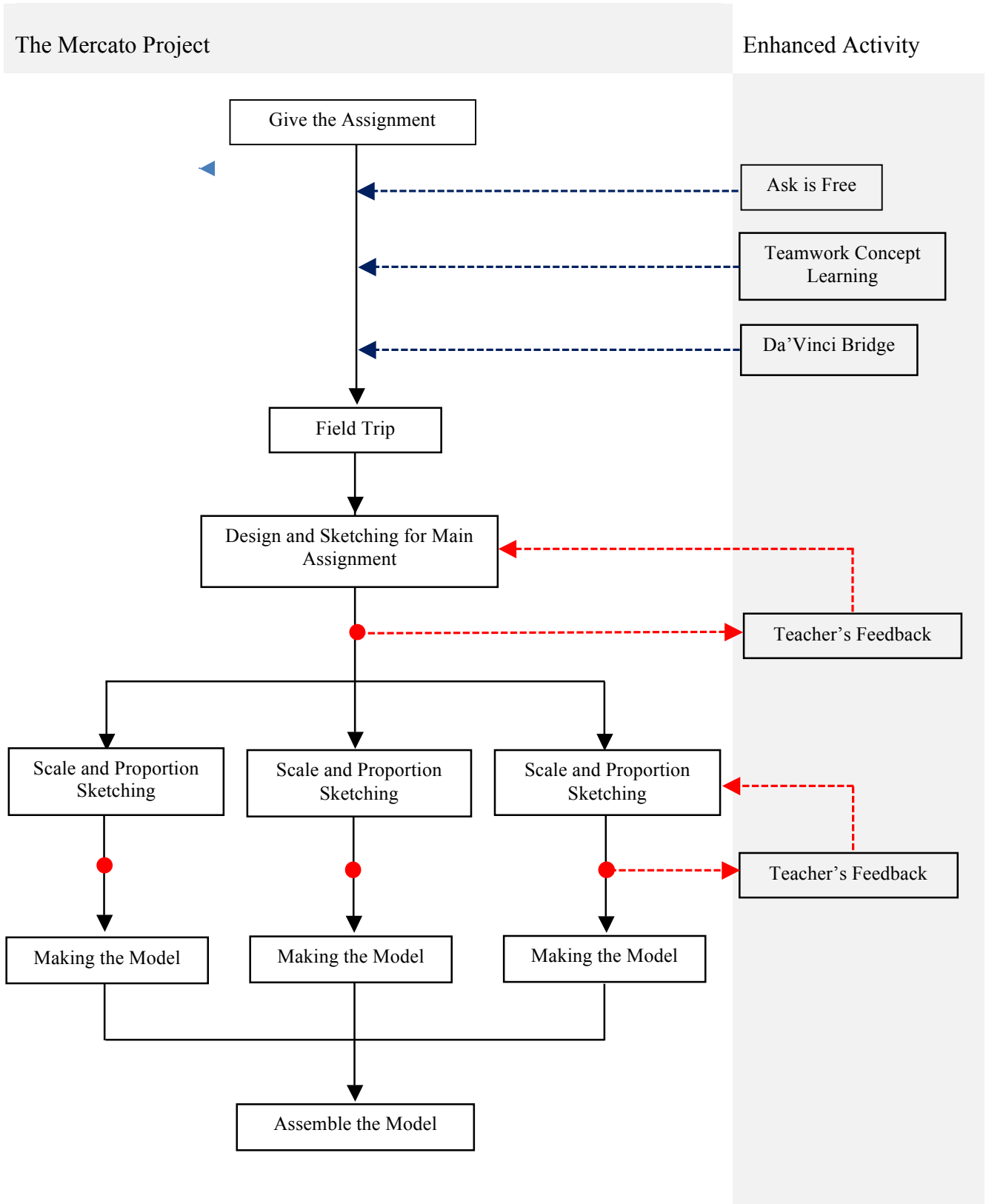


Figure 1: Schematic shows the learning process diagram of the Mercato Project.

### 3. Data collection procedures

Data were collected from 34 questionnaires using a 5-point Likert scale of TBL self-evaluation (Gibbs, 1994; Griffith University, 2011; Gallegos & Peeters, 2011), 6 open-ended questions (Gibbs, 1994; Griffith University, 2011) and model evaluation.

### 4. Data analysis

Data from the students were collected from the 70 ESC students in Mercato activity. The study wanted to compare the mean between two groups of 34 items. The statistical analysis was done using an independent sample t-test ( $p < 0.05$ ).

## Results and discussion

### 1. Model evaluation

The models of group 1A, 1B, 2A and 2B were created in a three-day duration but we found that the models of the students in room 1 were changed a lot when compared to the first-day design. The students in room 1 faced the problems about changing their idea at the last minute during the second day while the students in room 2 followed their initial idea. Therefore, room 2 models were complete and more detailed than room 1. Model 2B was the most beautiful and high creativity.

#### Room 1



Assignment A

Assignment B

## Room 2



Assignment A



Assignment B

Figure 2: Mercato Models from the two assignments.

### 2. TBL self-evaluation questionnaire

The result showed the most of students agreed that Mercato activity made them learning substantially ( $4.41 \pm 0.58$ ), working as a part of Mercato team to be a valuable experience ( $4.41 \pm 0.69$ ) and working in team helped to learn better than working alone ( $4.41 \pm 0.81$ ). In addition, we also found that they used criticism, creativity and problem solving much more during working in Mercato team. The mean score of group A and group B students' TBL self-evaluation were compared using independent sample t-test. Data was shown in table 2.

**Table 2:** The results of TBL self-evaluation in term of total mean score, standard deviation and p-value of independent sample t-test between group A and group B.

| Items  | T-test<br>p-value | Group A<br>mean $\pm$ SD | Group B<br>mean $\pm$ SD |
|--|-------------------|--------------------------|--------------------------|
| 1. After finished with the Mercato workpiece, I have found that I have learnt more about how to plan many tasks well.  | 0.088             | 4.26 $\pm$ 0.61          | 3.97 $\pm$ 0.76          |
| 2. I have found that this activity made me learning substantially.   | 0.457             | 4.46 $\pm$ 0.51          | 4.35 $\pm$ 0.65          |
| 3. I have found that the activity did not too difficult to manage but I have learnt a lot from itself.   | 0.659             | 4.03 $\pm$ 0.86          | 3.94 $\pm$ 0.78          |
| 4. I have realized the links in all of the Mercato's activities which have run from the assignment, the field observing, the 3 people group's task, the 6 people group's task, the 18 people group's task, the drawing and the modeling. | 0.868             | 3.80 $\pm$ 0.96          | 3.76 $\pm$ 0.78          |
| 5. I have found that being part of a team improves my problem solving skill.   | 0.665             | 4.26 $\pm$ 0.89          | 4.18 $\pm$ 0.63          |
| 6. Being part of a team discussion has improved my ability to think through a problem.   | 0.9               | 4.23 $\pm$ 0.77          | 4.21 $\pm$ 0.73          |
| 7. In most of the teams I have been on, the team has made good decisions and worked well together.   | 0.973             | 4.23 $\pm$ 0.84          | 4.24 $\pm$ 0.82          |

|  |       |           |           |
|--|-------|-----------|-----------|
| 8. The team experiments with different ways of doing things and is creative in its approach. | 0.87  | 4.18±0.58 | 4.15±0.67 |
| 9. I feel that team-based learning has improved my critical thinking skill.                  | 0.127 | 4.37±0.65 | 4.09±0.87 |
| 10. I have found that working as teams always make good decisions.                           | 0.529 | 3.86±0.77 | 3.74±0.83 |
| 11. I have found that teacher's comments was valuable for every step of working process.     | 0.153 | 4.17±1.01 | 4.47±0.66 |
| 10. I think the duration for doing Mercato was suitable.                                     | 0.684 | 3.20±1.13 | 3.09±1.14 |
| 12. I have found that I loved working with a team.   | 0.783 | 3.97±0.98 | 3.91±0.79 |
| 13. I have found that I had a foundness for Mercato workpiece.                               | 0.994 | 3.94±1.06 | 3.94±0.81 |
| 14. have found that working with a team has helped me develop leadership skills.             | 0.076 | 3.43±0.74 | 3.09±0.83 |

| Items  | T-test p-value | Group A Mean | Group B Mean |
|--|----------------|--------------|--------------|
| 15. The leadership roles were shared by all of the team members.   | 0.384          | 2.91±0.92    | 3.12±1.01    |
| 16. If there is an activity that working in a team like this, I will be happy to participate in.         | 0.365          | 3.94±0.87    | 3.76±0.74    |
| 17. I felt very impressive in the team members.  | 0.424          | 3.89±0.99    | 4.06±0.78    |
| 18. I have found that I have a high degree of trust in the team members.                                 | 0.63           | 3.94±0.68    | 4.03±0.80    |
| 19. The controversy has happened in my team.   | 0.848          | 3.49±1.01    | 3.53±0.86    |
| 20. Disagreements did not arouse defensive reactions such as projection, repression and rationalization. | 0.595          | 3.43±1.46    | 3.62±1.48    |
| 21. Member resources are fully recognised and utilised   | 0.58           | 3.74±0.95    | 3.62±0.92    |
| 22. Communications between members were opened and the team members participated in team.                | 0.673          | 3.66±0.97    | 3.56±0.96    |
| 23. The team members have actively listened to the other's opinions.                                     | 0.491          | 3.60±1.01    | 3.44±0.89    |
| 24. The team has well-established and agreed on approaches to problem solving and decision making        | 0.264          | 3.57±0.78    | 3.32±1.04    |
| 25. I have found working as part of a team in my classes to be a valuable experience.                    | 0.269          | 4.31±0.68    | 4.50±0.71    |
| 26. I have found that the other team members respected me.   | 0.212          | 3.86±0.81    | 3.59±0.96    |
| 27. I could show my ability in a team to achieve the success.  | 0.387          | 3.86±0.81    | 3.68±0.91    |
| 28. I have found that the team has worked well together.   | 0.074          | 4.06±0.64    | 3.76±0.70    |
| 29. I have found that team-based learning has more efficiency than learning alone.                       | 0.517          | 4.34±0.84    | 4.47±0.79    |
| 30. I have found that the team members could motivate me to work harder.                                 | 0.319          | 4.09±0.92    | 4.29±0.80    |

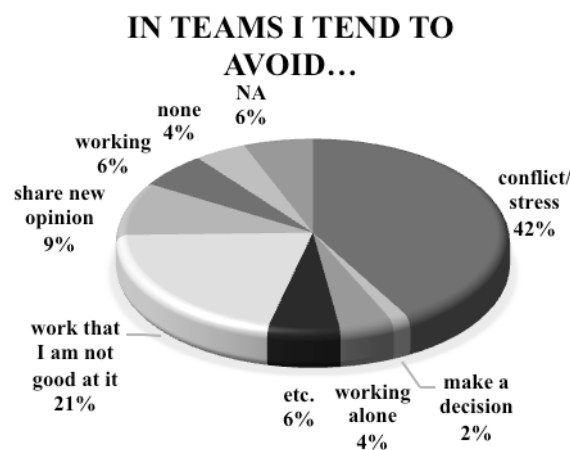
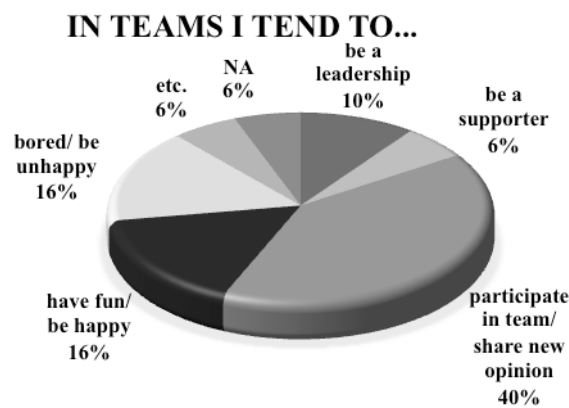


|   |       |           |           |
|---|-------|-----------|-----------|
| 31. I feel that the task's distribution in a team has been fair.  | 0.602 | 3.62±0.99 | 3.74±0.86 |
| 32. I have found that working with a team helps me develop skills in working with others.               | 0.848 | 4.38±0.60 | 4.41±0.66 |
| 33. I have found that working with a team has helped me develop more respect for the opinion of others. | 0.591 | 4.26±0.74 | 4.35±0.73 |

Quantitative analyses confirmed that although the construction of Mercato models between 2 groups were built differently, there was no significant difference of overall student TBL self-evaluation by using independent sample t-test ( $p < 0.05$ ). Statistical analysis indicated that we could control the standard of learning process and feedback process between 2 rooms which did not make the students feel different significantly.

### 3. Open-ended questions

From 6 open-ended questions, the results showed that in teams they tended to participate in team and shared new opinion (40%) but they tended to avoid conflict and stress (41%). They liked teams where all members participated in team (48%) but they didn't like teams where had the disagreement and conflict (48%). They would like to be in the united team (36%) and funny or happy team (29%). They would like their team to be a perfect team (43%) and good friend (25%). Finally, 67% of our students thought that they could be a good leader or supporter in their team while 30% of them thought that they could not be a good leader and supporter (N/A 3%).



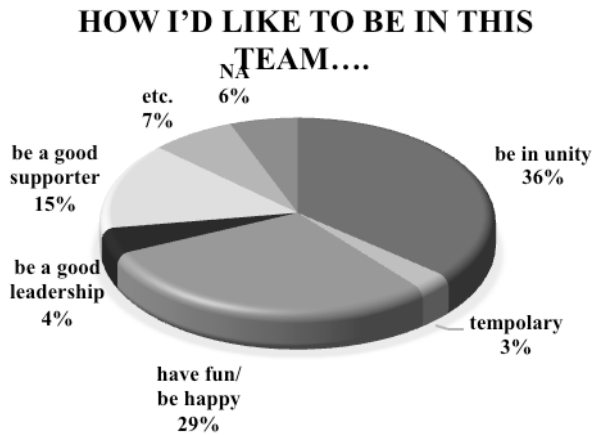
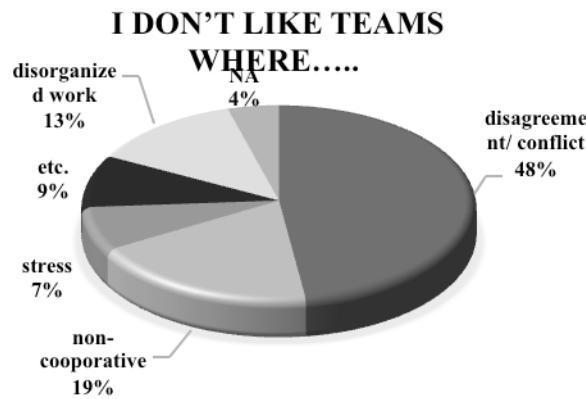
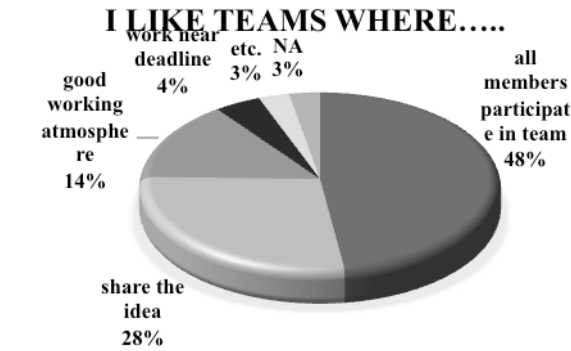


Figure 3: Percentage of the answers from 6 open-ended questions.

## **Conclusions**

The Mercato project was accomplished using TBL to expose students and help them improve their soft skills such as criticism, creativity and problem solving for applying course content during the orientation camp. Most of the students had the good attitudes toward the Mercato project which will help us easily to encourage more TBL projects with them during the 3 years long in our school. In contrast, some students still had poor attitudes toward team project such as felt boring and unhappy that we need to improve more instruction techniques to develop their attitudes. Further study need to follow up and measure TBL performance of the 10th batch of ESC-KMUTT students.

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