A STUDY ON THE ASSESSMENT OF REFLECTIVE JOURNAL BASED ON CAPSTONE DESIGN

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ABSTRACT

A reflective journal is a personal record of student's learning experiences. The aim of this research is to explore how the practice of critical reflection within a team-task activity process can be facilitated through the application of reflective processes and tools. The study subjects were 4th graders under molecular biology. They completed Capstone Design I in the first semester of the fourth grade and Capstone Design II in the second semester. In this study, we investigated how students' perceptions of reflection students changed with the passage of time. A distinction was drawn between reflection as a form of individual development (reflection-writing through team activities, the contribution as a team member, self-development and reflection, and role and activities in concrete ways and reflects action plans to develop oneself).

Keywords: Capstone Design, reflective journal, team-task activity.

INTRODUCTION

Reflection is an important skill to develop, and requires many people to think about how they personally are relating to what is happening on their course, during their assignment, or in their placement. Reflection has many facets. For example, reflecting on work enhances its meaning. Reflecting on experiences encourages insight and complex learning. A reflective journal is a means for learners to reflect on their learning and learning experiences in different ways such as collection of notes, observations, thoughts and other relevant materials built-up over a period of time.

Self-reflection's currency as a topic of educational importance has resulted in the incorporation of reflection journals as learning tools that promote reflection into many curricula, including PBL (Mann et al. 2009). Reflection journal contributes to enable students to critically review processes of their own learning and behaviours, and to understand their ability to transform their own learning strategies (Gleaves et al., 2008).

Reflective learning is a learned process that requires time and practice. It is also an active process: involving thinking through issues yourself, asking questions and seeking out relevant information to aid your understanding. The role of reflection in education has created an upsurge of interest amongst educators and researchers since Dewey's (1991) ground-breaking work, which emphasized the positive roles that reflection might play in fostering students' self-reflection, critical thinking, and in the demonstrable development of professional values or skills (Lew & Schmidt, 2011).

Teachers who promote reflective classrooms ensure that students are fully engaged in the process of making meaning. They organize instruction so that students are the producers, not just the consumers, of knowledge. To best guide children in the habits of reflection, these teachers approach their role as that of "facilitator of meaning making."

Reflective journal is a space where a learner can record and reflect upon their observations and responses to situations, which can then be used to explore and analyse ways of thinking. Journals, although generally written, can also contain images, drawings and other types of reference materials.

Reflective journals have been used widely in teacher education programs to promote reflective thinking (Sinclair & Woodward, 1997; Freidus, 1998). Reflective or learning journals are considered to be one of the most common strategies employed because of the practical utilization (Göker, 2016). The structure and format of reflective journals could include free stream-of-consciousness writing or a structured analysis of critical events. To promote reflective thinking in teaching, reflective journals are commonly used in research studies on different disciplines and teacher education (Bolton, 2010; Göker, 2006; Moon, 2006).

This study used the parameter of the 2018 reflective journal program to determine if there is an impact in students' reflection changes during Capstone Design I in the first semester of the fourth grade and Capstone Design II in the second semester for 4th graders under molecular biology at D University in B City, the Republic of Korea.

METHODOLOGY
Subjects
The study subjects were 4th graders under molecular biology. They completed Capstone Design I in the first semester of the fourth grade and Capstone Design II in the second semester. March and June fall into the first semester (Capstone Design I, semester I) and September and December fall into the second semester (Capstone Design II, semester II). In other words, they will carry out tasks for graduation over the course of one year. Since it is difficult to carry out the task alone, a team has been formed and carried out jointly. The supervisor intervenes to check the performance of the task and helps with difficulties such as providing the equipment and safety. At this time, students used the learning assessment tool to investigate their reflective journal.

Types of reflection
This study was conducted according to the development study method of Lee and Lim (2013). Their program outcomes were generated from the development study method of Van den Akker (1999) to study or develop curriculum, instructional design, intervention plan, program, and model in various fields of education.

Application of the reflection journal
This study was carried out in three stages as follows. First, we evaluated what (reflection-writing) they learned through team tasks (Table 1). In Lee and Lim's method (2013), we used the target with a slight modification to the task. Second, we evaluated the contribution as a team member. we evaluated the degree of self - development and reflection in the team activities (Table 2). Third, as a student, we assessed his/her ability to play the role of a member of a mixed interdisciplinary team (Table 3). Lastly, we assessed the ability of students to play the role of members of mixed interdisciplinary teams in three grades (Table 4). We modified Lee and Lim 's method (2013) by setting explicitly the achievement scale.

Table 1. The degree of reflection-writing through team activities

Score	Scoring criteria : Rubric
5	Be very clear about the tasks of the team and describe the experience and knowledge gained in the course of action very specifically.
4	Appreciate the experience and knowledge gained in the course of the course by clearly recognizing the team' tasks.
3	Recognize clearly the team's tasks and describe some of the experience and knowledge acquired during the course of the course.
2	Describe some of the experiences and knowledge acquired during the course of the project because they are not clearly aware of the team' tasks.
1	They do not clearly identify the team's tasks and do not describe their experience or knowledge at all.

Table 2. The degree of contribution as a team member

Score	Scoring criteria : Rubric
5	Be very clear about your role and responsibilities, and build a friendly relationship with your team members and describe your team initiative in a very specific way.
4	They clearly describe their roles and responsibilities, and establish friendly relationships with team members to adequately describe their team initiative.
3	Be clear about your role and responsibilities, and establish friendly relationships with team members to describe some of your team's initiative.
2	Describe the extent of team contribution without clearly knowing their roles and responsibilities and not forming friendly relationships with team members.
1	They do not clearly know their roles and responsibilities. They do not form friendly relationships with their team members and can not describe the extent of their contribution to the team.

Table 3. Self-development and reflection

Score	Scoring criteria : Rubric
5	Describe in detail the efforts of team members to clearly identify their deficiencies and to improve them.
4	Appreciate your deficiencies in your team activities and describe your efforts to improve them.
3	Describe in detail some of your efforts to improve your awareness of your shortcomings in team activities.
2	Describe some of your efforts to improve on your lack of awareness of your shortcomings in team activities.

1	I can not clearly identify my shortcomings in team activities and I can not describe my efforts to improve them.

Table 4. Analytic rubric of reflection journal

Score	Scoring criteria : Rubric
3	As a member of a complex interdisciplinary team, it clearly reflects its role and activities in concrete ways and reflects action plans to develop oneself.
2	As a member of a complex interdisciplinary team, I have expressed some of the ways in which I can comprehensively reflect on my roles and activities and develop myself.
1	As a member of a mixed interdisciplinary team, I can not express my own ability to reflect on my role and grow myself.

Research limitations
Students who did not complete the questionnaire or who did not submit a report, either a single item or no answer, were excluded from the analysis.

Statistical analyses
Statistical analysis of data is a key step in every scientific researches. Data were analyzed using the SPSS version 21 (SPSS Inc, Chicago, IL) statistical software package (IBM Corp, 2012). The results were submitted to an ANOVA with an F test, and when relevant, the Greenhouse-Geisser (1959) was used to assess the change in a continuous outcome with three observations across time or within-subjects. Means and standard deviations should be reported for each observation of the outcome with Greenhouse-Geisser corrections.

RESULTS
In this study, we investigated how students' perceptions of reflection students changed with the passage of time. The first question on the role of reflection was to describe how learning through the activities of the team's tasks helped me. Score 1 was that student do not clearly identify the team's tasks and do not describe their experience or knowledge at all. Their frequency was 28% in March, 20% in June, 12% in September and 0% in December (Fig. 1). Whereas, score 5 was very clear about the tasks of the team and describe the experience and knowledge gained in the course of action very specifically. Their frequency was 24% in March, 32% in June, 48% in September and 72% in December. Semester I and Semester II were statistically significant difference among five groups and total was a statistically significant difference between two semester groups ($p<0.01$) (Table 5).
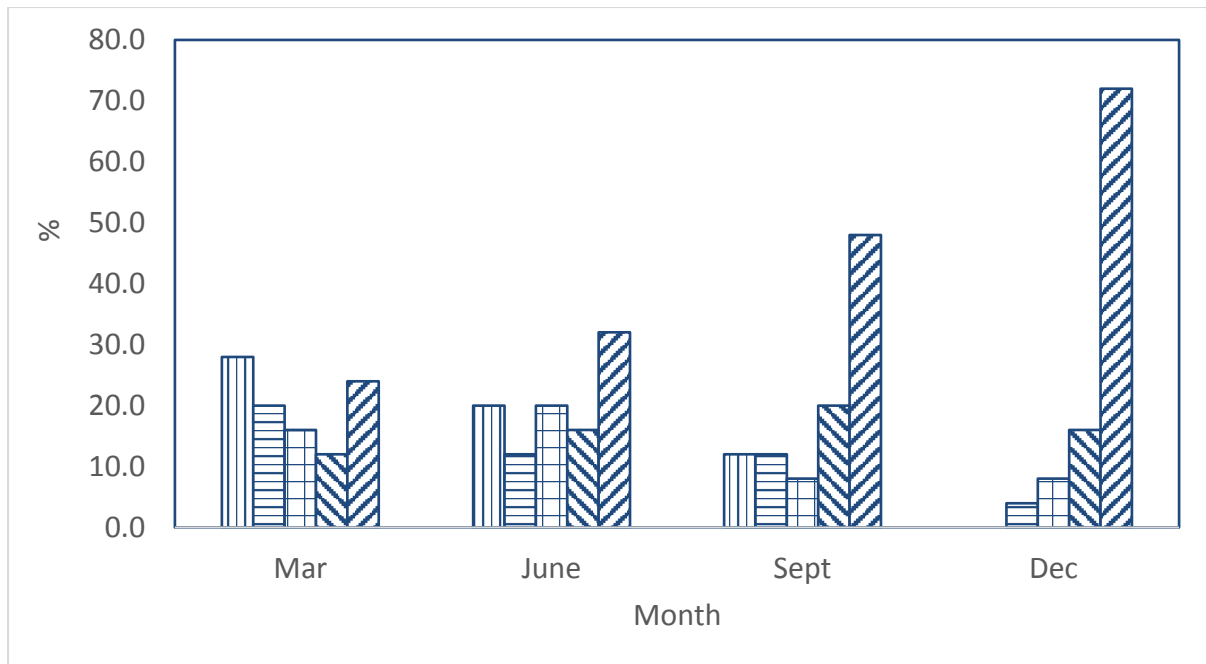
Figure 1. The frequencies (%) of five scores about reflection-writing through team activities and changes according to time for one year.
▥ : Score 1, ▤ : Score 2, ▦ : Score 3, ▧ : Score 4, ▨ : Score 5.

Figure 2 was shown the frequencies (%) of five scores about contribution as a team member and changes according to time for one year. They do not clearly know their roles and responsibilities. A student with a score of 1 did not clearly know his/her role and responsibilities and did not describe the contribution of the team at all. Their frequency was 24% in March, 16% in June, 12% in September and 4% in December. A student with a score of 5 was very clear about his/her role and responsibilities, and build a friendly relationship with his / her team members and describe his / her team initiative in a very specific way. Their frequency was 16% in March, 24% in June, 36% in September and 36% in December. Semester I and Semester II were statistically significant difference among five groups and total was a statistically significant difference between two semester groups ($p<0.01$) (Table 5).
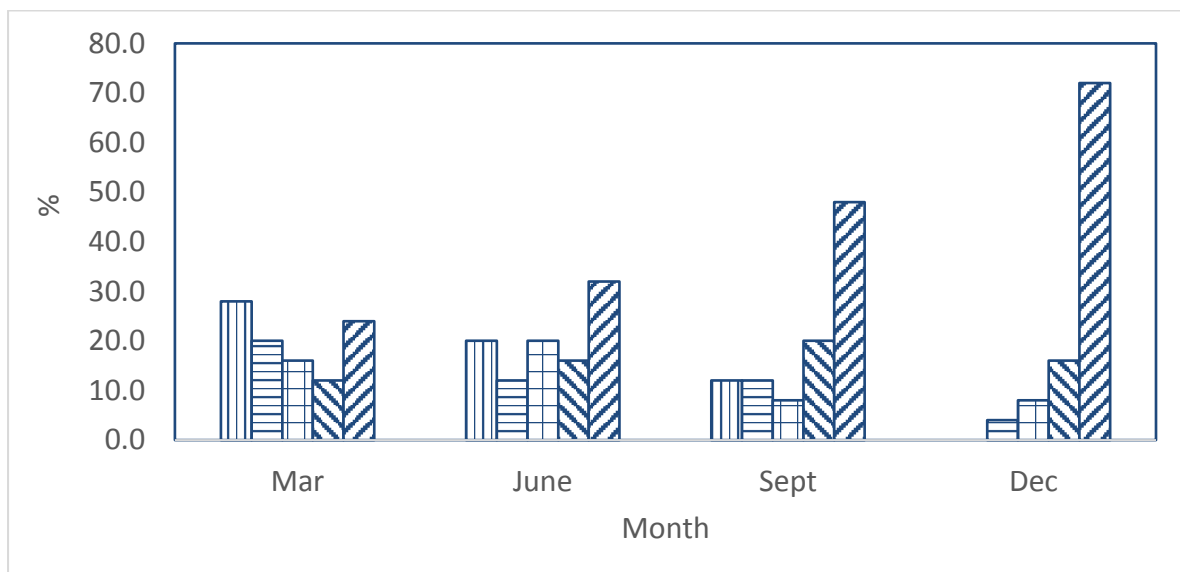

Figure 2. The frequencies (%) of five scores about contribution as a team member and changes according to time for one year. Symbols are same as Figure 1.

Figure 3 was shown the frequencies (%) of five scores about self-development and reflection and changes according to time for one year. A student with a score of 1 did not write clearly identify his / her shortcomings in team activities and could not describe my efforts to improve them. Their frequency was 32% in March, 28% in June, 24% in September and 16% in December. A student with a score of 5 described in detail the efforts of team members to clearly identify their deficiencies and to improve them. Their frequency was 12% in March, 12% in June, 16% in September and 32% in December. Semester I was a statistically non-significant difference ($p>0.05$) (Table 5). However, Semester II was a statistically significant difference among groups ($p<0.01$). total was a statistically significant difference between two semister groups ($p<0.01$).
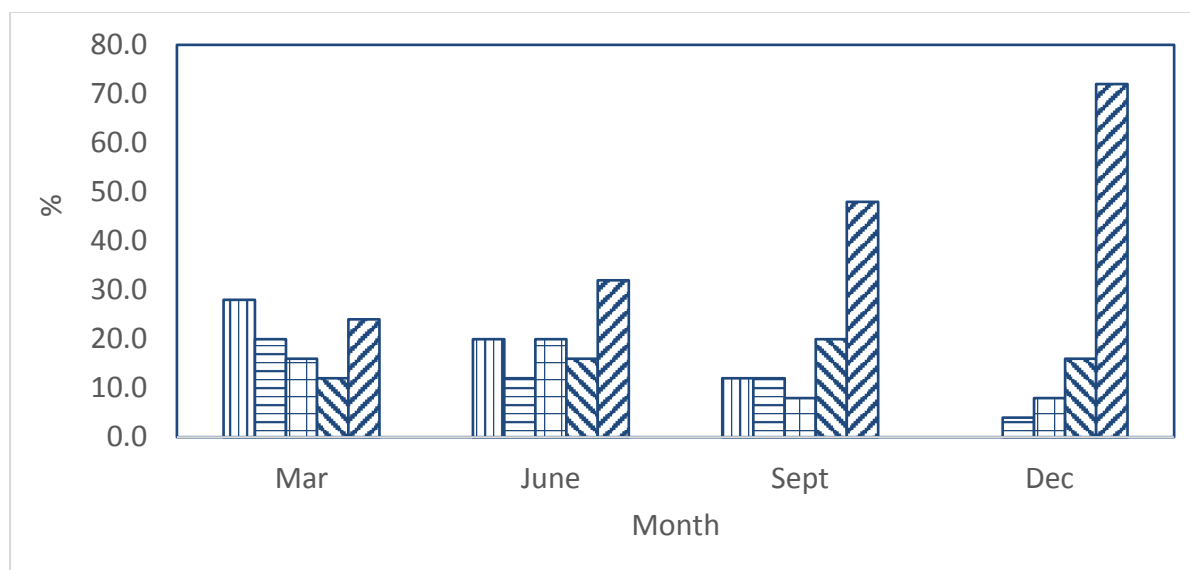

Figure 3. The frequencies (%) of five scores about self-development and reflection and changes according to time for one year. Symbols are same as Figure 1.

We assessed the ability of students to play the role of members of mixed interdisciplinary teams in three grades (Fig. 4). A student with a score of 1 can not express my own ability to reflect on her/his role and grow her/himself as a member of a mixed interdisciplinary team. Their frequency was 36% in March, 32% in June, 20% in September and 16% in December. A student with a score of 2 have expressed some of the ways in which she/he can comprehensively reflect on her/his roles and activities and develop her/himself as a member of a complex interdisciplinary team. Their frequency was 28% in March, 28% in June, 36% in September and 36% in December. A student with a score of 3 reflects clearly her/his role and activities in concrete ways and reflects action plans to develop oneself as a member of a complex interdisciplinary team. Their frequency was 36% in March, 40% in June, 44% in September and 48% in December. Semester I was a statistically non-significant difference ($p>0.05$) (Table 5). However, Semister II was a statistically significant difference among groups ($p<0.01$). total was a statistically significant difference between two semester groups ($p<0.01$).
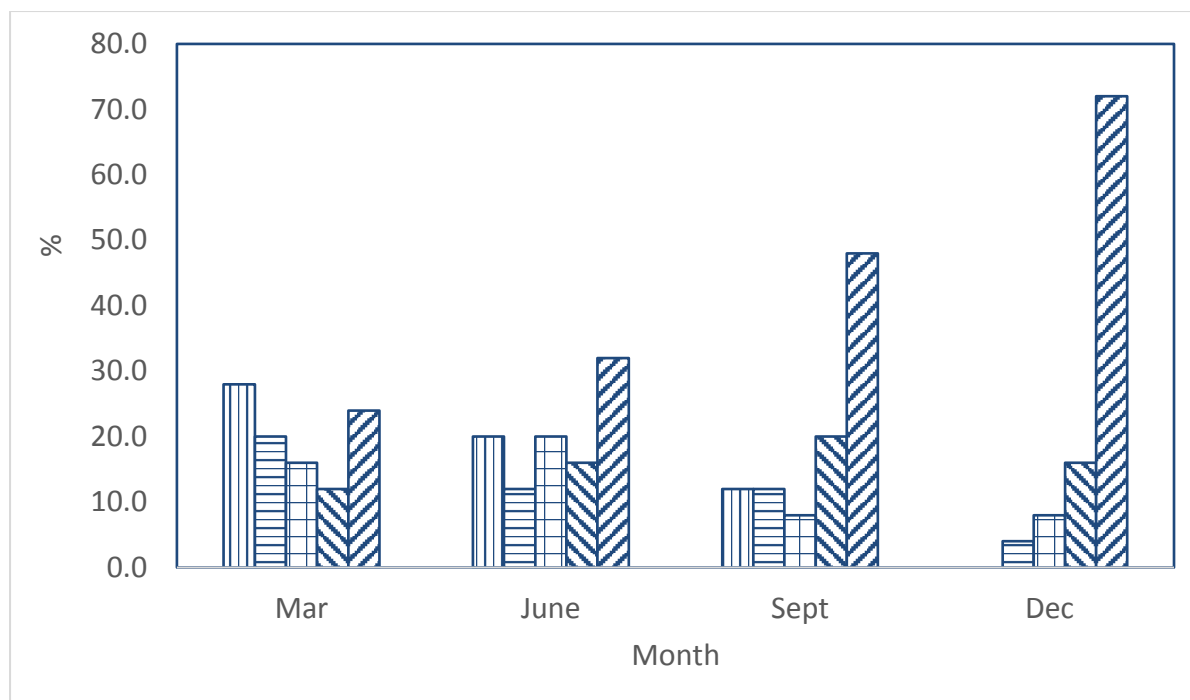
Figure 4. The frequencies (%) of three scores about analytic rubric of reflection journal and changes according to time for one year. Symbols are same as Figure 1.

Table 5. Correlations between frequency counts for coding categories present in student reflection according to semester I and II

Category	*t*-test		
	Semester I	Semester II	Total
Team activities	4.342*	3.375*	4.906*
Contribution as a team member	4.232*	3.361*	4.924*
Self-development and reflection	2.752	5.099*	6.928*
Reflection journal	1.001	3.843*	4.190*

The main effects of the model were assessed with repeated-measures ANOVA ($p<0.05$). Post hoc testing was followed by paired *t* tests (Bonferonni corrections were applied for multiple comparisons.). *: Significant, $p <0.05$.

DISCUSSION

Capstone Design is a culminating course offered to undergraduate students in several Disciplines at the universities or Institutes of Technology including Dong-eui University in the world. Students work in teams to design, build, and test prototypes with real world applications. A requirement for completion of their degrees, Capstone Design challenges students in teams of four to push their own boundaries, and apply the knowledge and skills learned in the classroom and on co-op work terms. It reinforces the concepts of team work, project management, research and development. At the end of each semester students showcase their efforts at the Capstone Design Products. In Capstone Design, Students provide the following deliverable: weekly progress reports, project statement, specifications, project proposal, interim report, and final report. In this report, the roles and descriptions of individuals are very important to help the evaluators to appreciate and understand. There are many trial and error

in the process of deriving the result, so reflection is very important. The use of writing as a means to encourage reflection has a long tradition in the fields of teacher professional education (Aspasia et al., 2016). Either as journal or portfolio or assessment writing, this externalization of idea, thoughs and experience on paper, enables the writer to re-engage upon their missing or neglected parts, facilitatiuong thus transformative learning (Mezirow, 1990). Reflective journals have a long pedigree in the professional development of groups such as pre-service teachers and health professionals, where they provide a medium through which learners can identify viable topics for concern, and reflect critically on their experiences (Uline et al., 2004). There was a result of introspection through the execution of capstone design of molecular biology. Although many criteria programs were not applied, the program used in this study was effective.

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