APPLIED COOPERATIVE LEARNING APPROACH EMPLOYED ON INDUSTRIAL ENGINEERING LABORATORY COURSES

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ABSTRACT

Learning process should always be meaningful and challenging yet enjoyable in order to stimulate the enthusiasm and interest of the students to perform certain tasks or academic related activities with cooperation. This study aimed to determine the frequency and extent of Cooperative Learning Approach applied on the Industrial Engineering Laboratory Courses with an end of improving the outcomes-based teaching and learning laboratory manuals. Descriptive type of research was utilized in the study. Results showed that cooperative learning approach is always being employed in Industrial Materials and Processes, Methods Study and Ergonomics which also obtained a very great extent in terms positive interdependence, individual accountability, student-to-student interaction, social skills and group processes. The frequency of Cooperative learning approach is significantly higher in Ergonomics compared to Method Study and Industrial Materials and Processes while no significant differences exist in the extent of cooperative learning. Machine Shop work activities are mostly being done in individual rather than by group. Team work in Method Study can still be improved through enhancing some of the objectives and procedures in the laboratory manual. The significant contribution of each member to the accomplishment of certain project should always be internalized and accompanied by realization and reflection.

Keywords: Education, Cooperative Learning, Descriptive, Philippines.

INTRODUCTION

Learning process should always be meaningful and challenging yet enjoyable in order to stimulate the enthusiasm and interest of the students to perform certain tasks or academic related activities with cooperation. It would provide better retention if they learn things by doing where experience directs them for additional knowledge and skills. Guiding them to work in a group would lead them to better understand the value of respect, social interaction, teamwork and confidence to express ideas and concepts in order to accomplish certain goals as a team with unity and cooperation. This is where cooperative learning enters to interactive and dynamic classrooms. Everyone is busy doing their share to the achievement of group goals.

The next generation of Information age has been getting more challenging with the new set of discoveries and innovations being introduced for dynamic end-users while tough Higher Educational Institutions are simultaneously reengineering their student services and curricula to sink in and sustain academic growth with new technologies (Dotong, 2014).

Kagan (2010) defined cooperative learning as “a teaching arrangement that refers to small, heterogeneous groups of students working together to achieve at common goal; students work together to learn and are responsible for the team mate’s learning as well as their own”. There were positive effects of cooperative

learning on students' motor performance, and some social achievements such as a greater autonomy of the students in the learning process (Velázquez-Callado,2012).

Several definitions of cooperative learning have been formulated. The present study is anchored in the Johnson & Johnson (2009) model of cooperative learning which is an instruction that involves students working in teams to accomplish a common goal, under conditions that include in the five elements: positive interdependence, individual accountability, student – to- student interaction, social skills and group process.

Positive interdependence means that the team members are obliged to rely on one another to achieve the goal. If any team members fail to do their part, everyone suffers consequences. Individual accountability characterizes that all students in a group are held accountable for doing their share of the work and for mastery of all of the material to be learned. Student-to-student interaction states that although some of the group work may be parcelled out and done individually, some must be done interactively, with group members providing one another with feedback, challenging reasoning and conclusions, and perhaps most importantly, teaching and encouraging one another. Social skills demonstrate the appropriate use of collaborative skills of the students where they are encouraged and helped to develop and practice trust-building, leadership, decision-making, communication, and conflict management skills. Group processing describes the team members who set the group goals, periodically assess what they are doing well as a team, and identify changes they will make to function more effectively in the future (Johnson & Johnson, 2009).

The study identified three industrial engineering courses with laboratory namely: Industrial Material and Processes, Method Study and Ergonomics to evaluate whether cooperative learning approach is being done as part of teaching and learning activities.

Modern engineer training is not conceivable without knowledge of work psychology and ergonomics (Lükő, 2013). By now, work psychology and ergonomics has not only become important and part of the curriculum in higher education and vocational education, but nearly omnipresent in everyday life. The attention is drawn to ergonomics also by such common practical problems as loss of earnings caused by health impairment, or the consumers' (users') aspects and interests in product design etc. Injuries at work and occupational diseases may jeopardise the economic success, or even the existence of companies.

Industrial material and processes deals with metals, plastics, glass and ceramics, elastometers, wood, pulp, and other common engineering materials, where their uses and production processes are being discussed to acquaint the students in the nature of different materials being utilized in manufacturing industries as well as its effects on production system decisions. Continuously advancing industrial companies demand graduates who can quickly adjust to the workflow and who can instantly utilize the knowledge and skills acquired in the complex, interdisciplinary field of mechatronics. Method Study deals with productivity concepts and techniques, work measurement, wage payment, training practices as well as the indirect and expense labor standards.

Ergonomics discusses the origins and development of human factors and ergonomics, movement, cognitive and environmental factors in ergonomics workplace design and evaluation as well as the tools and techniques of ergonomic risk assessment.

These are some of the professional courses of industrial engineering that would help students understand the nature of the program of their study to perform effectively their duties and responsibilities once employed in manufacturing industries where laboratory works are at most observable.

Laboratory exercises at home or in school may be done either by individual or by group. But most of the time, due to the nature of engineering laboratory courses where procedures require two or more students to accomplish certain experiment, therefore, cooperative learning is necessary. The university prepares the Industrial engineering students to become critical thinkers and competitive team players in a corporate world. Therefore, teaching strategies should be innovative enough to guide the students towards an end of meeting the demands of global standards through cooperative learning.

The students will identify the extent of cooperative learning approach employed by their teachers in three identified courses in terms of five elements: positive interdependence, individual accountability, student – to- student interaction, social skills and group process. Identified concerns from the findings will be given appropriate action plan to address the needs of the program.

Cooperative learning could create a positive atmosphere among students especially in engineering laboratory courses. That's the reason why this study was initiated to further assess its utilization and usefulness. Learning could be easier in engineering programs if appropriate techniques could be identified and integrated in specific laboratory courses.

OBJECTIVES OF THE STUDY

The study generally aims to determine the extent of Cooperative Learning Approach applied on the Industrial Engineering Courses with Laboratory in Lyceum of the Philippines University, Batangas. Specifically, this study is guided by the following objectives: to identify the frequency of cooperative learning approach applied in the industrial engineering laboratory courses in terms of: Industrial Materials and Processes, Methods Study and Ergonomics; to determine the extent of cooperative learning applied in industrial engineering laboratory courses in terms of five elements: positive interdependence, individual accountability, student-to-student interaction, social skills and group processes; to test the differences on the frequency of cooperative learning on the three laboratory courses and difference on the extent of cooperative learning in terms of the five elements; and to propose an action plan to improve the Industrial Engineering Laboratory Manuals.

METHODS

Research Design

Descriptive type of research design will be utilized in the study. The respondents of the study will be the 100 percent of the total population of the currently enrolled 25 Fourth Year BS Industrial Engineering at the Lyceum of the Philippines University – Batangas during the 2nd Semester of School Year 2013-2014.

The survey questionnaire to be utilized in the study is a researcher-made instrument based on the five elements of Cooperative Learning Approach. The questionnaire is composed of two parts: First part is composed of 25 statements which will assess the experience of the respondents regarding the utilization of cooperative learning either in laboratory activities, assignments and projects wherein these statements were grouped according to 5 elements or variable while the second part is the extent of utilization the five elements in the three identified courses of industrial engineering with laboratory. The questionnaire will be

pilot-tested to the fourth year computer engineering students who will not be included in the study to test its reliability using the Cronbach Alpha of greater than 0.75.

The questionnaires were administered by the researchers personally to the respondents during the month of December, 2013 and 100% retrieval rating of the questionnaire was achieve.

This scale was used to analyze and interpret the result of the data gathered: 3.50 – 4.00: Great Extent/Always/High; 2.50 – 3.49: Moderate Extent / Sometimes/Average; 1.50 – 2.49: Less Extent / Seldom/Low; 1.00 – 1.49: No Extent /Almost Never/ Very Low.

RESULTS AND DISCUSSION

Frequency of Cooperative Learning Approach in Industrial Engineering Laboratory Courses

Positive interdependence is always being observed in terms of sharing of knowledge and information which is always being done as cooperative learning approach in Industrial Engineering Laboratory courses as denoted by the total weighted mean score of 3.87 as well as caring for the groups to complete the task and demonstrating proficiency in performing the assigned task as indicated by the total weighted mean scores of 3.77 and 3.65, respectively.

The total composite mean score of 3.76 implies that cooperative learning approach is always being done in Industrial Engineering Laboratory courses specifically in terms of positive interdependence.

They also learn how to encourage the others to speak, how to ask for help and when to do it. They are also taught how to divide the tasks and work cooperatively for achieving a very common goal (Lavasani, Afzali & Afzali, 2011). Part of the practice of engineering students is to share what they have learned from the exercises through discussion of findings and active participation of the each member during the process of the activities. Ensuring that everyone contributes to the accomplishment of the task is always being observed.

Maintaining positive outlook towards the attainment of group goals is always being observed as cooperative learning approach in terms of individual accountability as denoted by the computed total weighted mean score of 3.83 followed by working independently with accuracy and identifying laboratory procedures as denoted by the total weighted mean scores of 3.63 and 3.55, respectively.

The total composite mean score of 3.67 implies that cooperative learning approach is always being done in Industrial Engineering Laboratory courses specifically in terms of individual accountability.

Each member understands the value of working independently towards the attainment of the group goals. Everyone is an important part of the process and every output is significant to accomplish the task. It is the responsibility of each member to be aware of all laboratory procedures so that they can contribute to the achievement of their objectives.

In terms of student-to-student interaction, the cooperative learning approach in challenging other members' reasoning and ideas is always being employed in laboratory courses of industrial engineering program as denoted by the total weighted mean score of 3.72 on rank number 1 followed by always promoting a safe feeling for all by reducing anxiety and applying proficiently the laboratory processes with shared resources as denoted by the total weighted mean scores of 3.68 and 3.63, respectively.

The total composite mean score of 3.68 implies that cooperative learning approach is always being done in Industrial Engineering Laboratory courses specifically in terms of student-to-student interaction. In terms of social skills, cooperative learning is always being applied through identifying possible solutions in the problem with appropriate communication as denoted by the total weighted mean score of 3.83 followed by encouraging the group to practice trust-building and demonstrating conflict management skills with weighted mean scores of 3.60 and 3.50, respectively.

The total composite mean score of 3.64 implies that cooperative learning approach is always being done in Industrial Engineering Laboratory courses specifically in terms of Social Skills.

Maintaining effective working relationships among students is always applied and developed during group processes as well as in analyzing how well the students are achieving their goals with total weighted mean scores of 3.72, 3.70 and 3.65, respectively. The total composite mean score of 3.69 implies that cooperative learning approach is always being done in Industrial Engineering Laboratory courses specifically in terms of group processes.

If there is a good teamwork, it results a win-win scenario where teachers are able to teach more and students are able to learn more to meet their course objectives more efficiently. Working together helps teachers learn how to be more effectively use laboratory time to impart knowledge and help the students to be more committed and dedicated to gain positive experience (Baruah & Baruah, 2014).

Table 1. Extent of Cooperative Learning Approach in Terms of Positive Interdependence

Positive Interdependence	**WM**	**VI**	**Rank**
1. Require participation of each member to share knowledge to finish the task	3.60	GE	3.5
2. Encourage participation of each member to assist one another to attain certain goal	3.65	GE	2
3. Promote camaraderie and teamwork to accomplish the objectives of the activity	3.70	GE	1
4. Motivate each member to participate in the exercises to obtain high remarks	3.60	GE	3.5
5. Require support from each member to achieve better knowledge and performance	3.50	GE	5
Composite Mean	**3.61**	**GE**	

Table 1 presents the extent of cooperative learning approach in terms of positive interdependence. There is a great extent in promoting camaraderie and teamwork to accomplish the objectives of the activity in terms of positive interdependence with total weighted mean score of 3.70 followed by encouraging participation of each member to assist one another to attain certain goal and requiring participation of each member to share knowledge to finish the task as well as motivating each member to participate in the exercises to obtain high remarks with total computed weighted mean scores of 3.65, 3.60 and 3.60, respectively. Meanwhile, there is also great extent on requiring support from each member to achieve better knowledge and performance with the least weighted mean score of 3.50 on rank number 5.

The composite mean score of 3.61 implies that cooperative learning approach has a great extent in the Industrial Engineering Laboratory courses specifically in terms of positive interdependence.

According to the study of Baruah and Baruah (2014), the use of teams has really expanded dramatically to face the competitive challenges. One of the most common skills required by new work practices and processes is the ability to work in a team. As we know- education is also a process, it has an important role in recognising the needs & importance of teamwork where teachers can encourage their students to combine different skills they have to make the most of their united efforts towards a common goal. Table 2 presents the extent of cooperative learning approach in terms of individual accountability.

Table 2. Extent of Cooperative Learning Approach in Terms of Individual Accountability

Individual Accountability	WM	VI	Rank
1. Guide each member to become responsible while performing his tasks	3.55	GE	4
2. Require the attention of each member to learn certain procedures	3.75	GE	1
3. Bring about certain obligation for each member to perform	3.40	ME	5
4. Keep each member liable for whatever happens to the output of the exercise	3.65	GE	2.5
5. Teach each member to manage his own individual time to finish the assigned task	3.65	GE	2.5
Composite Mean	**3.80**	**GE**	

There is a great extent on requiring the attention of each member to learn certain procedure in terms of individual accountability as denoted by the computed weighted mean score of 3.75 followed by keeping each member liable for whatever happens to the output of the exercise and teaching each member to manage his own individual time to finish the assigned task with weighted mean score of 3.65.

There is also great extent on guiding each member to become responsible with 3.55 weighted mean score while performing their tasks and bringing about certain obligation for each member to perform obtained the least weighted mean score of 3.40. The composite mean score of 3.80 implies that cooperative learning approach has a great extent in the Industrial Engineering Laboratory courses specifically in terms of individual accountability.

Making the students accountable in all aspects of their learning experience inside the laboratory would enhance their sense of responsibility and they will better appreciate the value of being cautious. Time management is another factor that needs to be realized and observed by the students during laboratory classes to accomplish certain task in most specified time with accuracy and quality of outputs. Table 3 shows the extent of cooperative learning approach in terms of student-to-student interaction.

Table 3. Extent of Cooperative Learning Approach in Terms of Student-to-Student interaction

Student-to-Student interaction	WM	VI	Rank
1. Promote encouragement for each member to stay positive towards the attainment of the group goal	3.80	GE	1.5
2. Require each member to share whatever resources he has within the group.	3.80	GE	1.5
3. Encourage each member to provide constructive feedback of the assigned task	3.50	GE	5
4. Involve the participation in teaching other members of the group	3.55	GE	4
5. Motivate each member to keep an open mind and promote a safe feeling for all by reducing anxiety.	3.70	GE	3
Composite Mean	**3.67**	**GE**	

There is a great extent on promoting encouragement for each member to stay positive towards the attainment of the group goal and requiring each member to share whatever resources he has within the group and as indicated by the weighted mean score of 3.80 on rank number 1 followed by motivating each member to keep an open mind and promote a safe feeling for all by reducing anxiety and involve the participation in teaching other members of the group as denoted by the weighted mean scores of 3.70 and 3.55, on rank number 3 and 4, respectively. However, there is also great extent on encouraging each member to provide constructive feedback of the assigned task as manifested by the least weighted mean score of 3.50 on rank number 5.

The composite mean score of 3.67 implies that cooperative learning approach has a great extent in the Industrial Engineering Laboratory courses specifically in terms of student-to-student interaction.

Learning could be best acquired in a situation where students can easily adapt to the atmosphere that encourages active participation and cooperation among members of the class. Mauladin (2013) stated that it is important to provide a method of learning about the good and the bad, what should and what should not be done when one is in a shared living environment. Learning method provides not only moral ethics against fellow human beings, but also knowledge of the ethics of the environment.

Table 4 shows the extent of cooperative learning approach in terms of social skills. There is a great extent on the encouraging meaningful conversation of the assigned task and cultivating respect among members of the group as denoted by the weighted mean score of 3.65 followed by another great extent on requiring everyone's attention to stay in focus with the group work with 3.60 weighted mean score. Meanwhile, there is also a moderate extent on driving each participation to express ideas and opinions and maintain harmonious rapport with proper communication with the least weighted mean score of 3.45 on rank number 4.5.

Table 4. Extent of Cooperative Learning Approach in Terms of Social Skills

D. Social skills	**WM**	**VI**	**Rank**
1. Drive each participation to express ideas and opinions	3.45	ME	4.5
2. Encourage meaningful conversation of the assigned task	3.65	GE	1.5
3. Require everyone's attention to stay in focus with the group work	3.60	GE	3.0
4. Maintain harmonious rapport with proper communication	3.45	ME	4.5
5. Cultivate respect among members of the group	3.65	GE	1.5
Composite Mean	**3.56**	**GE**	

The composite mean score of 3.56 implies that cooperative learning approach has a great extent in the Industrial Engineering Laboratory courses specifically in terms of social skills. Communication among members is the key to encourage participation in the laboratory exercises. Respect as an important component of social values maintains good interpersonal relationship to stay more focus on group work. Activities in Industrial Engineering courses provide

Credibility among students is developed when they become not only expert in the subject but when they acquire the value of trustworthiness (Reyes, 2013).

Table 5. Extent of Cooperative Learning Approach in Terms of Group Processes

E. Group Processes	WM	VI	Rank
1. Expect each member to analyze how well he is achieving his goals while maintaining effective working relationship	3.45	ME	5
2. Oblige each member of the team to set and achieve group goals.	3.65	GE	2.5
3. Help the group realize how it can perform better from the previous exercise	3.65	GE	2.5
4. Help me understand the strength and weaknesses of each member	3.50	GE	4
5. Help me formulate future plans to achieve higher grades.	3.75	GE	1
Composite Mean	**3.60**	**GE**	

There is a great extent on helping them formulate future plans to achieve higher grades as denoted by the weighted mean score of 3.75 followed by obliging each member of the team to set and achieve group goals and help the group realize how it can perform better from the previous exercise as denoted by the weighted mean score of 3.65. Meanwhile, there is also a great extent on helping them understand the strength and weaknesses of each member with 3.50 weighted mean score and moderate extent on expecting each member to analyze how well they are achieving their goals while maintaining effective working relationship with the least weighted mean score of 3.45.

The composite mean score of 3.60 implies that cooperative learning approach has a great extent in the Industrial Engineering Laboratory courses specifically in terms of group processes.

Good working relationship among students provides better learning experience which creates an atmosphere of camaraderie and teamwork to easily achieve the goals of the group. Knowing the strengths and weaknesses of each member keeps the group informed on how to make everyone involved in the activity and to determine the specific task appropriate to assign on each member.

Table 6. Differences on the Frequency of Applied Cooperative Learning in Industrial Engineering Laboratory Courses

	Mean	t-value	p-value	Interpretation	Decision
Industrial Materials Method Study	3.61 3.64	-1.095	.287	Not Significant	Accept
Industrial Materials Ergonomics	3.61 3.82	-3.868	.001	Significant	Reject
Method Study Ergonomics	3.64 3.82	-3.870	.001	Significant	Reject

There is no significant difference in the frequency of the applied cooperative learning between Industrial Materials and Method Study as denoted by the p-value of .287 which is greater than the 0.05 level of significance, therefore, the null hypothesis is accepted on this variable. However, frequency of cooperative learning in ergonomics is significantly higher than industrial materials and method study as denoted by the p-value of 0.001 which is less than the 0.05 level of significance. Therefore, the null hypothesis of no significant difference on these variables is rejected.

Table 7. Differences on the Extent of Cooperative Leaning in Industrial Engineering Laboratory Courses

	Sum of Squares	df	Mean Square	F	Sig.	Remarks
Between Groups	.702	4	.175	1.100	.361	Not Significant
Within Groups	15.148	95	.159			
Total	15.850	99				

There is no significant difference on the extent of Cooperative Learning in Industrial Engineering Laboratory Courses as denoted by the computed p-value of .361 which is greater than the 0.05 level of significance, therefore the null hypothesis of no significant difference is accepted. This signifies that each element obtained various levels of observation from the students enrolled in three laboratory courses. There is no singular element of cooperative learning applied in industrial engineering laboratory courses as considered distinctive. The degree of application of cooperative learning is diverse across each element in terms of positive interdependence, individual accountability, student-to-student interaction, social skills and group processes. This signifies that each element is being addressed accordingly during the laboratory classes.

Help the students realize through attending seminars or inviting qualified speakers during general assembly or college days the benefit of having positive mental attitude that would provide them a source of reflection. This could somehow change their views in life to increase their level of study habits and be more active and cooperative individual while working in a team that they may use towards the productivity of their future employment (Laguador, 2013).

CONCLUSION

There is a very high application of cooperative learning approaches in industrial engineering laboratory courses in terms of Industrial Materials and Processes, Method Study and ergonomics. There is a great extent on the application of cooperative learning approaches in industrial engineering laboratory courses in terms individual accountability as the highest element and social skills as the least. The frequency of Cooperative learning approach is significantly higher in Ergonomics compared to Method Study and Industrial Materials and Processes. No significant differences exist on the extent of cooperative leaning in Industrial Engineering Laboratory Courses. Outcomes-based teaching and learning activities are integrated in the proposed action plan to improve the industrial engineering laboratory manuals.

RECOMMENDATION

The proposed action plan may be implemented through integrating outcomes-based teaching and learning activities to the Industrial Engineering Laboratory Manuals. Textbook committee and OBE Task Force may also be consulted to examine the accuracy of the content and the relevance of the laboratory exercises to the outcomes-based education. Behavior of the students during laboratory classes may also be constantly observed on how they performed, participate and responded to the activity. The grades of the students may also be monitored and reported to keep the students updated of their academic performance. Future researches may also be conducted to determine the level of effectiveness of the laboratory manuals in the academic performance of the students and its usefulness as an Outcomes-based teaching and learning instructional Material

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