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Enhance Digital Signal Processing Course Performance with Collaborative Learning

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ABSTRACT

All Electrical Engineering majors at Universitas Andalas are required to take a course in digital signal processing (DSP). The goal of this course is to introduce students to the fundamentals of digital signal processing and their practical applications. The course learning outcome (CLO) was not adequately met since a teacher-cantered approach was employed to deliver the course contents. This article's focus is on explaining how a collaborative learning approach may be used in digital signal processing (DSP) courses. The study's goal is to establish whether or not the approach is useful for mastering DSP. Mandalas University's Electrical Engineering Department's Digital Signal Processing (DSP) class is where the research is being done. We acquire this information via several means, including but not limited to: self-evaluation, homework, a project, and tests. The suggested notion is compared to the goal established in the semester learning plan in order to reach a conclusion. The study's findings are reported in descriptive form.

Keywords:

Indicators of success in the classroom, Collective instruction, Alternatives to Traditional Classroom Structures that Put Students.

INTRODUCTION

At Universitas Mandalas, students in the Electrical Engineering programme are required to take a course on digital signal processing (DSP) as part of their required coursework (Unhand). This class meets during the spring semester, the last semester of the academic year. Before beginning the DSP course, all students in the department must complete the prerequisite course, Signal and System [1]. Since 2016, Electrical Engineering at Unhand has followed a high school curriculum (K-PT) based on learning objectives. The SNPT (Indonesian National Higher Education Standards) and the KKNI (Indonesian National Qualification Framework) were used to design the learning outcomes (IABEE). The Department of Electrical Engineering uses several student learning outcomes (SLO) to guide its teaching and assessment of students, including: (1) a firm grasp of the engineering sciences, engineering principles, and engineering design fundamental to the analysis and design of electrical power systems, communications systems, and control systems. (2) Able to use the outcomes of information and data analyses to make sound decisions in the context of problem-solving in the area of expertise. Thirdly,

they have the ability to use mathematical, scientific, and technical methods to address difficult issues in electrical power, communications, and control systems [1–2].

These SLOs were created as the CLO for a course on digital signal processing. One of the DSP CLOs is that students be able to transition from analogue to digital and digital to analogue. The student (2) is competent in z-domain analysis of digital systems. The third criterion is that the student be competent in the application of discrete-systems mathematics. (4) A learner may create a filter that works as intended in the frequency domain. With DSP being a required subject, it has an average enrolment of 130 students every semester. Since the course relies on a conventional approach to education, mastering the CLO was a hard challenge. So-called "teacher-centred" learning emphasises the instructor as the primary classroom participant in conventional classroom settings (TCL). One drawback of this approach is that it encourages pupils to remain passive in class, which increases the prevalence of students with bad grades. The CLOs are not gaining value as anticipated. Grade data from the last two years in the DSP course corroborate this.

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Studies have demonstrated that studying in a group setting has positive effects on students' performance in school. Students benefit academically and academically from working in groups [3, 4] and from the increased transfer of knowledge that results from working in groups [5, 6]. Social skills such as speaking in front of a group, presenting information, solving issues, taking charge, delegating responsibility, and organising information are all honed via group study [6]. With this research in mind, we suggest introducing a cooperative learning approach to the DSP course in the next school year (AY 2020/21), with the goal of raising the quality of students' set CLOs. That led to an overall improvement in the course's average grade.

METHODS

The Mandalas University Electrical Engineering Department's DSP Classes (A, B, and C) are all participating in the study.

A total of around 133 individuals are enrolled in this class. Groups of these pupils have been formed. The group's make-up, including the mix and variety of its individuals, is decided by using the student list provided from the learning management system. To prevent cliques from forming among students, instructors always randomly assign them to groups rather than letting them choose their own. Given the underrepresentation of females in the class, (b) at least one female student is included in each group. c) Each class group consists of an equal number of students from the same cohort. It follows that there are somewhere from 9 to 10 groups, each consisting of anywhere from four to five pupils. In order to collect this information, we use several forms of assessment, including homework, assignments, midterms, and final exams, to measure how well our students have grasped the material presented in class. To further improve the information, self-evaluation is also implemented. The analysis is performed by determining what proportion of pupils get a score higher than the goal. We want all of our students to get at least a 55 on each CLO. 55 is the equivalent value of a "C" according to Andalas University's Academic Regulation. There should be at least 55% of students who are successful in each CLO. The indicator is updated with the results of summative evaluation. The analytical result is then described in detail.

WHAT WE FOUND AND HOW WE TALK ABOUT IT

Students' personal responsibility, collaboration, and communication abilities, among other "soft skills," may be described via data collected through self-assessment, homework, and assignments. You may see examples of these three softer abilities in figures 1, 2, and 3

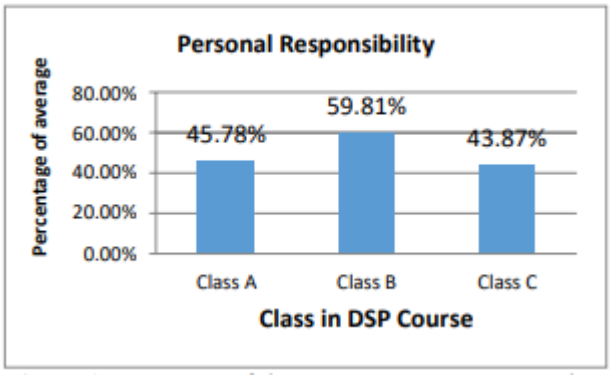

Figure 1 Percentage of the average score on personal responsibility in a group.

Figure 1 shows that students in class C have the lowest average score, which is 43.87% on personal responsibility in the group. Class B is the top scorer and the second by Class A with the average score of 59.81% and 45.78% respectively.

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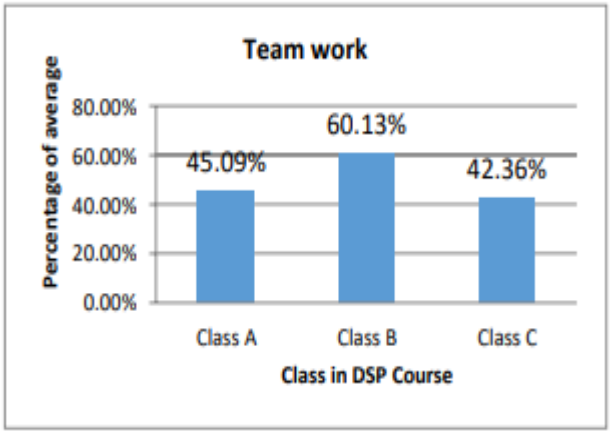

Figure 2 Percentage of the average score on teamwork in a group.

Students in Class B have the highest average score which is 60.13% on teamwork. At the same time, Class A and Class C are the second and the last with the average score of 45.09% and 42.36% respectively.

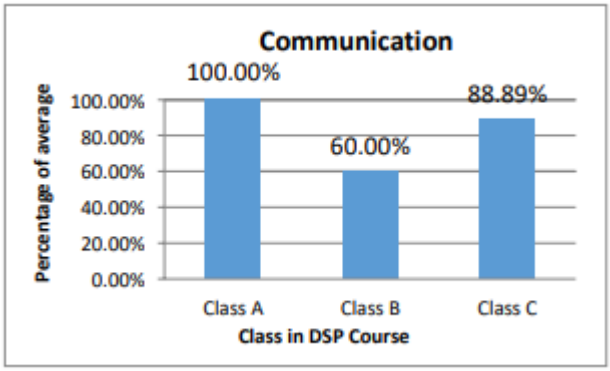

Figure 3 Percentage of the average score on communication in a group.

The pupils in Class B had the lowest average score on communication abilities (figure 3). Class A students have the greatest average score, at 100%, while Class C students have the lowest, at 88.89%. The Assignment, Final Project, Midterm, and Final Exam all measure and evaluate students' progress towards CLOs. The student's performance in CLO 1 was evaluated through the Assignment, and CLO 2 was evaluated via the Final Project. Students' progress towards CLO 3 and CLO 4 is measured by the Midterm and Final examinations. Figure 4 provides a concise overview of the CLO evaluation outcomes. The results are reported as a percentage in accordance with the DSP course's semester-long learning plan.

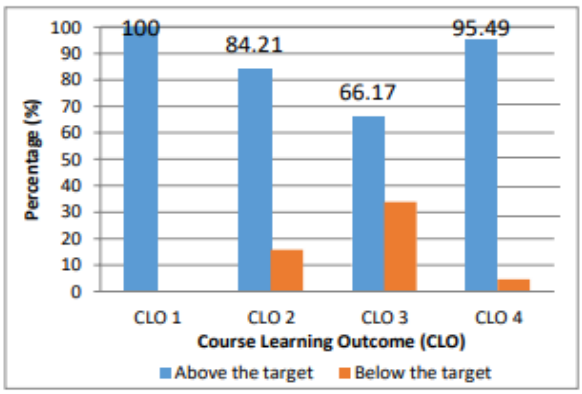

Figure 4 Percentage of achievement on different CLOs.

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When compared to other examinations, the percentage for CLO 1's evaluation is the highest at 100%. A student's ability to create a filter that satisfies frequency-domain parameters is shown in CLO 4, which follows this CLO 1. CLO 2 represents 95.49 percent of the total debt. Fourth and fifth place are held by CLO 2 (84.21%) and CLO 3 (66.17%). In general, each CLO % is higher than the goal. Each CLO's goal is 55%. Equally important, the bare minimum is a 66.17% mark. In order to determine a student's final grade for the 2019-2020 school year, all of their assessment scores will be added together. Figure 5 depicts the Alphabet conversion from score to letter grade.

In this next school year (2019-2020), students will get a grade that reflects the enhanced success they've had in the course so far. Each CLO exceeds its quota by at least 66.17 percent. The fact that more students were successful in completing the course this year lends credence to this observation.

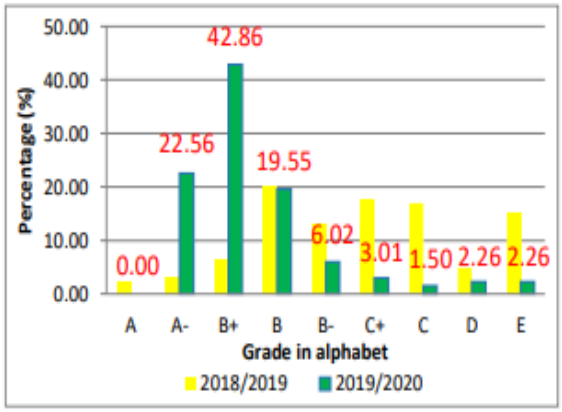

Figure 5 The comparison of the grade distribution between two academic years in the DSP course

Similarly, the number of students who earned an A- or B+ during the 2019-2020 school year has grown. There was a total increase of 55.74 percent compared to the previous year. The same rule of thumb is used for the A-grade.

CONCLUSION

Based on the results of this research, it can be said that the use of cooperative learning techniques in a digital signal processing course significantly enhances the educational value of the experience. Each CLO exceeds its quota by at least 66.17 percent. The fact that more students were successful in completing the course this year lends credence to this observation.

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