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## Research Article

### Application of Student-Centered Activities Among Engineering Students in the New Norm of Learning

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## ABSTRACT

This action research aimed to implement the blended learning modality through student-centred activity in the new normal of the engineering department of the Cavite State University – CCAT Campus. The study utilized quasi-experimental research design. Inferential and observation design were utilized to augment and support the research design findings. The Center for Educational Effectiveness at the University of California, Davis, provided the researchers with the checklists, questionnaires with Likert scales, and field and observation notes. Results showed that there was significant difference among the means observed as caused by the intervention. The action research concluded that there is an increase in student' cognitive, affective, and psychomotor domains after the intervention, and the research identified that asynchronous classes and time management allotted for students were the critical challenges.

**Keywords:** Action research, Engineering, Interactive learning, Intervention

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## Introduction

In early 2020, the COVID-19 epidemic altered people's lives as well as those of corporations, academics, and universities. Everyone's lives completely changed and one of the greatly affected by the pandemic were government mechanisms (Mendoza and Tadeo, 2023), business (Dagpin et al., 2022) (Tadeo and Mojica, 2023), schools, academies, and universities; this resulted in the transformation of taking classes from face-to-face into online or modular form. Depending on their age, academic level, and stage of their programs, students have experienced the COVID-19 epidemic in a

variety of ways. Those transitioning from one stage of their education to another, such as those moving from school to tertiary education or from tertiary education to employment, face unique challenges. They will not be able to finish their school curriculum and assessment (Daniel, 2020).

It was being academic professionals who were involved, the university's commitment to quality education, inclusive growth for all stakeholders, and holistic development that is responsive to the needs of the times. The suddenness of the situation, teachers and administrators were caught off guard and were forced

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to build emergency remote learning systems almost immediately (Donnelly, Gresham, and Patrinos, 2021). The Cavite State University (CvSU) – Cavite College of Arts and Trades (CCAT) supported the initiative of the university to conduct online classes in sustaining the quality education for Engineering students using a blended learning modality.

Consequently, the researchers aimed to implement the blended learning modality in the new normal of the engineering department at Cavite State University – CCAT Campus. In order to achieve student-centered activities, the researchers assessed and enhanced the approaches of the faculty of the engineering department. The research results may benefit engineering students, other programs, faculty, administrators, and the Cavite State University – CCAT Campus in implementing quality education.

### **Objectives**

Generally, this action research aimed to determine the effect of the application of student-centered activities among engineering students in the new learning norm in Cavite State University – CCAT Campus.

Specifically, the researchers aimed to:

1. design and implement student-centered strategies;
2. evaluate the implemented interactive learning strategies in terms of;
  - a. cognitive;
  - b. affective; and
  - c. psychomotor;
3. identify challenges in the implementation of student-centered strategies; and
4. craft a possible action plan to address the challenges encountered in learning intervention.

### **Review of related studies**

The COVID-19 pandemic was the catalyst for online delivery to become widely used in higher education. Based on survey data gathered after a sizable time of totally online delivery and while students were free to select conventional, online, or hybrid approaches to learning, collaboration, and assessment, this study reflects on students' preferences for online teaching, collaboration, and assessment.

The majority of earlier studies examined student preferences in particular courses or at the institutional level. Nevertheless, the current study examines student choices in the following fields: arts, business, hospitality, science, and technology. Studies have shown that students prefer small group discussions over standard lectures when recordings are available online. While there were minor differences within disciplines, these preferences were generally the same among students from different academic fields. The findings show that students prefer totally online delivery to conventional on-campus instruction, learning, and evaluation (Berezina, Gill & Siti, 2021).

In the twenty-first century, preparation for higher education, professions, and citizenship presents substantial difficulties for both students and instructors in STEM classrooms. In order to address these challenges, educators have advocated for student-centered instruction, with numerous programs emerging to shape and define such contexts. However, strategies must be developed to assist teachers in transitioning to non-traditional teaching. In order to prepare student peer leaders for their duties as teachers in these programs, this study looked into the impacts of teaching in student-centered, peer-mediated STEM classrooms. The study focuses on the issues teachers face as their roles and identities change, how they develop or oppose growth, and how instructors view themselves as they apply student-centered teaching. This study suggests that substantially modifying the learning environment can have predictable effects on teachers' identities and approaches to teaching, which can inform teacher education and professional development programs for STEM teachers, maximizing teachers' success as they implement student-centered pedagogy (Keiler, 2018).

The change from the new millennium of the twenty-first century to the fourth Industrial Revolution and the worldwide Covid-19 epidemic were two of the many changes that occurred on a global scale. All of this calls for changes in education, especially in engineering. The complicated world demands new skills, including flexibility, lifelong learning, and sophisticated problem-solving; the fourth industrial revolution demands dynamic and integrated

curricula; and the worldwide pandemic demands in-depth online knowledge. According to the Outcome-Based Education (OBE) Framework, all of these changes in engineering education call for a change from teacher-centered to student-centered learning (SCL). This paper systematically addresses how effective implementation of SCL can transform engineering education using a simple but powerful method, Informal Cooperative Learning (Hassan, Mohd-Yusof, and Zakaria, 2020).

In the Philippines, it was challenging to push education forward among the new normal. Covid-19 has caused a deadly pandemic. Despite widespread opposition, the Department of Education (DepEd) and the Commission on Higher Education (CHED) adopted and implemented the flexible blended learning model. This resulted from the virus' likelihood of spreading if courses were opened. The many learning modes include modular (printed), modular (digitized), online, educational television, radio-based instruction, home schooling, and blended learning. In cities where students and learners have the luxury of having an internet connection at home and where contemporary living has been adopted, online learning is predominantly utilized for high schools and universities. Those who live in remote areas or provinces with spotty internet connectivity employ modular distance learning. The use of Modular Distance Learning Modules created by teachers with various tasks and learning activities based on the essential learning competencies (Anzaldo, 2021).

Higher education has used blended learning to maintain quality education in the face of the pandemic. In order to better understand the lived experiences of students at Cebu Technological University-Moalboal Campus, this research set out to look into them. The philosophies of autonomy and independence, industrialisation, and contact and communication are reflections of the three historical approaches to remote education or distance learning. With the help of 11 participants, the data were examined utilizing the Interpretative Phenomenological Analysis (IPA) and the Modified Van Kaam Method by Moustakas. Four emerging core themes were identified: (Theme 1) challenges and struggles in blended learning,

(Theme 2) student learning preferences, (Theme 3) motivation is essential, and (Theme 4) internet websites are user-friendly. These four core themes indicate that those students struggle in a blended learning mode. These college students lived experiences may suggest an action plan for the university to investigate pedagogical remedies to address the student's learning difficulties (Ando, 2022).

In order to implement efficient online education practices with high levels of communication and engagement in higher education in light of the COVID-19 pandemic, the procedure needs to be carefully evaluated. In this relation, the purpose of this study is to first establish the levels of satisfaction that higher education students have with online learning during the pandemic process that affects the entire world, and then to show how these levels vary depending on factors like gender, discipline, educational level, and grade level. A quantitative cross-sectional design was used in the investigation. The sample for the study consists of 13447 college students who attended Istanbul University - Cerrahpasa online during the autumn semester of 2020-2021. Students' satisfaction with online education was found to be moderate. Students also favored Zoom from the synchronous platforms and Canvas from the asynchronous platforms in the online learning environment. In contrast, female students are much less happy with the process than male students are, with students in the social sciences, engineering, and science being more satisfied than those in the medical and health sciences. Sixth-grade students were more satisfied with the process than other grade levels, and graduate students were significantly more satisfied than undergraduate and associate degree students. Ultimately, the low impact level was reached by all significant differences. The study made several recommendations for teachers and future research to develop more efficient online learning environments (Biber, Can, Kucuk and Simsek, 2021).

Salih (2019) conducted a study entitled using social media as an interactive tool for learning and teaching purposes. This study investigates how teachers and students at the Baghdad, Iraq, university use social media as teaching tools. It aims to determine whether learning

and interpersonal communication is accomplished in a virtual environment. 180 randomly chosen digital users from various academic institutions have taken part in the study throughout August 29 to December 31, 2018. College students from the four educational institutions who are undergraduate, graduate, postgraduate, and Ph.D. candidates make up the sample population. The actual questionnaire was administered at the institution in both Arabic and English, considering the participants' academic backgrounds and previous educational experiences. The questionnaire is being created in two languages to get more data from remote users who virtually communicate in their native tongue. The study used primary and secondary sources in collecting data. The primary data comes from the respondents who answered the questions in questionnaires. Secondary data comes from the internet, journals, and any related sources. Results suggested that the key to academic and professional success at institutions is leveraging social media apps as tools that save time and effort when transmitting information, instructions, rules, or guidelines and engross individuals anytime, anywhere. This paper supports using social media in higher education for teaching and learning. According to the university of Baghdad's internet users' scattered responses, academics at all educational levels can advance their skills and engage in intellectual discussion with one another on social media platforms. Educators must use social media in the classroom to teach their students. The paradigm shift is currently happening with learners, teachers, or school administrators adaptable to acquire knowledge and necessary practices in the virtual domain.

Based on academic performance and student involvement in learning settings, Goksun and Gursoy (2019) assessed the reflections of gamification activities employed as formative assessment methods. The use of gamification tools was also examined to see if it affects student engagement and academic performance. A total of three search groups were identified. Two experimental groups employed the 7E educational model that had been gamified with Kahoot and Quizizz, while a control group used the conventional 7E instruction strategy. The

study utilized a mixed-method research design in conducting this study. A quantitative research approach was utilized to identify the impact of gamification as a formative assessment tool using Kahoot and Quizizz applications on academic achievement and student engagement. In contrast, a qualitative approach was utilized to determine pre-service teachers' professional and personal views on gamification applications (Kahoot and Quizzes). A quantitative student engagement scale and a test of academic accomplishment were used to obtain the data. In contrast, focus group interviews with pre-service instructors who participated in instructional activities made gamified with Kahoot and Quizizz programs yielded qualitative data. In the academic year 2017–2018, 97 pre-service teachers from Adiyaman University's Faculty of Education participated in a course on scientific research methodologies. The study participants were randomly divided into three and selected randomly. There were 30 participants for the Kahoot experiment group, 33 for the Quizizz experiment group, and 34 for the control group. To ascertain whether the modifications were brought about by the gamification program or the way the course content was presented, a control group was set up. Focus group interviews with six aspiring teachers were chosen using the greatest diversity sample method. The data collected from the participants were analyzed using the mixed design MANOVA. The study's findings showed that gamification impacted students' engagement and academic performance in the scientific research methods course. Post-hoc tests could not determine the impact's direction, but they did suggest that inter-measurement interaction may have had an effect. Academic attainment and student engagement were also considerably affected by the Kahoot-based instructional activities as compared to the control group. On the other hand, Quizizz-based instructional activities could have been more successful as compared to the control group. Additionally, the qualitative findings revealed that the participants' technological issues were related to the Quizizz application's limited ability to provide visual feedback. The findings also revealed that students loved utilizing the emojis offered as feedback, that their

curiosity about the successes of their peers was piqued, that they aspired to lead their class in exam scores, and that they delighted in the competitive environment. Additionally, regarding infrastructure and application-related issues, the findings showed that students encountered slow Internet speeds, problems connecting to school networks, and high hardware requirements. Additionally, it was found that the three most popular applications among the students were Plickers, Kahoot, and Socrative. The study found that Plickers' feedback form was the most engaging for students and that Kahoot provided the most competitive environment while being the easiest to use. The results also showed that the competitive climate reduces student response time, the badge-winning environment makes students feel important, and the reward system increases student motivation in the class. According to the study, teachers should use technology to evaluate numerous and different formative assessments, particularly for active learning activities.

According to Ansari and Khan (2020), using social media would help students become more enthusiastic and dynamic by facilitating collaborative learning, the transfer of resource materials, and interactions with peers and teachers. This research looked at how social media and mobile technologies are used to communicate with academics and transfer resources in higher education institutions. Data were gathered from students at an Indian public university using online and offline surveys. To analyze the study, a seven-point Likert scale was utilized. Furthermore, the use of social media for group learning was evaluated using four symbols, the use of peer interaction was evaluated using five signs, the use of teacher interaction was evaluated using four symbols, the use of social media for academic performance was evaluated using four indicators, and the use of online knowledge sharing behavior was evaluated using five signs. A total of 360 university students were the study participants who were selected using a convenience sampling technique. A structured equation model and confirmatory factor analysis were utilized to analyze the data gathered from the participants. The findings showed that most students were

female and between the ages of 15 and 20. Additionally, the study discovered that students use social networking sites for 1 to 5 hours per week for collaborative learning and global teacher interaction. Additionally, it was found that students who were more involved in collaborative learning via social media performed better in class. According to the study, using online social media for group projects and communicating with peers and mentors promotes student involvement, which in turn affects academic achievement. Pupils who are shy in front of their peers would gain the most from communication equipment. Instructors may become more available online for worldwide collaborative teaching and learning. Such devices would also be helpful for students who are physically challenged. The researchers recommended that higher education authorities offer a platform to foster and develop students' intellectual abilities.

Santiago et al. (2021) studied the adaptability of flexible learning in the new normal. The learning tools and e-learning resources, learning platforms and online learning systems, and learning engagements of students in their new typical learning environment were all investigated in this study. The purpose of the research is to identify the learning tools, resources, meeting platforms, and online learning systems that are in use. In addition to the topics addressed, the researchers aimed to determine students' talents and examine them in relation to meeting platforms and online learning systems. They also want to know how students use the flexible form of online learning at Cavite State University - Silang Campus. The variables in the study are separated into two categories. The independent variables include flexible learning adaptabilities such as e-learning materials, digital meeting platforms, online learning systems, and learning engagement. At the same time, the students of Cavite State University - Silang Campus are the dependent variable. The researchers used stratified random sampling, with four departments responding to a standardized questionnaire. The data was acquired via a self-created online questionnaire because it was inexpensive, and the replies were anonymous. It measured the variables using validation techniques such as construct, content, and

face validity. Cellphones and mobile applications were the most often used instructional tools and e-learning resources, according to the data. Additionally, for asynchronous classrooms, Google Classroom was the most popular platform, while Google Meet was popular for online classes. The researchers observed that the students had extensive understanding of online learning systems and meeting platforms. Students regarded Facebook as the most handy during flexible learning, followed by Google and Zoom as the most accessible, communicative, monitorable, and sustainable. As a result, the majority of students thought that the most significant component in engaging in online learning was preparation. During the CoViD 19 epidemic, students were found to be using educational resources such as smartphones, computer devices, and mobile applications to complete their assignments. They prioritized Google Meet over all other online meeting platforms. Students evaluated the online platform because it allowed for direct communication with teachers, collaboration with other learners, and open discussion. This study is vital for educational institutions and school administrators in developing policies, guidelines, and online learning content.

Abouhashem et al. (2021) discovered the distinctive method of online interactive learning in STEM education. This study assessed the online interactive learning method in STEM education. The productivity of the course design was assessed in this study when it was implemented on school pupils. It displays how each learning material affects student replies. The study's objectives are to determine the effect of course design and create improved student interaction and creative peer collaboration. The researchers have main variables in this study, such as online interactive learning as the independent variable and STEM education as the dependent variable. The study utilized an experimental design to exercise five online STEM programs with repetitive cycles. This research presented the results of a novel interactive online STEM education technique developed to overcome the constraints of the virtual classroom. The teaching method employed creates an interactive learning environment that encourages student engagement, retention, and

involvement, ultimately leading to STEM inventions. In a student-centered approach, both synchronous and asynchronous mechanisms and a feedback mechanism were implemented. The strategy's effectiveness was proved by the highest rates of student retention and STEM creativity, as well as the model's potential for replicability and sustainability. As a result, the scope of such activities might be expanded further by their durability and replicability to vulnerable student populations, such as academically introverted and especially challenged students.

## Methods

### *Research Design*

The study employed quasi-experimental research designs in its execution. This action research, in particular, employed a descriptive design to describe the mean scores of the participants. In particular, quasi-experimental methodologies were employed to scaffold intervention and analyses among participants. Moreover, inferential and observation designs were used to supplement and corroborate the findings of the previously described design. The prior null hypothesis in this action research is that there are no significant differences in the variables under study between courses using motivational-interactive learning methodologies and those without intervention.

### *Research instrument*

Additionally, the authors used Likert-scale questionnaires, checklists, and field and observation notes as research instruments as the basis for data analysis. In support of calibrated and standard measures of variables, the researchers have used the motivation matrix of the University of California Davis, Center for Educational Effectiveness, as a key research instrument in this action research.

### *Participants of the Study*

The teachers used the Engineering students as the subject of this action research and let them answer the questionnaire using google forms. The classes involved were CPEN 50 – Computer Engineering as a Discipline and ENSC 32 – Engineering Economics.

## Results and Discussion

### Adoption and Implementation Process

The authors aimed to examine techniques to increase students' learning experiences utilizing the Google Suite as a major delivery tool in instruction delivery through their collective and collaborative thoughts to comprehend and explore the dimensions of the new normal of

learning. This action research investigated the use of motivated interactive-learning strategies prior to class discussion to identify the potential consequences for students' cognitive, emotional, and psychomotor abilities. As a result, presenting a suggestion technique to improve class delivery in engineering education.

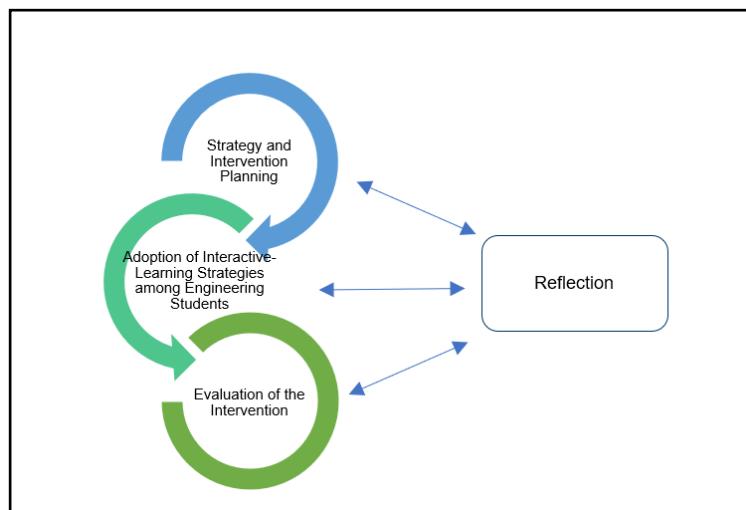


Figure 1. Ideation to Evaluation Framework

### Intervention Assessment

Table 1. Teachers' observation

Areas of Observation	Without Intervention	With Intervention
The class atmosphere of motivation	Students were actively listening; few were participating.	All students were actively participating and shared their ideas/insights.
Excitement among students / Fun environment towards learning / Class involvement and participation.	Most students participated, but still, some of them were shy to answer.	All students were engaged, and they were able to share their ideas actively.
Clear understanding of the students toward concepts	Students clearly understood the concepts but were hesitant to share and collaborate with others.	They attentively participate and collaborate with others to share the concepts learned from the discussion.
Class comfortability of interaction	Students were shy because of the barriers caused by the online setup, which made them hold their ideas.	They can comfortably interact and boldly ask and share their insights.
Attention of students / Stimulation of class curiosity and thinking	Some of them were attentive and participated in the discussion.	Students listened attentively and actively shared and participated in the class discussion.

Table 1 shows the teachers' observations across engineering students with induced intervention and placebo classes. It generally shows that there were positive results of observed responses from the students, such as the

willingness of the students in class participation and engagement, confidence in sharing their ideas, and observed attentiveness to queries.

Table 2. Students' response

	VARIABLES	without intervention		with intervention	
		Mean	Description	Mean	Description
Cognitive	I understood the concepts, ideas and terminologies well.	4.03	Agree	4.50	Highly Agree
	I understood of subject concept and relevance to CPEN 50 – Computer Engineering as a Discipline and ENSC – Engineering Economics general practices.	4.10	Agree	4.50	Highly Agree
	Linking of subject concepts with the view of the competitiveness of my course	4.10	Agree	4.30	Highly Agree
Affective	I am comfortable with socializing with classmates and other colleagues via online	4.10	Agree	4.20	Highly Agree
	I cooperate peacefully and amicably with classmates or group mates.	4.33	Highly Agree	4.60	Highly Agree
	I empathize with my classmates during discussions and idea confrontation	4.20	Highly Agree	4.40	Highly Agree
Psychomotor	I follow the procedures and instructions of the facilitator towards the subject	4.53	Highly Agree	4.70	Highly Agree
	I apply the subject skill in conceptualization of plan.	4.17	Agree	4.30	Highly Agree

Table 2 presents the students' responses towards their experiences in their respective classes, both from classes that have intervention and without the intervention of interactive

motivational strategy. Generally, the students were more motivated and participated more in intervention classes, as evidenced by higher mean values than in control groups.

Table 3. t-test values of with and without intervention phases

t-test value	p-value	Decision
2.93	0.01	REJECTED

The table shows the t-test VALUE of the intervention conducted in the action research. It reveals that the t-test value of 2.93 with a significant value of 1.76 is statistically significant, following and complying with a critical value of 0.05. Hence, the null hypothesis that there is no

significant difference among the means observed as caused by the intervention is thereby

#### Rejected

It can be significantly inferred that the utilization of student-centered activity in the

classes of CPEN 50 – Computer Engineering as a Discipline and ENSC 32 – Engineering Economics is a causal determinant of the increased

value of means, translating improvements in the cognitive, affective and psychomotor domains and sub-variables under study.

*Table 4. Teachers' observation: Challenges*

There is a standing challenge regarding the type of asynchronous classes.
There is an identified constraint towards time management among students.

## Conclusion

The authors concluded the following:

1. The Department of Engineering has implemented an intervention of student-centered activity in the CPEN 50 – Computer Engineering as a Discipline and ENSC 32 – Engineering Economics.
2. There is an increase in students' cognitive, affective, and psychomotor domains after the intervention.
3. It was identified that the type of asynchronous classes and time management allotted for students in CPEN 50 – Computer Engineering as a Discipline and ENSC 32 – Engineering Economics were critical challenges.

## Recommendation

The researchers recommend the following action plans:

1. It is recommended to utilize time management to maximize the time allotment for students to present their outputs.
2. It is recommended that the teacher will maximize the time allotted for teaching hours and preparation for the next meeting.

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