A MULTIPLE REGRESSION ANALYSIS OF THE FACTORS AFFECTING ACADEMIC PERFORMANCE OF COMPUTER-AIDED DESIGNING STUDENTS DURING FLEXIBLE LEARNING PROGRAM IN PHILIPPINE STATE UNIVERSITIES

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ABSTRACT. *The shifting of educational setup to flexible learning during the Covid-19 pandemic subsequently brought challenges, both to the educators and to the learners, especially for courses that require hands-on demonstration such as Computer-Aided Designing (CAD). Such challenges affected the academic performance of college students in Philippine state universities. To shed light in understanding the academic performance of CAD students, this study identified four determinants: learner factor, Teacher factor, parental guidance, and learning facilities. 165 students who are taking CAD courses from three colleges in a state university located in Northern Mindanao, Philippines responded to the online survey. Results of multiple regression analysis revealed that all four factors have an explained variance of 81.2% toward the academic performance of the students. Moreover, learner factors and parental guidance significantly influenced the academic performance of CAD students. Alternately, Teacher factor and learning facilities reported otherwise. Recommendations for future studies are discussed in this study.*

Keywords: Academic Performance, Computer-Aided Designing, Flexible Learning, Philippine State University

INTRODUCTION

COVID-19 has become a public health emergency concern worldwide [1]. One of the countries affected is the Philippines. The Philippines was challenged and became affected areas was the education sector [2]. As a result, schools were forced to stop face-to-face learning and shift dramatically to an online modality or flexible learning [3, 4]. Despite the disruption of the Covid-19 pandemic, students continue their education via online learning. The abrupt changes in the teaching and learning process brought a huge adjustment to the teachers as well as learners. Online platforms are heavily used by people all over the world for communication, entertainment, and information gathering Similar to this, the educational system also uses internet technology to conduct academic activities [5].

Teaching in an online setting is undertaken remotely and on digital platforms. The learning process is done via video calls, teleconferencing or digital messaging. So far, this one is the best alternative while schools were still unable to operate for the safety of every learner. According to Angdhiri [6], many students who participated in home-based learning programs also say that the workload of online classes is larger than that of regular classes. The general consensus is that home-based learning programs, although highly beneficial and a good alternative to school as schools are closed, still require some getting used to by students, as it is a novel concept and not many are experienced with it. This is because students when in the house, do not have enough course learning facilities and Teachers available compared to school. To be specific for example, teaching Computer-Aided Designing (CAD) is dependent on interactions between the tutor and the student(s), and it necessitates step-by-step instructions that guide students through sophisticated user interfaces. For a lecturer who is responsible for 60 or more distant learners on his or her own, this can be quite challenging [7]. The home-learning program, according to students, is even more difficult than conventional classes. Even while regular classes were challenging, having buddies makes them much more tolerable and less stressful. The advantages of having friends to mingle with and being stranded alone are removed in online programs [6].

In general, students perform worse on online schoolwork than they do in a face-to-face classes. Less intellectually prepared students and those pursuing bachelor's degrees are notably affected negatively by taking online courses. Additionally, new data from 2020 indicates that the pandemic's shift to online course-taking resulted in a drop in course completion [8].

The previous study reports that there are factors affecting the Academic Performance of students during online learning. However, little is known about the perspective and experiences of students in a state university, particularly those studying CAD courses. To address this gap in the literature, this study aims to determine the factors affecting the academic performance of state university students taking CAD. With this, it is good to identify which factors influence the student's academic performance using flexible learning to have a result that could help derive a policy that will make flexible learning programs an alternative learning delivery in the future, not only during the Pandemic.

The Nature of Computer-Aided Designing (CAD) Course

Computer-aided design system has the competence to assist intelligent modeling and evaluation because it has the capacity to understand the implicit information included in a drawing that gives it the 'competence' to support intelligent modeling and evaluation [9, 10]. The usage of computer tools for the technical drawing must be taken into consideration due to the theoretical foundations of Cuba's third improvement of Basic Secondary Education and changes made to the subject of Labor Education. The necessity to promote learning computer skills and mastering it using computer-aided drawing (CAD) tools is highlighted in the specialized scientific literature [11]. Also, it was recommended in the study of Zachariah Zira and Sunday Wilfred [12], that building engineering drawing education should use the AutoCAD application instruction technique. Teachers should employ teaching strategies that engage students and encourage them to invest more time and energy into the learning process in order to achieve higher academic

results. However, online CAD instruction is more difficult than teaching other online subjects because on-campus students participate in face-to-face tutorials and interact with their tutor who is able to interactively and visually display components of the CAD graphical user interface. Meanwhile, in distance learning, students rely only on communication with the lecturer and the accessible teaching materials [7]

Flexible Learning Program (FLP)

In the middle of 2nd semester of SY 2019-2020, the majority of classes at higher education institutions (HEIs) were still in the pandemic. The Commission on Higher Education (CHED) issued a number of advisories [13] to help all public and private colleges deal to the pandemic's difficulties and hazards as well as the government's tightened community quarantine [14]. Because of the pandemic, HEIs were greatly affected, and decided to shift the learning program from face-to-face to online learning. The Flexible Learning Program (FLP) has become the program implemented by major state universities and colleges. Since then, Technology became a vital classroom for teachers and learners, where students and Teachers meet. According to the Department of Education and Skills of Dublin [15], the role that technology should play in enhancing the learning experience wherein the newest technologies must be utilized by educational institutions if they are to have a significant impact on both teaching and learning. Truly, technology has shifted how students can access education, enabling them to benefit from the excellence and efficacy that higher education has to offer [16, 17].

Academic Performance

The prediction and explanation of academic performance and the investigation of the factors relating to the academic success and persistence of students are topics of utmost importance in higher education [18]. Academic performance is an important predictor of performance at other levels of education and of other important job outcomes, such as job performance and salary [19]. One of the most relevant perspectives in understanding academic performance is social–the cognitive theory of motivation initiated by Dweck's work in 1986 [20]. The main premise is that student behaviors are a function of desires to achieve particular goals, and research has focused primarily on the two dominant goals of learning: learning (also called mastery or task-oriented) and performance (also called ego-oriented).

Factors affecting the Academic Performance of the Student

The study has shown that achievement goals, self-efficacy, and class size are important antecedents of academic performance, but there are still many other factors that may explain differences in academic performance [21]. The following subtopics will discuss more on the different variables that are believed to have affected the academic performance of the students in the flexible learning programs.

The Influence of Learner Factor towards Academic Performance

The learner factor is described in this study by two ideas: the learner's study habits and the learner's time management. Study habits are the most important predictor of academic performance because academic success and fulfilling educational objectives depend on a number of factors, the most crucial of which is an individual's study habits because the use of diverse and efficient study techniques enhances students' academic performance. So, it is recommended to consider and assess students' study habits at the time of entry into university. In addition, specific training should be offered to students in order to help them learn or modify study habits to increase their academic achievements [22, 23].

Due to their attendance at classes, completion of homework, and preparation for tests, students generally lead very hectic and stressful lives. They also have their own daily schedules and lives, which are essential for striking a balance between their academic and extracurricular obligations. Finding the time to complete everything at once might be difficult, but in spite of being busy, time management can be quite helpful to them [24]. Although the relationship is tenuous, all time management practices are significantly linked to students' academic success. Time planning, meanwhile, has a strong correlation with making wise decisions [25]. Students who practice time management complete their assignments on time. Due to this habit of time management, the learners can succeed in their academic studies because they will create a lesson plan and learn the daily portions on a specific day [24]. Based on the proof presented in the literature review, the first hypothesis of this study is:

H1: The learner factor has a significant influence on the academic performance of the students learning CAD in a flexible learning program setting.

The Influence of Parental Guidance towards the Academic Performance of the Student

Various research on the essence of parents' role in the learner's development has emphasized the importance of parental support in every individual's psychological well-being, educational goals, and future plans. To some extent, their educational achievement can benefit from time spent out of school on educationally-related activities and accomplishments. Moreover, action on the part of parents, counselors, teachers, and schools can help students develop positive coping skills and realistic expectations of themselves, and help them overcome background conditions that might otherwise affect their chances of being successful in school [26]. The findings of this study revealed the significant impact of parental support on academic achievement as well as on the development of the self-concept of children. The results have reflected a developmental sequence, such that earlier family support processes enable the child to establish a better academic status and positive self-concept which then contribute to the maturation of his/her personality and career. Further, the study showed that parental support in doing homework and other academic activities has a significant impact on the academic performance of the students [27]. The students face a number of problems in developing positive study attitudes and study habits. It is empirical to give guidance to the student to improve their behavior towards their studies and study habits since it is directly proportional to their academic achievement. The guidance from the teacher also affects the student's performance. The guidance from the parents and the teachers indirectly affects the performance of the students [28]. More so, Fan demonstrated that parents'

educational aspirations for their children proved to be strongly related to student's academic growth. Based on the proof presented in the literature review, the second hypothesis of this study is:

H2: Parental guidance has a significant influence on the academic performance of the students learning CAD in a flexible learning program setting.

The Influence of Teacher Factor on the Academic Performance of the Student

Unusually, regular poor academic performance by the majority of students is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners [29]. Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the achievements of learners. According to Ayeni [30], teaching is a process that involves bringing about desirable changes in learners so as to achieve specific outcomes. In order for the method used for teaching to be effective, Adunola [29] maintains that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of the complexity of the concepts to be covered. Another study suggested that the teacher-centered and student-centered approach is still an effective strategy in improving students' academic performance [31]. The students' poor academic achievement in continuing education is the effect of the teachers' lack of motivation from school administration, lack of teaching and learning aids, lack of preparation on the part of the teachers, failure to mark the learners' assignments, and tardiness on the part of the teachers. Therefore, teachers perform better when they are motivated than when they are frustrated or unmotivated [32]. Based on the proof presented in the literature review, the first hypothesis of this study is:

H3: The Teacher factor has a significant influence on the academic performance of the students learning CAD in a flexible learning program setting.

The Influence of Learning Facilities towards the Academic Performance of the Student

Students' academic performances are greatly impacted by their facilities, and low performance is a direct result of inadequate facilities [33]. If students are just surrounded with enough facilities they are to use, then, it is expected that majority of them could score higher than those without enough resources. There are so many literatures tell that facilities are very important to be available for students to achieve good academic performance. Moreover, [34] the availability of classrooms and laboratories has a beneficial impact on students' academic performance, or the availability of more classrooms and laboratories does improve students' academic success. Based on the proof presented in the literature review, the first hypothesis of this study is:

H4: The learning facilities have a significant influence on the academic performance of the students learning CAD in a flexible learning program setting.

Statement of the Problem

This study aims to determine the influence of several factors affecting the academic performance of students taking Computer-Aided Designing (CAD) courses in flexible learning programs. This will give evidence to the policy-making body and the faculty members of the University on how to strengthen the flexible learning program delivery.

Specifically, this study aims to:

1. identify which of the following variables significantly influence the Academic Performance of the students taking CAD: (a) Learner factor, (b) Teacher factor, (c) Learning Facilities, and (d) Parental Guidance; and to
2. determine the explained variance of the four variables that influence the Academic performance of students in CAD.

METHODOLOGY

Research Design

This study used a survey research design to determine the influence of the four factors identified in the study on the academic performance of the students taking CAD during FLP. It further recognizes which among the factors brings significant contribution towards students' academic performance.

Research Location

This study was conducted at the University of Science and Technology of Southern Philippines (USTP) – Cagayan de Oro Campus. This University is located in the center of Cagayan de Oro City. It is one of the most competitive SUCs in Mindanao.

Population

The respondents of this study are college students who took the CAD during the implementation of the FLP. They are from the three colleges of the University namely the College of Engineering and Architecture (CEA), College of Science and Technology Education (CSTE), and College of Technology (COT), since, these students already experienced and adjusted their academic life in higher education. More so, this group already established stable emotional and academic performance and recently experienced the flexible learning program offered by the University.

Sample, Sampling Procedure, and Sample Size

The sample was selected from the target population who are enrolled in the University. Purposive sampling techniques were used in the study. Purposive sampling, also known as judgmental, selective, or subjective sampling, is a method that uses the researcher's judgment to choose the sampling units [35]. The respondents were selected based on the given criteria: a) first-year to third-year students in their identified college, b) must have taken CAD during a pandemic, c) enrolled in the university during the data collection – second semester of 2021-2022. Table 1 shows the demographic profile of the respondents.

The sample size was calculated using the G*Power. In this study, the researcher followed the advice of Hair, Risher, Sarstedt, and Ringle [36] that choosing the sample size should be based on power analyses that reflect the model structure, expected significance level, expected effect sizes, power level, and a number of predictors. When calculated, the minimum required sample size is 129. This study collected responses for 150 students. The sample size satisfies the sample size computation of G*Power.

Research Instrument

The instrument used in the study was culled from the different authors. It was composed of three sections: The first section was about the filtering question such as, a) Are you currently enrolled this semester at USTP? b) Are you enrolled in a CAD course?

Table 1. Demographic profile of the respondents (n=165)

Characteristics	F	%
Gender		
Female	78	47.3
Male	87	52.7
Year-level		
First Year	39	23.6
Second Year	24	14.5
Third Year	102	61.8
College where enrolled		
College of Engineering and Architecture	37	22.4
College of Science and Technology Education	41	24.8
College of Technology	87	52.7
Total	165	100

The second section was about the demographic profile of the respondents. The third section is composed of 25 questions adopted from different scholars to measure the learner factor and teacher factor were adopted from Aloz, Caranto and David [37], parental guidance [38], Teacher factor and learning facilities [39]. Each item is measured using a five-point Likert scale. A Likert scale is an ordered scale from which respondents choose one option that best aligns with their view. It is often used to measure respondents' attitudes by asking the extent to which they agree or disagree with a particular question or statement [40]. Constructed statements that will measure the research participants' responses will be adapted from a number of instruments and will be validated to test its validity and reliability. As measured using Cronbach Alpha (shown in Table 2), the research instrument showed a high level of reliability with all constructs measuring with a minimum value of .780 and the highest value of .842. The questions for each construct of this study are reflected in Appendix A.

Table 2. Reliability result of the research instrument

Construct	No. of Items	Cronbach Alpha
Learner Factor	10	.779
Teacher Factor	7	.780
Learning Facility	5	.842
Parental Guidance	3	.780

Data Collection Methods

The data for this study was taken from the respondents through the online survey. On the other hand, students' grade in CAD was the basis for their academic performance hence it was taken from the registrar's office following the standard process for acquiring such data. All data gathered were asked for permission from the registrar, deans, chairpersons, and Teachers s. The questionnaire link, in Google forms, was disseminated to the students through the help of the CAD teachers.

Data Analysis Technique

The main goal of this study is to determine the factor that could affect the academic performance of students in flexible learning programs. To analyze the data to answer the research question of the study, multiple linear regression was employed. Inferential analysis was used to determine the factors that influence the academic performance of the students. A p-value of less than 0.05 in the regression analysis indicates a significant influence of the factor identified in this study [41] on the Academic Performance of the students taking CAD during FLP. Prior to multiple regression analysis, statistical assumptions such as (1) linearity, (2) homoskedasticity, (3) independence of errors, (4) normality, and (5) independence of independent variables were met [42]

FINDINGS AND DISCUSSION

This study was conducted to explore the factors that influence the academic performance in CAD as perceived and experienced by Philippine state university students located in Northern Mindanao, Philippines. Four hypotheses were tested to check the effect of independent variables on dependent variables. Multiple regression analysis was used to test which of the four factors, namely: Teacher's characteristics, parental guidance, learner factor, and learning facilities, strongly influence the academic performance of the students in Computer-Aided Design course in a state university in Northern Mindanao, Philippines. A significant regression equation was found to be significant ($F(4, 160) = 164.704$, $p<.001$) (Table 3), with an explained variance of 80.0% (R^2=.800) (Table 4). Furthermore, the data analysis revealed that parental guidance ($\beta = .902$, $p<.001$) and learner factor ($\beta = -.091$, $p=.023$) significantly influence the academic performance of CAD students. Alternately, the learning facilities ($\beta = .010$, $p=.798$) and Teacher's characteristics ($\beta=-.047$, $p=.185$), do not significantly influence the academic performance of the students in CAD. Thus, hypotheses 1 and 4 are not supported in this study, while hypotheses 2 and 3 are supported (Table 5)

Table 3. ANOVA results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	249.669	4	62.417	164.704	.000[b]
	Residual	60.635	160	.379		
	Total	310.303	164			

a. Dependent Variable: GPA
b. Predictors: (Constant), Parental Guidance, Teacher's Characteristics, Learning Facilities, Learner Factor

Table 4 Model summary

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin-Watson
1	.894[a]	.800	.795	.62339	2.164

a. Predictors: (Constant), Parental Guidance, Teacher 's Characteristics, Learning Facilities, Learner Factor
b. Dependent Variable: GPA

Table 5 Coefficients results

	Unstandardized coefficient		Standardized coefficient	t-value	p-value	Collinearity Statistics		Remarks (Hypothesis supported or not)
	B	Std error	Beta			Tolerance	VIF	

1	(Constant)	-.377	.424		-.890	.375	-.377	.424	
	Learner Factor	-.193	.084	-.091	-2.303	.023	-.193	.084	Not Supported
	Teacher's Characteristics	.069	.052	.047	1.331	.185	.069	.052	Supported
	Learning Facilities	.021	.083	.010	.256	.798	.021	.083	Supported
	Parental Guidance	1.733	.068	.902	25.493	.000	1.733	.068	Not Supported

a. Dependent Variable: GPA

Investigating in detail the specific influence of each factor on academic performance, parental guidance is the most significant and has the highest effect on the academic performance of the students in CAD ($\beta = .902$, $p<.001$). This means, that the more the parents support the education of their children, the more the students excel in their academic performance. This finding agrees with the study of Chohan [27] and Malaran *et.al* [43] stating that parental support for their children's academic activities has a significant impact on the academic performance of the students.

The learner factor, on the other hand, has a negative significant influence on the academic performance of the student ($\beta =-.091$, $p<.001$). This implies that for every increase in the learner factors, there will be a corresponding decrease in their academic performance. To better understand the operational definition of the learner factor, Appendix A shows the question items asked for this construct. The findings of this study disagree with the report of Muktar and Kyauta [22] stating that study habits are the most important predictor of academic performance and global research has revealed that study habits affect academic performance. Meanwhile, Jafari, Aghaei and Khatony [44], showed that study habits have varying levels of influence on academic performance, from weak to desirable levels.

Finally, both learning facilities and teacher factors have a positive but not significant contribution towards the academic performance of students in CAD. The result could be attributed to the fact that in the university where the study was conducted during the time the data were collected, classes are done either through online or modular modality. The teacher's physical presence is not around, and the delivery of instruction is given through emails, messenger, or the university's LMS.

CONCLUSION

The factors that contribute to the success of the academic performance of students in CAD is explained by 80.0% of the factors identified in this study. This study proves that in a flexible learning modality, the support and guidance of the parents to the students play a vital role in the success of the students. While the learner factor has a significant influence, it has a negative influence on academic performance. The teacher factor and learning facilities factor are not significant contributors to the student's academic performance. This is because, the setting by which this study was conducted was an online or modular modality where the physical presence of a teacher is not around, nor the physical classroom is not the actual classroom.

SCOPE AND LIMITATION OF THE STUDY

This study mainly focused on the quantitative methodology. Hence, understanding the in-depth perceptions of the students regarding the results of this study is not cover. Furthermore, this study focuses on the perspectives and students in a Philippine state university who are taking Computer-Aided Designing courses. The findings of this study cannot be generalized to other areas of the discipline.

RECOMMENDATIONS

The positive and significant influence of parental support on academic performance implies that academic institutions should, more than ever will strengthen the collaboration between parents and academic institutions. It is interesting to note that this study revealed that as the students demonstrate time management and positive study habits, their academic performance would decrease. It is therefore recommended for future studies that an exploration of this phenomenon may be investigated. Finally, this study may be replicated by other students who are from another discipline.

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Appendix A. Question Items used in this study

Construct	Question Items
Learner Factor: In learning Computer-Aided Designing (CAD) during Flexible Learning Program (FLP), as student, I…	
LF1	study only when there is a quiz.
LF2	feel tired, bored and sleepy.
LF3	prefer listening to radio, watching TV, etc.
LF4	am lazy to study
LF5	am disturbed when studying
LF6	have no time to study at home
LF7	study only when I like
LF8	don't have a comfortable place to study
LF9	I copy the assignments of friends.
Teacher Factor: In learning Computer-Aided Designing (CAD) during Flexible Learning Program (FLP), my teacher…	
TF1	has mastery of the subject matter.
TF 2	discuss many topic in a short period of time
TF3	uses audio/visual aids
TF4	gives too much memory work.
TF5	provides varied activities
TF6	uses lecture method only
TF7	always scolds students
TF8	is frequently out/absent from class
TF9	is always late
Learning Facilities: In learning Computer-Aided Designing (CAD) during Flexible Learning Program (FLP), I have…	
LFaci1	gadget like laptop/desktop that can be utilized for online study.
LFaci2	gadget like android phone that can be utilized for online study.
LFaci3	fast internet (data or WiFi) connectivity at home.
LFaci4	a learning space at home that makes me comfortable for my study.
LFaci5	access to online resources such as YouTube, Google, etc. which help me in my study.
Parental Guidance: In learning Computer-Aided Designing (CAD) during Flexible Learning Program (FLP), my parents…	
PG1	help me every time I encountered difficulty in online learning.
PG2	provide me with emotional support especially during my downfall moments.
PG3	are enthusiastic about my academic progress.