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RESEARCH ARTICLE

Students' Online Learning Satisfacton in Relation to their Academic Performance in Mathematics

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Abstract: Students' satisfaction are indicators of academic success in relation to the student's performance in online learning. This study determined the predictors of students' academic performance at Misamis University, particularly Junior High School students. The total populations of junior high students were 415, and the target respondents were 200 students. The researchers used the descriptive-correlational research design and the Students' Online Learning Satisfaction Questionnaire (SOLSQ) as instruments. Mean, standard deviation, Pearson r , and Stepwise Regression Analysis were the statistical tools used. Findings revealed that students were highly satisfied with their online learning. They performed very satisfactorily in their online class. There was a significant relationship between the students' online learning satisfaction and their academic performance in mathematics. Teacher characteristics predicted students' academic performance in Mathematics. Knowledge and literacy in using technologies as a medium for instruction help teachers to be more effective in teaching online learning. The study recommends that teachers need to be digitally literate in using technology as a medium of instruction. Future researchers have to look into other factors that might contribute to the student's academic performance in online learning.

Keywords: academic performance in Mathematics, online learning, online learning satisfaction, teacher characteristics

1. Introduction

Online learning has become increasingly important as a new approach to education worldwide. Most higher education institutions are introducing online programs due to increased access to educational technology and the Internet, the flexibility of such programs, and the opportunities they bring to learners, instructors, and institutions (Miller, 2018). Unlike traditional classroom teaching, online teaching and learning occur in a virtual environment via the Internet (Khan, Egbue, Palkie, & Madden, 2017). In addition, online education seems to be the path many students take to secure a degree (Paul & Jefferson, 2019).

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environment via the Internet (Khan, Egbue, Palkie, & Madden, 2017). In addition, online education seems to be the path many students take to secure a degree (Paul & Jefferson, 2019).

Online learning is the utilization of communication and information technology with regard to education, which has seen intense research (Aldholay, 2018). Since its initiation, it has been recognized with various but comparable terms like “distance learning,” “e-learning,” and “blended learning.” It is described as conveying directives through the web using digital gadgets such as laptops, desktops, smartphones, and tablets. World over, governments are deploying it to endorse technology in the education domain (Alrajawy, 2017). Also, it comprises two types of learning: asynchronous and synchronous. Asynchronous online learning is identified as a flexible setting where learners set their own pace and do not include real-time interaction. At the same time, synchronous learning refers to synchronous courses that provide online learning environments that are very interactive and use web conferencing products. For example, synchronous distance education includes teacher-student interaction simultaneously at different locations (Archer & Garrison, 2018).

One of the challenges of online learning relates to students’ learning satisfaction with virtual classes. Student satisfaction is a widely used indicator in assessing the quality and effectiveness of online programs (Sampson, 2017). This operationalization relies upon the argument that when students report their satisfaction with a course, they assess the quality of their learning experience. A high level of student satisfaction can indicate timely and substantive interaction between students and their instructors. It may also indicate that the teaching methods strongly reflect learning goals and student expectations (Moore, 2017). Additionally, student satisfaction can influence student motivation and attitude, which may strongly influence how well students learn in a course (McFarland & Hamilton, 2017).

In Sakarya Universitesi, Turkey, motivation strongly predicted online learning satisfaction. Five constructs of motivation, including escape, social contact, desire to learn, self-development and academic progress, were significantly related to satisfaction (Shih, Chen, & Wey, 2017).

In Qatar, students may experience lower satisfaction, a lack of interaction with instructors and peers, and reduced motivation to do the required coursework (Alkhatib, 2018). This may be due to engineering programs’ unique demands for active and interactive laboratory sessions providing hands-on experiences and effective skills development (Potkonjak et al., 2017). For example, courses such as engineering design are rarely encountered in a full-scale online mode due to the need for technical skills and problem-solving abilities (Alkhatib, 2018).

There are more factors to consider when looking at students’ academic performance in Mathematics. Aside from natural items, such as a student’s academic track record or reported learning challenges, wrenches have been thrown into the mix due to online learning (Alonazi & Ahmed, 2018). Some additional factors affecting student performance in Mathematics pertain to the student’s environment, family status, and new teaching methods. The student’s situation at home is a greater factor than ever before now that students are spending more time at home and often learning remotely. Many students, who may have been successful in prior academic settings, might be struggling with new hybrid and online teaching environments. Students thrive when given opportunities to collaborate and converse with peers. They grow from classroom discussions and social interactions with classmates, both academically and socially. Now, they’re deprived of these opportunities to do so in person. This is not to say that discussions cannot be achieved virtually, but this success depends greatly on the teacher or facilitator to ensure their effectiveness (Chazen, 2020).

Students’ satisfaction is an indicator of academic success about the student’s performance in online learning. The mid-Atlantic University investigated whether very high levels of life satisfaction were associated with academic success at the college level (Antaramian, 2017). It

was revealed that students with very high life satisfaction were at a significant advantage over those with average life satisfaction in terms of academic performance in Mathematics, including greater student engagement, academic self-efficacy, approach-oriented achievement goals, and lower academic stress. The most satisfied students also earned higher Grade Point Averages (GPAs) than their less satisfied peers (Antamarian, Francis & Taylor, 2017).

In the Philippines, barriers such as lack of a good internet connection for participating in online activities, limited teaching aids in synchronous learning, and lack of available gadgets and equipment suitable for distance learning are the factors that inhibit students' satisfaction and engagement in learning online. Therefore, it can be concluded that both students and faculty members were not fully prepared to undergo full online learning. However, the faculties are doing their best to utilize the available resources and create online teaching strategies to meet the students' demands and needs.

The learner's satisfaction is an important factor in the success of any education program. Many researchers and educators are interested in online learning to enhance and improve student engagement and satisfaction in a virtual class. Hence, the researchers would like to determine the relationship between the students' online learning engagement and satisfaction in relation to their academic performance in Mathematics. This study mainly focuses on the Grade 9 students at Misamis University. Data gathered from this study will be additional information to the existing online class. They can be utilized as a basis to recommend effective ways of teaching in an online class to satisfy the learners' needs in education and help the students be more engaged in the virtual class at Misamis University.

2. Research Method and Materials [11pt, Garamond, Bold, Justified]

2.1. Research Design

This study used a descriptive-correlational design. The research method was used to explain phenomena, attitudes, opinions, behaviors, and other defined variables through collecting numerical data, which are analyzed using statistically-based methods (Kapici & Akçay, 2016). Therefore, the descriptive-correlational design would be appropriate for this study to determine students' academic performance predictors at Misamis University.

2.2. Research Setting

The study was conducted at Misamis University, Ozamiz City. Misamis University has 12 colleges offering 29 programs, including graduate programs, and has complete Basic Education programs. The university has undergone the most extensive academic transformation in its academic pursuit of excellence and a rigid Institutional Sustainability Assessment or ISA by Commission on Higher Education (CHED), awarded as Centers of Development for Teacher Education, Criminology, and Information Technology programs. The university also received awards from the Philippine Association of Colleges and Universities [PACUCOA] with the most substantial part of accredited programs for two years, recertified by DNV as having conformed to ISO 9001:2008 with a rating of excellent. Also, Misamis University is using an online learning modality with Microsoft Teams as the Learning Management System (LMS) to cater to the needs of the students in virtual learning. Microsoft Teams is a proprietary business communication platform developed by Microsoft as part of the Microsoft 365 family of products. This is where teachers and students conduct their classes in an asynchronous or synchronous schedule.

2.3. Respondents of the Study

The respondents of the study were Junior High School students at Misamis University. They were chosen through stratified sampling. The total population of junior high students was 415. Using a sample size calculator by Raosoft, our target respondents were 200 students. Selection of the participants was based on the following criteria: 1) students who

are enrolled in the Junior High School Department at Misamis University for the academic year 2020-2021; 2) students who completed their requirements in the second quarter; and 3) students who will give their full consent to serve as respondents of the study. Before the survey was conducted, the researcher ensured that all those criteria would be met.

2.4. Instruments

The study used the following instruments:

a. *Students' Online Learning Satisfaction (SOLS).*

It is a 15-item questionnaire with five constructs, adopted and modified from Davis (2014), designed to determine the students' online learning satisfaction. Responses were solicited using a five-point scale ranging from 5 (strongly agree) to 1 (strongly disagree). This was validated by experts and pilot tested to the education students who would be excluded in the study and must yield a Cronbach's Alpha coefficient of 0.70 and up. Hence, the instrument would be valid and reliable for the study. The instrument of SOLS shown on Appendix 1.

To determine students' level of online learning satisfaction, the following continuum was used:

Responses	Continuum	Interpretation
5- Strongly Agree	4.20-5.0	Very Highly Satisfied
4- Agree	3.40-4.19	Highly Satisfied
3- Neutral	2.60-3.39	Moderately Satisfied
2- Disagree	1.80-2.59	Less Satisfied
1-Strongly Disagree	1.0-1.79	Least Satisfied

b. *Students' Academic Performance in Mathematics.*

The researcher used documentary analysis using the second quarter grades of the students from their teachers. In determining the academic performance in Mathematics of the students, the following scale was used based on the DepEd grading system:

Rating	Interpretation
90-100	Outstanding (O)
85-89	Very Satisfactory (VS)
80-84	Satisfactory (S)
75-79	Fairly Satisfactory (FS)
74 and below	Did not Meet Expectation (DME)

2.5. Data Collection

In gathering the data, the researcher asked permission from the College of Education at Misamis University to conduct the study. Moreover, after the approval, the researcher asked permission from the Office of the Vice President for Academic Affairs (VPAA) to survey the selected respondents. After obtaining the permits, the researchers prepared a consent letter for the respondents. The researchers explained the importance of the study to the respondents. The data gathering was conducted on the school premises only. The researchers conducted and administered the survey questionnaires among the study's respondents to ensure complete cooperation with them and easier access for data retrieval. The data gathered were tallied, analyzed, and interpreted.

2.6. Ethical Considerations

To uphold the ethical aspect of this study, the researcher solicited the voluntary participation of the respondents. The respondents were assured that they would not be harmed in any way. Respect for the respondents' dignity was prioritized. Protection of the privacy of the respondents, an adequate level of confidentiality of the research data, and the anonymity of individuals participating in the research were ensured. Moreover, deception



and exaggeration about the aims and objectives of the research were avoided; affiliations in any form, sources of funding, and any possible conflicts of interest were declared. Finally, any communication about the research was done with honesty and transparency, and any misleading information and misinterpretations of primary data findings were avoided. The researcher asked the respondents to sign the informed consent as proof of their willingness to participate. And the participants can withdraw anytime if they find it necessary.

2.7. Data Analysis

The study used the following tools in analyzing the data gathered with the use of Minitab Software:

Mean and standard deviation. These were used to determine the students' online learning engagement, online learning satisfaction, and academic performance in mathematics.

Pearson r Product Moment Correlation Coefficient. This was used to explore the significant relationship between students' online learning engagement, students' online learning satisfaction, and students' academic performance in mathematics.

Stepwise Regression Analysis. It was utilized to identify the predictors in the independent variables of the student's academic performance in mathematics.

3. Results and Discussion

3.1. Students' Online Learning Satisfaction

Data in Table 1 revealed that, in general, the student's online learning satisfaction was high ($M = 3.50$; $SD = 0.92$). In addition, students were highly satisfied with online learning in terms of the effectiveness of the feedback, timeliness of the feedback, discussion boards, dialogue between teachers, and student and teacher characteristics.

This means that their teachers constantly provided effective feedback related to Mathematics in terms of clarifications, instruction, and sufficient explanations of the questions related to Mathematics. Also, timely feedback was constantly provided to the students, which helped them complete and improve assignments and be more focused on learning. Furthermore, through discussion boards, students become more comfortable participating in class, it is more convenient to their schedule, and they can have plenty of time to think about their responses for online discussions. In addition, students were able to communicate effectively with their teachers. And in terms of teacher characteristics, teachers possess technological skills, which make their teaching more interesting and creative.

Student satisfaction is a widely used indicator in assessing the quality and effectiveness of online programs (Sampson, 2017). This operationalization relies upon the argument that when students report their satisfaction with a course, they assess the quality of their learning experience. The effectiveness and timeliness of the feedback encourage students to think critically about their work and reflect on what they need to do to improve it helps them see their learning in new ways and gain increased satisfaction from it helps promote dialogue between staff and students (Nicol, 2010). Also, high student satisfaction can indicate timely and substantive interaction between students and their instructors. It may also indicate that the teaching methods strongly reflect learning goals and student expectations (Moore, 2017). Teachers possessing good qualities and characteristics increase students' satisfaction (Ali, 2011).

For students to be highly satisfied online, teachers need to constantly provide meaningful feedback to their students in terms of clarifications, instruction, and sufficient explanations on the questions related to Mathematics. Teachers giving timely feedback encourage students to be more active and highly satisfied with their online classes. Also, teachers need to use discussion boards to communicate with their students since it makes the students more comfortable to ask questions, and it is more convenient for both teachers and

students. Furthermore, dialogue between students and teachers needs to be practiced in online learning for them to communicate effectively. And for teacher characteristics, they need to be knowledgeable and skillful in using technology as a medium of instruction.

Table 1. Students' Online Learning Satisfaction

Online Learning Satisfaction	Mean	SD	QI
Effectiveness of the feedback	3.52	0.90	Highly Satisfied
Timeliness of the feedback	3.51	0.92	Highly Satisfied
Use of Discussion Boards	3.50	0.90	Highly Satisfied
Dialogue between teachers and students	3.46	0.93	Highly Satisfied
Teacher Characteristics	3.50	0.94	Highly Satisfied
Overall Satisfaction	3.50	0.92	Highly Satisfied

Satisfaction Level: 4.20-5.0 (Very Highly Satisfied); 3.40-4.19 (Highly Satisfied); 2.60-3.39 (Moderately Satisfied); 1.80-2.59 (Less Satisfied); 1.0-1.79 (Least Satisfied)

3.2. Students' Academic Performance in Mathematics

Data in Table 2 revealed that students' academic performance in Mathematics, in general, was very satisfactory (M=86.76). Student's academic performance in Mathematics was measured through written and performance tasks.

Written tasks are equivalent to 50 percent, which includes quizzes, assignments, and reflections. And performance tasks are equivalent to percent, which includes attendance and participation. The finding shows that the students performed very satisfactorily in their online learning.

Students' outstanding performance is attributed to several factors. One of these factors is the ability of teachers to create different online activities that would help engage learners in their online classes (Amid, 2018). On the other hand, the inability of the teacher to produce interactive activities and methods in teaching affects students' academic performance (Bawaneh, 2011).

For students to have outstanding grades, they need to be more attentive in class, participate in online activities, meet assignment deadlines, employ netiquette, and study lessons in Mathematics. In addition, teachers need to be flexible in creating different online activities that would engage learners in the online class.

Teachers are still responsible for providing the best services to students (Whitehead, 2016). With these, teachers must be equipped with skills and knowledge in using technologies to create online activities. And most importantly, they need to understand the nature of the learners, including their learning style and multiple intelligences, so they can plan activities and strategies that fit the learners' needs.

Table 2. Students' Academic Performance in Mathematics

Students' Academic Performance in Mathematics	Frequency	Percent
Outstanding (O)	69	34.50
Very Satisfactory (VS)	59	29.50
Satisfactory (S)	37	18.50
Fairly Satisfactory (FS)	27	13.50
Did not Meet Expectation (DME)	8	4
Overall Performance	M= 86.30	Very Satisfactory

Performance Scale: 90-100 (Outstanding); 85-89 (Very Satisfactory); 80-84 (Satisfactory); 75-79 (Fairly Satisfactory); 74 and below (Did not Meet Expectation)



3.3. Significant Relationship between the Students' Online Learning Satisfaction and Academic Performance in Mathematics

Data in Table 3 revealed that all of the areas in students' online learning satisfaction were found to be related to student's academic performance in Mathematics, namely: effectiveness of the feedback ($r=0.28$; $p=0.00$); timeliness of the feedback ($r=0.22$; $p=0.00$); use of discussion boards ($r=0.15$; $p=0.04$); a dialogue between teachers and students ($r=0.25$; $p=0.00$); and teacher characteristics ($r=0.26$; $p=0.00$).

This means that areas under students' online learning engagement, such as the effectiveness of the feedback, timeliness of the feedback, use of discussion boards, dialogue between teachers and students, and teacher characteristics affect students' academic performance in Mathematics. In other words, if the student is highly or least satisfied with their online learning, it affects their academic performance in Mathematics.

The effectiveness of the feedback affects the student's academic performance in Math by explaining what they are doing correctly and incorrectly, with the focus of the feedback on what the students are doing right. It is most productive to a student's learning when they are provided with an explanation of what is accurate and inaccurate about their work (Dinham, 2007). The timeliness of the feedback affects students' academic performance by giving immediate feedback. This deeply engages, motivates, and satisfies students in online learning (Damas, 2012). Also, using discussion boards helps create a social presence in an online course and a sense of community. Presence and community, in turn, can foster emotional connections. They also improve student learning and can create greater feelings of satisfaction with the course (Hattie, 2012). Dialogue between teachers and students affects academic performance in Math through an open exchange of perspectives that deepen students' understanding of an issue or topic. The dialogue process promotes analysis of course content and encourages reflection. Dialogues provide a means to encourage inclusive practices in online classes (Corwin, 2009). And lastly, a teacher's characteristics, influence, ideas, and expectations of his or her students' capabilities affect student academic performance and achievements. If teachers believe in their students, their students begin to believe in themselves. Students take into effect their teachers' beliefs about them and accept them as part of who they are and their abilities (Grichland, 2017).

Teachers need to explain what is accurate and inaccurate about the student's work and constantly give immediate feedback to students. Discussion boards need to be practiced in online learning so that it will be more convenient for teachers and students to communicate. Teachers must provide activities that allow students to share their opinions or perspectives about a topic. This can be in the form of oral recitation. Teachers need to be knowledgeable and skillful in using technology as a medium of instruction.

Table 3. Significant Relationship between the Students' Online Learning Satisfaction and Academic Performance in Mathematics

Variables	r- value	p-value	Remarks
Effectiveness of the feedback and Performance	0.28	0.00	Highly Significant
Timeliness of the feedback and Performance	0.22	0.00	Highly Significant
Use of Discussion Boards and Performance	0.15	0.04	Significant
Dialogue between teachers and students and Performance	0.25	0.00	Highly Significant
Teacher Characteristics and Performance	0.26	0.00	Highly Significant

Note: $p<0.01$ (Highly Significant); $p<0.05$ (Significant); $p>0.05$ (Not Significant)

3.4. Predictor of Students' Academic Performance in Mathematics

Regression analysis was used to explore the predictor of students' mathematics academic performance, resulting in p-values lesser than 0.01 alpha level. Data revealed that among the five factors in the students' online learning satisfaction, only one factor- teacher



characteristics ($= 1.92$, $t= 3.77$, $p= 0.00$) affects students' academic performance in Mathematics. Other factors like feedback effectiveness, timeliness, use of discussion boards, and dialogue between teachers and students do not affect the student's academic performance in Mathematics. Therefore, these factors do not predict students' academic performance in Mathematics.

The regression equation ($\text{Academic Performance} = 79.66 + 1.92 \text{ Teacher Characteristics}$) indicates that for every unit increase of the teacher characteristics, the student's academic performance also increases by 1.92. The data shows that only 6.70 percent of student's academic performance in Mathematics is attributed to students' online learning satisfaction with teacher characteristics. In comparison, the remaining 93.30 percent is attributed to other factors not included in the study. Thus, future researchers have to look into these factors that might predict the student's academic performance in Mathematics.

Teacher characteristics include teachers' literacy in using technology in online learning. Digitally literate teachers see technology for all of its creative potential rather than something they are mandated to do in a step-by-step fashion. Digital literacy doesn't require teachers to become experts, but it requires that they understand the digital tools that can unlock their deeper teaching potential (Reed, 2014). Also, teachers' modeling, support and encouragement, facilitating discussions, multiple communication modes, and required participation are the characteristics that predict students' academic performance in Mathematics (Maxwell & Shackelford, 2012).

Teachers need to be digitally literate in using technology as a medium of instruction. They need to be knowledgeable in using technology in their lessons, interactive activities, exams, projects, and other tasks. And as for the principal, she should mandate or encourage teachers, especially those unfamiliar with the different technological tools used in the virtual class, to attend webinars.

Table 4. Predictor of Students' Academic Performance

Predictor	Coef	SE Coef	T-Value	P-Value
Constant	79.66	1.84	43.32	0.00
Teacher Characteristics	1.92	0.51	3.77	0.00

$r^2 = 6.70\%$

Dependent Variable: Teacher Characteristics

Academic Performance = $79.66 + 1.916 \text{ Teacher Characteristics}$

4. Conclusion

Students averagely take part in online learning. They are convinced by the teacher's feedback regarding clarifications, instruction, and sufficient explanations of the mathematics-related questions. Within these, they got outstanding performance in written and performance-related tasks in Mathematics. Student's satisfaction with online learning affects their academic performance in a way that if the students are highly or least satisfied with their online learning, their performance in class will be affected. Teacher characteristics are the main factor that contributes to the student's academic performance in online learning, which means that teachers are digitally literate, facilitate discussions, and support and encourage the students to take part in every lesson in online learning.

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Appendix 1:

Students' Online Learning Satisfaction
(Modified and Adopted from Davis, 2014)

Directions: Below are the statements regarding students' online learning satisfaction. Please rate the following statements and indicate your response by clicking the number of column based on the following scale: 1= Strongly Disagree , 2= Disagree, 3= Neutral, 4= Agree, and 5= Strongly Agree

	5	4	3	2	1
A. Effectiveness of the feedback					
1. I am satisfied with my online learning experience in Mathematics because effective feedback related to my class work is constantly provided to me in terms of clarification for my questions about the course.					
2. I am satisfied with my online learning experience in Mathematics because effective feedback related to my class work is constantly provided to me in terms of instruction on how to fix incorrect problems in assignments.					
3. I am satisfied with my online learning experience in Mathematics because effective feedback related to my class work is constantly provided to me in terms of sufficient explanations on my specific questions related to my class work.					
B. Timeliness of the feedback					
1. I am satisfied with my online learning experience in Mathematics because timely feedback related to my class work is constantly provided to me so that I am able to complete my assignments efficiently.					
2. I am satisfied with my online learning experience in Mathematics because timely feedback related to my class work is constantly provided to me so that I am able to improve my assignments for better grades.					
3. I am satisfied with my online learning experience in Mathematics because timely feedback related to my class work is constantly provided to me so that I am more focused on learning.					
C. Use of Discussion Boards					
1. I am satisfied with my online learning experience in Mathematics because discussion boards make me more comfortable in participating than traditional modes of discussion.					
2. I am satisfied with my online learning experience in Mathematics because asynchronous discussions (where I can post my discussions at any time of the day) are more convenient to my schedule than traditional discussions.					
3. I am satisfied with my online learning experience in Mathematics because I have a plenty of time to think and draft my responses for online discussions.					
D. Dialogue between teachers and students					
1. I am satisfied with my online learning experience in Mathematics because I am able to communicate effectively with my teacher throughout the semester.					
2. I am satisfied with my online learning experience in Mathematics because online dialogue with my teacher helps me as I learn in the online course.					
3. I am satisfied with my online learning experience in Mathematics because I feel less distant in my online learning due to online dialogue with my teacher.					
E. Teacher Characteristics					
1. I am satisfied with my online learning experience in					



Mathematics because I still get the same explanation from online teachers as I do from traditional teachers.					
2. I am satisfied with my online learning experience in Mathematics because online instruction and traditional teachers offer the same amount of help with my learning issues.					
3. I am satisfied with my online learning experience in Mathematics because technology makes online teachers more creative in teaching than a more traditional classroom.					