



Perception of Student Learning in College Mathematics: Using Online and Face-to face modalities

4756

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Abstract

Before the pandemic, not all were receptive to have online classes, or it remained a contested issue. Meeting the challenges of the pandemic however paved the way towards accelerating the digitization of education globally. Taking a positive perspective, Taparia (2020) believes that the “the pandemic provided universities an opportunity to reimagine education around the pillars of access and affordability with the myriad tools and techniques now at their disposal.” The lessons learned --- advantages, weaknesses or limitations, and challenges of holding online teaching and learning during the pandemic serve as basis for strengthening and enhancing future educational programs of higher education as part of its strategic plans to meet the demands of the 21st century characterized by innovation, fast paced technological changes and a highly competitive global economy. College Mathematics subjects remains to be a very challenging area for college level students and this will remain thruought. The subjects involves logic and critical thinking analysis that is totally different from other subjects. Overall, combination of both online and face to face modalities creates better learning approaches.

Keywords: mathematics, online teaching, face to face, modalities, pandemic.

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I. Introduction

Before the pandemic, not all were receptive to have online classes, or it remained a contested issue. Meeting the challenges of the pandemic however paved the way towards accelerating the digitization of education globally. Taking a positive perspective, Taparia (2020) believes that the “the pandemic provided universities an opportunity to reimagine education around the pillars of access and affordability with the myriad tools and techniques now at their disposal.” The lessons learned --- advantages, weaknesses or limitations, and challenges of holding online teaching and learning during the pandemic serve as basis for strengthening and enhancing future educational programs of higher education as part of its strategic plans to meet the demands of the 21st century characterized by innovation, fast

paced technological changes and a highly competitive global economy. Rasiah et al. (2020), opined that the pandemic experience should serve as “an eye-opener and a not-so-gentle reminder to institutions of higher education, the need to develop effective and sustainable crisis and emergency planning, as it is increasingly becoming an expected feature of all institutions.”

After the pandemic, a course which needs more serious or in-depth investigation is the effectiveness of delivering mathematics whether online, face-to-face or a combination of both. Mathematics which had been taught online during the pandemic, provides an opportunity to find out some features which can be applied to enrich the learning experiences of students as universities return to face-to-face instruction. College Algebra, which is offered as a General



Education course is taken by students as a prerequisite to advance to preferred technical-related majors such Engineering, Medical and the like. Mathematics had been regarded as source of frustration and source of academic struggle for freshmen. Students cannot advance to higher courses without passing this subject, thus College Mathematics or College Algebra had been regarded as a “gate keeper.”

The global pandemic disrupts or even interrupts the education and learning of any students around the world. In many cases not all institutions are prepared to shift from the traditional face to face to online/hybrid or combination. In the workplace, industry or even in the corporate world things are totally different. Tawadrous, M.I, D.F. Antiado and F.G. Castillo (2016) did mention about using mobile platform in the workplace and it was fully implemented specifically in the human resource department. Also the use of mobile platform is very beneficial considering the generation of students are into this kind of platform.

This paper intended to explore students' perception of learning College Mathematics using both online and face-to face modalities (modified format) – the subject taught online, and assessments administered in a physical environment or classroom. As a response to crises like the pandemic, or unforeseen eventualities; and meeting the demands of the 21st century, efforts to develop, improve and/ further enhance students' quantitative reasoning, critical as well problem-solving skills by offering College Mathematics/College Algebra need utmost attention in higher education. With the emergence and use of AI technologies and big data analytics offering solutions and possibilities, innovative teaching methods in Mathematics are needed to respond to these global changes as part of the digitalization efforts of higher educational institutions (Vinogradova & Iakobiuk, 2020).

In relation to the purpose of the study, it attempted to find out the following:

1. Describe students' general assessment of learning College Mathematics using the modified format (taught online, and assessments administered face-to-face).
2. Identify the strengths and weaknesses of learning College Mathematics using the modified format (taught online, and assessments administered face-to-face).
3. Recommend strategies in the delivery of teaching Math using different modalities.

II. Review of Related Literature and studies

With the challenges and the nature of how College Algebra and/ Mathematics is taught, this review of related studies delved into how students perceived learning this course during pre-pandemic and during pandemic, and the approaches and/strategies or e-learning tools utilized in teaching the course using the online platform.

College Algebra or College Mathematics is perceived by most students as difficult and because of the possibility of a failing mark, it causes a lot of anxiety and fear. This course is a prerequisite or taken mandatory for most majors and/ to meet General Education requirements. When students fail, they would find themselves repeating the course once or twice or several times, thus College Algebra is regarded as a “gatekeeper.” To achieve satisfactorily in College Algebra is a challenge for both students and faculty (Nguyen, 2014; Ling Shing et al., 2014 and Love, 2018). Unlike other courses, Anderson (2020) and Cassibba et al. (2021) characterized teaching and learning mathematics as involving a tactile ritual - where one finds teacher and students working out numerical or quantitative problems and solutions on a blackboard. It uses a “chalk-and-talk method” (Ling Shing et al., 2014) and, face-to-face interaction and dialogue are essential components to enable students to understand and figure out hidden concepts using



mathematical formulas and/notations (Rao, 2020).

Learning and thinking mathematically is multi-modal which requires that language and the sensorial channels of vision, hearing, touch, and movement are sophisticatedly linked thus, learning mathematics is not solely a mental or cognitive activity (Radford, 2009). According to Castillo (2010) suggests that the process of ICT to be included in teaching pedagogy as all students are using different platforms in the course delivery.

Pre-pandemic: Students' Perception of Learning Mathematics Online

Math anxiety tends to affect students' academic performance in secondary and tertiary levels of education. It influences their decision to avoid careers that require heavy math, and feelings of inadequacy occur when computational skills are needed in daily life (Love 2018). To address the debilitating effect of students' negative perceptions or fear of Math and, improve academic performance of students starting collegiate level, online platforms using e-learning tools had been utilized. Combining the use of Facebook as an educational for discussion and Pearson Online Assessment to solve problem sets using complex mathematical symbols, tended to increase students' interest, ability to understand and gained more confidence in College Mathematics (Ling Shing et.al, 2014).

Homework provides more opportunity for students to reinforce knowledge and concepts learned in their learning environment - online or physical class. Students taking College Algebra who had high skills in arithmetic had been found performing better when homework are given online using the MyMathLab system, and students with low level arithmetic skill performed better in traditional paper homework (Mathai & Olsen, 2013). Apparently, the level of arithmetic skill of a student needs to be ascertained when giving a homework whether it is given online or the usual paper homework. On the other hand, (Burch & Kuo, 2010) pointed out that using a homework

online system (Pearson/Addison-Wesley's Course Compass) increases the retention rate and improves performance of students during exams in College Algebra. The use on homework online system allowed students to repeat, review and redo their assignments without being penalized and with problem hints they can work on their homework.

According to Umoh & Akpan (2014) utilizing blended e-learning tools enhanced students' interest and motivation towards college mathematics. Use of e-learning tools increase knowledge and understanding about the relevance and application of Mathematics in the students' future career and ability to respond to the needs of a diverse environment.

Graham and Lazari (2018) believe that College Algebra can be offered online with careful planning, management, and adequate resources. Evidently, Graham and Lazari (2018) compared the performance of students in College Algebra done in a traditional or classroom setting and in an online class. Based on the results of Final Examination (in a monitored setting) of the two groups, students performed better online however retention rate for the traditional class was higher. The lower performance retention rate of students for the online class had been attributed to the following factors: lack of preparation for a fast-paced instructional delivery; unable to manage time to meet the requirements of the course together with other courses and learning styles not fitting an online delivery of instruction.

The presence of student-teacher dialogue or interaction, and student-to-student virtual collaborations had been perceived as necessary in learning mathematics online among adult students (who had dependents, and/ holding full-time jobs and going back to pursue a college degree). Without these factors, it causes unfavourable learning experiences such as anxiety and dissatisfaction towards the course (Kilgore, 2018). Learning mathematics online, according to Kilgore (2018) attracts adult learners due to its accessibility and convenience - -- one can easily enroll, access course materials



with ease and flexibility of class schedules (self-paced).

During the Pandemic: Students' Perception of Learning Mathematics Online

The abrupt shift to an online learning platform due to the pandemic, have caught the academic community unprepared and posed many challenges. In line with learning mathematics online, students encountered the following (Bringula et al., 2021): 1) Technical challenges due to power interruptions, intermittent internet connection, etc.; 2) Personal or innate challenges the student faces such as procrastination, lack of motivation, etc.; 3) Domestic challenges or factors relating to home environment such as doing household chores, noise, doing errands, etc.; 4) Assessment challenges concerning immediate feedback, submission details, inadequate time to answer problems, unclear instructions; 5) Pedagogical challenges which refers to the inability of students to understand a topic; 6) Seeking consultations from friends of teachers, however unavailable. These challenges affected the mathematics self-concept of students. Notions of getting low grades, inability to understand the lesson and solve problem sets, not completing the course, unable to do better relative to their classmates and not enjoying their class were evident. Similar challenges had been experienced had been reported in the study conducted by Hyland & O'Shea (2021).

In the study of Hyland & O'Shea (2021), students perceived that Mathematics is a social subject thus, needs to be delivered face-to-face where interaction and communication between student and instructor, and among peers are necessary. Lack of support from their instructors and peers increased feelings of anxiety and feeling of isolation. Drawing mathematical notations to show how one arrived at problem solutions also caused difficulty in communicating online. Saving money traveling to and from the campus, the convenience which favoured their situation and accessibility to more resources were cited as the benefits of learning Mathematics online. When asked about the preference of learning online the

year ahead (future/ back to normal) with all the resources and support in place, forty seven percent (47%) wanted to their learning online; thirty percent wanted it in class or face-to-face; and the rest using blended approach.

4759

Mathematics is perceived as different from other disciplines – writing or drawing numerical scripts or mathematical notations online was pointed as a major barrier in communication and finding mathematics as highly abstract and perceived as “difficult,” students were unable to teach themselves without the guidance and/ support from their teacher or peers (Mullen, 2021). Teachers in a face-to-face learning environment commonly use the blackboard filling every space to scribble mathematical notations or symbols as they explain step by step how one arrives at a solution, however doing this online had been a big issue (Trenholm & Peschke (2020).

Ramadhani et al. (2021) conducted a study to find out the difficulties experienced by undergraduate students learning mathematics online during the pandemic which he characterized as “learning in an emergency situation.” The lack of competency or proficiency in the use of e-learning technology on the part of students made them perceive learning mathematics online as ineffective. The inability to use IT in the process of implementing online learning serve as obstacles for students to interact with classmates or peers and their instructors, being unable to address technical problems related to the learning systems and difficulty understanding instructional objectives. Taking e-learning of mathematics subjects with a lot of calculations and analysis, requires independence and creativity on the part of the student to understand a given task. Please take note that College Mathematics fall under General Education category therefore it is just a supporting subject/course in the major/concentration. According to Antiado, et al (2020) The value of general education as applied to their world and day to day experience is very much significant. Positive results can be expected if various mathematics learning software, online learning applications and online learning models



are utilized to develop students' online mathematics learning.

Another interesting point during pandemic is that the assessment is very difficult to measure considering it is online. Authentic learning is hard to gauge because of many parameters that may affect its validity. Therefore, innovative pedagogy as suggested by Castillo (2020) that it is an instructor's assistance given to students to acquire knowledge, skills and behavior upgrading. In long term any institutions are into total quality management (TQM) including teaching instruction. Furthermore, in another research study as explained by Castillo (2020) that there is a need to identify and apply the relevant concepts of TQM to every aspect of academic units and teaching and research is on top of the list.

III. Research Methodology

During the process on conducting the research study, various methodology was undertaken in order to ensure proper data was accomplished. Five research methods were used namely: experiment, survey, interview, observation and original data are incorporated in this research study. Survey method on the other hand was via Google forms in order to extract valuable information to its respondents in the study.

During the hype of pandemic COVID19, the questions are asked accordingly in order to determine the suitability of the teaching approach due to social distancing and other health protocols was implemented. Therefore, the challenge in implementing the questionnaire is significantly encountered. Using the Google form is the best option in conducting the research study and responses of the student's respondents. The following questions below are sent to the three (3) batches of students of 122. However, during the retrieval there are 89 students responded which is accounted to 72.95%.

Limited studies had been undertaken related to the teaching College Math online or face-to-face in the United Arab Emirates, thus this study is deemed relevant. Since the study is exploratory

and conducted in a semi-government academic institution, descriptive method had been utilized.

IV. Data Analysis, Results and Discussions

Initially, prior to carrying out the test of difference in the satisfaction on taking College Mathematics online across Learning modality, Age Group, and Gender, the assumption that the data come from a normal distribution must be established. The following questions were incorporated as part of the research study on College Mathematics. The socio demographics of the respondents are the following:

4760

There are 53 males and 36 females accounted to 59.6% and 40.4% respectively. While the age range is 17 to 39 years old with more than 70% below 25 years old accordingly. The average working experience of the respondents is 5 years.

1. Overall, I am satisfied with taking COLLEGE MATHEMATICS online. The respondents responded with the following answers below:

% Valid	Interpretation
34.8%	Strongly Agree
34.8%	Agree
18%	Neutral
6.2%	Disagree
4.4%	Strongly Disagree

Table No. 1 Responses on Taking Online

Based from the responses above with a combined 69.6% are satisfied in conducting the College Mathematics online. Maybe this is because online is the only possible solution during the pandemic. However, during the random interview majority of the respondents suggests that the course maybe taught online and face to face for convenient purposes. Other also suggested of pre-coding then application can be done thru online respectively.



At the time the research study was conducted was in the hype of pandemic COVID19 hence, the students are really worry about their studies and education in general. Another factor is that colleges and universities are not ready and equipped with online type of delivery. Plus, different colleges and universities are using different platform like Canvas, Moodle, Blackboard, Compass, Zoom etc. Different platforms have different advantages and disadvantages and more importantly the users (student) and professor will be able to use it at ease and properly.

2. On the question, "I prefer that the course is taught".

% Valid	Choices
37.1%	Completely Online
20.2%	Completely in a classroom setting or face to face.
42.7%	A combination of meeting in a classroom setting (face to face) and online.

Table No. 2 Course Taught (responses)

The respondents of the study prefer combination of classroom setting and online which is accounted to 42.7%, 37.1% completely online and 20.2% completely in a classroom setting or face to face respectively. The answers may influence the situation and scenario as pandemic brings the lecture to a hybrid type of instruction. Also a lot of factor to be consider like the facilities and infrastructure of the institution.

One of the purpose of the study is to "Describe students' general assessment of learning College Mathematics using the modified format (taught online, and assessments administered face-to-face). Table no. 2 shows mix and different reaction among students particularly on the delivery of the course. Somehow majority are more concern into the knowledge they will gain

as majority of them are into finance major. While human resources and management majors are not into quantitative or numbers related but to passed the course.

Therefore, the course expose them to numeric and arithmetic calculations that will help them both short term and long term.

3. What do you think is the greatest strength or advantage of taking COLLEGE MATHEMATICS online?

Common Answers	Estimate Response in %	Interpretation
Convenient	35 %	Positive
Accessible and we can watch again the video recording.	23 %	Positive
Safe at home and save money in travelling to university.	18 %	Positive
More time to focus on the exercises	15 %	Positive
No comment/others	9 %	-

Table No. 3 Responses on Greatest strength or advantage of taking online

Based from the open ended questions raised above, majority of the student respondents shows interest on the course to be delivered online. This is because during the hype of the pandemic COVID19, the United Arab Emirates are into lock down plus many residences are not travelling across each Emirates. The description of the answer in the open ended questions simply suggests that College Mathematics students



prefer taking the course online for many distinct reasons. 35% and 25% of the student respondents believed that the online is convenient and online platform can be viewed again and again contrary to face to face that it real time.

4. What do you think is the greatest weakness or disadvantage of taking COLLEGE MATHEMATICS online?

Common Answers	Estimate Response in %
Lack of Focus	34.83 %
Absorbing the information/ too much	28.08 %
Some technical issues/connections	21.34 %
No flaws/none	11.23 %
The lecture is clear	4.49 %

Table No. 4 Responses on weakness or disadvantage of taking online

Based from the responses, lack of focus accounted to 34.83% while absorbing the information/too much is 28.08% respectively. While some technical issues/connections at 21.34% and no flaws/none at 11.23%. The students also revealed that the lecture is clear despite the modes is online at 4.49%. This simply shows that the online was many issues to be faced. Same like face to face it will always surround by many concerns and challenges.

5. What do you think needs to be improved in learning COLLEGE MATHEMATICS online?

Common Answers	Estimate Response in %
More practice/exercises	26.96%
All aids/assistance provided	20.22%
More time for submission	16.85%
Nothing to improve	14.60%
Longer time for lecture	11.23%
Reduce the topic	10.11%

Table No. 5 Needs to be improve in learning College Mathematics Online

The global pandemic Covid19 disrupts if not interrupts the education and learning process globally. This means majority if not all academic institution will heavily rely on online type of delivery of class lecture and discussion. Student suggests that more practice/exercises accounted 26.96% is necessary and they conclude that all aids/assistance are provided to them at 20.22%, more time for submission at 16.85%, nothing to improve 14.60%, longer time for lecture at 11.23% and reduce the topic at 10.11%. Students need support during this online lecture delivery therefore the support exceeded their expectation.

Furthermore, the research study undergone series of test to conform to its significance and implication. Hence, the One-sample Kolmogorov-Smirnov Test was employed.

1. Do Satisfaction differ based on Learning Modality?

		Satisfaction	Modality
N		89	89
Normal Parameters ^{a,b}	Mean	3.85	2.06
	Std. Deviation	1.163	.896
Most Extreme Differences	Absolute	.247	.281
	Positive	.162	.251
	Negative	-.247	-.281
Kolmogorov-Smirnov Z		2.326	2.649
Asymp. Sig. (2-tailed)		.000	.000

a. Test distribution is Normal.
 b. Calculated from data.

Table No. 6 Assumption of Normality

The Kolmogorov-Smirnov shows that the p value is .000 (reported as $p < .001$) which is less than 0.05. We therefore have significant evidence to reject the null hypothesis that the variable follows a normal distribution.

Modality	Mean	N	Std. Deviation	Minimum	Maximum
1	4.58	33	.792	1	5
2	2.72	18	1.320	1	5
3	3.76	38	.883	1	5
Total	3.85	89	1.163	1	5



ANOVA Table						
			Sum of Squares	df	Mean Square	Sig.
Satisfaction * Modality	Between Groups	(Combined)	48.581	2	20.290	.000
		Linearity	10.515	1	10.515	.001
		Deviation from Linearity	38.046	1	38.046	.000
Within Groups			78.540	86	.913	
Total			119.101	88		

Measures of Association				
	R	R Squared	Eta	Eta Squared
Satisfaction * Modality	-.297	.088	.584	.341

Table No. 7 Test of Difference in Satisfaction

Comparing the means of satisfaction of the three learning modality groups, all p- values (Sig.) returned values that are reported as $p < 0.001$, that is less than the significant level of 0.05. This goes to show that there is evidence of difference in the levels of satisfaction between and within the three learning modality groups.

One-Sample Kolmogorov-Smirnov Test			
		Satisfaction	Age
N		89	89
Normal Parameters ^{a, b}	Mean	3.85	2.20
	Std. Deviation	1.163	1.416
Most Extreme Differences	Absolute	.247	.287
	Positive	.162	.287
	Negative	-.247	-.188
Kolmogorov-Smirnov Z		2.326	2.709
Asymp. Sig. (2-tailed)		.000	.000

a. Test distribution is Normal.
 b. Calculated from data.

Table No. 8 Test of Difference in Satisfaction

This shows that the no significant par value that affects the normal parameters valued at 3.85 mean and age group remains to be subjective in terms of extreme differences as to the positive and negative most extreme differences. Furthermore, the satisfaction according to age group is high when the respondents is of young age as compared to more aged student respondents.

Satisfaction					
Age	Mean	Ni	Std. Deviation	Minimum	Maximum
1	3.78	36	.929	1	5
2	3.66	29	1.344	1	5
3	4.00	6	1.549	1	5
4	4.44	9	.882	3	5
5	4.17	6	1.602	1	5
6	4.00	3	1.000	3	5
Total	3.85	89	1.163	1	5

ANOVA Table						
			Sum of Squares	df	Mean Square	Sig.
Satisfaction * Age	Between Groups	(Combined)	5.272	5	1.054	.575
		Linearity	2.653	1	2.653	.169
		Deviation from Linearity	2.619	4	.655	.752
Within Groups			113.830	83	1.371	
Total			119.101	88		

Measures of Association				
	R	R Squared	Eta	Eta Squared
Satisfaction * Age	.149	.022	.210	.044

Table No. 9 Satisfaction according to Age Group

Comparing the means of satisfaction of the different age groups, all the p-values (Sig.) were reported as higher than the significant level of 0.05. This implies not enough evidence of difference in the levels of satisfaction between and within the different age groups. This is evident in the close ranges of scores reflected in the above table of means. Using the satisfaction, Anova table and measures of association above, that age is factor in determining the satisfaction of the course delivery.

Mann-Whitney Test

Ranks				
	Gender	N	Mean Rank	Sum of Ranks
Satisfaction	1	53	45.95	2435.50
	2	36	43.60	1569.50
Total		89		

Test Statistics ^a	
	Satisfaction
Mann-Whitney U	903.500
Wilcoxon W	1569.500
Z	-.443
Asymp. Sig. (2-tailed)	.658

a. Grouping Variable: Gender

Table No. 10 Test of Difference in Satisfaction

Furthermore, the research study uses Mann-Whitney Test to determine if there is a difference in the dependent variable for the two independent groups. The results, indicate that there are no differences in the distribution of the responses between male and female as to the satisfaction of the course identified. Between the mean scores of Male and Female respondents, although the ranks showed a difference, there is not enough reason to believe that there is a difference in the levels of satisfaction across gender. This can be seen in the p-value (Asymp. Sig) of 0.658 which is way over the 0.05 significance level.

On the issue of choice of modality depend on age group? The age has been categorized below in groups.



Age * Modality Crosstabulation

Count		Modality			Total
		1	2	3	
Age	1	7	9	20	36
	2	13	6	10	29
	3	4	0	2	6
	4	5	2	2	9
	5	4	1	1	6
	6	0	0	3	3
Total		33	18	38	89

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.666 ^a	10	.082
Likelihood Ratio	19.285	10	.037
Linear-by-Linear Association	2.550	1	.110
N of Valid Cases	89		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is .61.

Table No. 11 and 12 Age Modality Cross tabulation and Chi Square Tests

In the preceding table, it can be seen clearly that the assumption for cells to have no count less than 5 is violated. Therefore, the Likelihood Ratio may be utilized to determine whether the choice of Learning Modality is dependent on Age or not. As reported in the above results, with a value of 19.285 which corresponds to a p-value of 0.037 which is less than the 0.05 level of significance, it is safe to claim that age is a determining factor in choosing the learning modality that is appropriate for them.

Conclusion and Recommendation

The global pandemic COVID19 change the world forever and not only that education sector is one of the industry affected the most. The instructions from face to face shifted from online or hybrid combination. This kind of practice became inevitable because it is the new normal in our modern day educational practice. Mathematics remains to be a very challenging subjects, course or discipline but its logic and contribution in moulding decision science and making is very significant. We have to understand that the basic purpose of teaching regardless of the discipline is to help students to learn. Students or person

learns from his own effort, abilities and experiences.

Effective teaching and learning depends upon the understanding of the nature of learner, the learning process as well as the learning situation. Those are some of the factors that may affect ability of learners to absorb and digest the knowledge, skills and abilities from the teacher. College Mathematics is a technical type of subject that is being taught by subject teacher/professor

Recommendation

Based from the results of the study, we recommend the following valuable insights to the institution for their evaluation and support.

1. Student maybe given degree of freedom in terms of submission subject to the college rules and regulations. During the semester many students faced health problems including Covid19 positive. Mitigating circumstances must also be observe in a case to case basis for the welfare of everyone.
2. Students may also given few days of submission in order to observe authentic learning. This will helo the students in working for their assignments and exercises on their own phase.
3. Some colleges and universities are also using open book examinations especially the course is a technical subject. This can be a good suggestion but needs further evalaution in order to ensure that rigor and learning willll be observe across discipline.
4. The use of MCQ's is very significant during online examinations therefore combination of other exam question types is important.
5. Regardless face to face or online, it is important that students learned something and link those knowledge into valuable insights to workplace or in business. This add value to their general knowledge in education and technology.
6. The pandemic Covid19 is temporary therefore, we must think that this online pedagogy help us to learned something with



the use platform and different digital technology.

7. College Mathematics is very important subject/course if not foundation in general education therefore, student must take the course seriously and equally important alongside with other subjects/courses.

Future Research Work

Future research related to mathematics and other discipline can be a good areas to explore with. However, this is very challenging considering that recovery and safeguard is in place due to this global pandemic. Student experience from other discipline is also a good starting point in order to compare student learning and experience. The use of different browser during examination can also be a good research area to detect student cheating and other forms of dishonesty while taking exams online.

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4765

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