Cognitive Effects of Online Learning to Health Programs Students of a Private Higher Education Institution in the Philippines

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Abstract

This study revolved around the cognitive effects of online learning to health programs. It aimed to profile the respondents in terms of sex, program, devices used, and residence; to determine the respondents' perceptions on the cognitive effects of online learning along entailing memory, critical thinking, comprehension and decision making; to discover the challenges encountered by the students in online learning; to know the significant difference of the responses when grouped according to profile variables and to present recommendations based from the findings. This research made use of the mixed methods design involving descriptive and comparative methods. The study was conducted for four months with 96 health programs respondents. The data were gathered through Google Forms. This study found that the majority of the respondents were female, enrolled in BS nursing, using both laptops and smartphones and are located in Nueva Vizcaya. The cognitive effects in terms of memory, critical thinking, and decision making were sometimes exhibited while effects along comprehension were usually demonstrated. Furthermore, the most prevalent challenges encountered by the students in online learning are environmental distractions and time constraint. There were no significant differences of the responses on the cognitive effects of the respondents when grouped according to the profile variables. The recommendations forwarded were using of app blocking applications, online information restricting platforms, evaluation of motivating factors and social support. The researchers recommend adding other socio-economic variables, increasing sample size, providing teachers with online-learning-related trainings and submitting coping strategies for review by authorities.

Keywords: comprehension, coping strategies, critical thinking, decision making, memory, online learning challenges, virtual classroom

1. Introduction

As the pandemic fast-tracked, many offices, organizations and institutions have all relied on the power of the internet to resume their operations and schools were not an exception. Colleges shifted into emergency mode, closing down campuses in an effort to prevent the spread of COVID-19 and transferring academic life online (Friedman & Moody, 2020). This sudden transition from face-to-face learning to online learning have had effects on the lives of students. In an online news article by Griffin Wiles (2020), he stated that with online class, students are prone to lack of motivation, procrastination, ineffective time management and minimized understanding of the presented lessons.

Online learning or online class, as most of people refer to it, is a type of education wherein students are not in the same location as the teacher or instructor or the other students unlike in the traditional type known as

face-to-face education where there is a physical classroom and teachers and students facilitate teaching and learning in the same location. In online courses, students attend class by visiting the class web pages. They accomplish assignments, tests and projects according to the class schedule. Students communicate with the instructor and classmates using e-mail and online discussion forums (Minnesota State Careerwise, 2015). According to Friedman and Moody (2020), online classes are characteristically a combination of lectures may it be recorded or live supplemented with readings and assessments that students can complete on their own time.

In the context of the Philippines, the Commission on Higher Education (CHED) responded by issuing guidelines on the implementation of flexible learning. The commission recognized that COVID-19 has brought unprecedented challenges in the life of many peoples around the world and that this had not been expected even rich individuals and nations. CHED then advances the shift in the teaching and learning process to flexible learning with the necessity of collaboration among stakeholders and strengthening the culture of sharing knowledge, resources and best practices. As defined, flexible learning is a pedagogical approach allowing flexibility of time, place and audience including, but not solely on the use of technology (CMO No. 4, s. of 2020).

Relative to CHED's mandate, Saint Mary's University weighed in and came up with their guidelines in virtual classes synchronously and asynchronously. It has proven its missionary nature as it has been so strong to provide, first and foremost, the needs of the studentry and employees. In April 2020, SMU suspended online classes and academic guidance to their students including instruction, quizzes, exams and other graded student outputs. To help its students who could not go home because of community quarantine restrictions and the suspension of public transports, the Office of the Dean of Students Affairs and Services (ODSAS) and the Lingkod Maria Community Development and Advocacy Center (LMCDAC) worked hard to locate these students and raised funds for their basic sustenance (Maslang, *et al.*, 2022).

Saint Mary's University of Bayombong, Nueva Vizcaya, one of the premier higher educational institution in the Northern Luzon, Philippines, responded to the challenges of flexible learning and the adjustment of relevant learning outcomes through its tagline Compassionate Teaching in CALMS (Saint Mary's University VPAA Circular 2, 2020). This means that the entire faculty and staff are committed through the SMU Course Augmenting Learning Management System. The core values of compassionate teaching are symbolically presented by 4 Cs – Communication, Clarity, Connection and Care. Hence, the school aligned its policies to the mandate of the Commission on Higher Education (CHED) regarding flexible learning and considered the welfare of students as its ultimate stakeholder.

On the part of the researchers, they initiated this specific study because they themselves have, at one point throughout the online learning process, experienced some noticeable cognitive changes that affected their academic lives. They also took into considerations the persistent voices of Marian students online may it be rants or posts in social media concerning their mental health and life changes they encounter due to online learning. This research was conducted to satisfy curiosity and to provide a better understanding about the cognitive effects of online learning. Critical thinking along with memory, comprehension and decision making are the four aspects of cognition that they studied. In particular, the researchers determined the: 1) perceptions of respondents on the cognitive effects of online learning along: Memory; Critical Thinking; Comprehension; and Decision making; 2) challenges encountered by students in online learning in terms of the aspects of cognition; and 3) significant difference of the cognitive effects of online learning on the respondents when grouped according to profile variables.

2. Methodology

The research employed quantitative approach using descriptive-comparative method. The technique in gathering data was through online survey questionnaire. The descriptive part dealt with the perceptions of respondents on the cognitive effects of online learning and challenges encountered by students. The comparative aspect was related to the significant difference of the cognitive effects when grouped according to profile variables which include sex, program, geographical location, and devices used in online learning.

This study was conducted at the School of Health and Natural Sciences of Saint Mary's University (SMU) located at Bayombong, Nueva Vizcaya, Philippines. This was an ideal research environment since it is one of the most competent schools in Nueva Vizcaya and at the same time, the researchers were enrolled at SMU- SHaNS which gives a clear advantage in terms of accessibility, availability and practicality involving data collection and persuasion of respondents.

There were ninety-six (96) undergraduate third-year students belonging to the School of Health and Natural Sciences (SHaNS) of Saint Mary's University who were enrolled in the second semester of school year 2020-2021. The 96 respondents were from the three departments of SHaNS. Specifically, 40 respondents were randomly selected from Bachelor of Science in Nursing, 32 respondents from Bachelor of Science in Medical

Laboratory Science, and 24 respondents from Bachelor of Science in Pharmacy.

This study used descriptive-survey method to provide and gather much needed data and information. The researchers used a questionnaire which was divided into two parts. The first part contained the profile variables which aimed to collect the basic information from their respondents namely sex, program, residence and devices used during online class. The second part contained the research variables namely memory, critical thinking, comprehension and decision making. By this, a 5-point Likert scale (never, occasionally, sometimes, usually, always) was used for gathering of responses in the part two of the questionnaire. Part of this instrument was synthesized from Memory Functioning Questionnaire (MFQ) by Gilewski and Zelinski (1988) and Multifactorial Memory Questionnaire (MMQ) by Troyer and Rich (2018).

The five-point Likert scale is a principle of measuring attitudes by asking respondents to respond to a series of statements about a topic, in terms of the frequency to which they agree with them (Mcleod, 2019). This research instrument was pilot tested to one class consisting of 50 students. In general, the pilot test yielded an excellent overall reliability (Cronbach alpha = 0.913) with acceptable reliability for memory (α = 0.607), excellent for critical thinking (α = 0.920), good for comprehension (α = 0.881), and acceptable for decision making (α = 0.696).

The statistical treatment for the perception of respondents on cognitive effects was through the presentation of mean and standard deviation with the 5-point Likert scale shown in Table 1.

Table 1. Five-point Likert scale for Cognitive Effects

Scale	Qualitative Description
1.00 – 1.49	Never
1.50 – 2.49	Occasionally
2.50 – 3.49	Sometimes
3.50 – 4.49	Usually
4.50 – 5.00	Always

For the comparison of the cognitive effects when grouped according to profile variables, Independent Samples t-Test was used for sex while One-way analysis of Variance (ANOVA) was employed for health program, residence, and devices used.

3. Results and Discussions

3.1 Perceptions of Respondents on the Cognitive Effects of Online Learning

3.1.1 Memory

Memory is the ability to store, retain, and subsequently recall information for a certain duration of time. (The Human Memory, 2019). Table 2 presents the respondents perceptions on how their memory is affected by online learning.

Table 2. Perceptions of Respondents on Memory

	Mean	SD	QD
1. I can remember the lessons, principles, and important information discussed in my subjects last week.	2.34	.88	Sometimes
2. I can remember the lessons, principles, and important information discussed in my subjects last month.	1.81	.86	Sometimes
3. I can remember the lessons, principles, and important information discussed in my subjects in the past six months.	1.36	.88	Occasionally
4. I have trouble remembering opening paragraphs, once I have finished reading.	1.77	.75	Sometimes
5. I have trouble remembering three or four paragraphs before the one I am currently reading.	1.63	.74	Sometimes
6. I have trouble remembering the paragraph before the one I am currently	1.46	.80	Occasionally

	Mean	SD	QD
reading.			
7. I have trouble remembering three or four sentences before the one I am currently reading.	1.48	.82	Occasionally
8. I feel that my memory is going downhill.	2.07	1.03	Sometimes
9. I have confidence in my ability to remember things.	2.01	.90	Sometimes
10. I worry that I will forget something important.	2.51	1.08	Usually
Overall Mean	1.84	.42	Sometimes

As shown in Table 2, the highest mean (2.51) that corresponds to the scale usually, this result means that the doubt that the participant will forget the ideas being imparted in that duration of time. In contrary the lowest mean (1.36) in memory that corresponds to the idea, information, and knowledge that were obtained by the participants in the past six months was occasionally remembered. Majority of the results yielded in the scale sometimes that stated most of the students have the capacity to remember from time to time the lessons being taught. In general, the study presented an overall mean of 1.84 and described as sometimes.

The results possibly imply two sides of a coin. First, the highest mean could indicate that some students could hardly cope with the demands of online learning affecting the duration of their memory in one semester which is similar to the answers of the respondents to the open-ended questions. Another factor would be the poor strategic learning, wherein students do not have the strong foundation to understand what are being taught.

3.1.2 Critical Thinking

Critical thinking is the ability to think clearly and rationally, understanding the logical connection between ideas (Skills You Need, 2011).

Table 3. Perceptions of Respondents on Critical Thinking

	Mean	SD	QD
1. I learn more about how to approach complex topics/ lessons in a variety of ways.	2.29	.91	Sometimes
2. I improve my ability to judge the value of new information.	2.26	.86	Sometimes
3. I develop a more open-minded and critical approach in interpreting, analyzing and judging new topics and lessons given to me.	2.44	.84	Sometimes
4. I develop a more focused and systematic way of thinking.	2.16	1.03	Sometimes
5. I have improved my reasoning skills like in answering open-ended questions on quizzes and exams.	2.14	1.02	Sometimes
6. Most assessments have stretched my intellectual abilities.	2.21	1.00	Sometimes
7. I learn to further explore ideas, theories, principles and procedures related to the subjects I am taking.	2.24	1.02	Sometimes
8. I learn more about how to analyze the key points and ideas in my subjects.	2.26	.99	Sometimes
9. I learn more about how to justify why certain procedures are undertaken in my subject area.	2.20	1.01	Sometimes
10. My interest in issues and questions related to my subjects and my course as a whole has increased.	2.23	.98	Sometimes
Overall Mean	2.24	.76	Sometimes

Table 3 shows that the common mean is 2.14 – 2.44 indicating that the critical thinking capabilities of the participants were *sometimes* progressive in online learning. This suggests that there would be an increased understanding of information in dealing with certain complex procedures, ideas, or topics. Thus, it gives an average mean of 2.24. The average mean is described as *sometimes*. The lowest mean which is 2.14 gives the possible reason that the students' reasoning skills were not greatly enhanced, but it also shows that there was

progress but not significant.

In contrast, the highest mean yielded is 2.44 and simply indicates that the development of open-mindedness and critical thinking judgment does not progress gradually and remain at the average level which is described as *sometimes*. The findings of the study showed that online learning provided a slight improvement in terms of critical thinking. In reference to the qualitative answers of the respondents, slight improvement may be due to the insufficiency of explanation and information about their lessons.

This finding is supported by some studies like Chang (2012), Maslang *et al.* (2021) and Damayon *et al.* (2022) which related that online learning could enhance critical thinking. It was also observed that the classes were determined to meet the criteria determined to promote critical thinking which are authenticity, community, reflection, and multiple perspectives. These are instrumental in making online learning contributory to the development of critical thinking skills among students.

3.1.3 Comprehension

Comprehension reflects the ability of the students to understand well the meaning or importance of something and it can also be the action or capability of understanding (Merriam-Webster Dictionary, 2021).

Table 4. Perceptions of Respondents on Comprehension

	Mean	SD	QD
1. I always make sure that I am in the mood when reading something	3.07	.98	Usually
2. I have learned to use context clues whenever I encounter unfamiliar words.	2.74	.93	Usually
3. I have learned to check first my dictionary whenever I encounter unfamiliar words in a sentence before proceeding to the next.	2.96	.98	Usually
4. I have developed my ability to summarize the idea when I am reading a text.	2.63	.95	Usually
5. I try to compare any situation in the text to my personal thoughts for me to easily remember the idea.	2.50	1.05	Usually
6. I strictly follow the rules in reading especially when encountering comma, apostrophe, dot and etc.	2.64	1.06	Usually
7. I try to connect the ideas of the text from the beginning up to conclusion.	2.58	.98	Usually
8. I evaluate my reading speed and pronunciation of every word to emphasize some thoughts in the text.	2.55	.93	Usually
9. I am a fan of re-reading the text.	2.12	1.04	Sometimes
10. I try to formulate questions and provide answers on it.	2.13	1.12	Sometimes
Overall mean	2.59	.70	Usually

Table 4 presents that the highest mean is 3.07 under the comprehension status. It portrays that the students ensured that they were in a good mood when reading which can also improve or help them to understand more the idea or the main point of what they were reading. On the other hand, the lowest mean is 2.12 which suggests students were not a fan of re-reading. The overall mean under comprehension status is 2.59 which is presented and described as usually.

The results could indicate that distance learning often requires students to work more independently than they are used to, so students need to adapt or adjust to the new way of reading strategies through the use of different platforms to interpret instructional texts effectively and based on their answers in Section 3, this is one of the most dominant challenges that is faced by students.

3.1.4 Decision Making

According to the University of Massachusetts Dartmouth (2016), decision making is the process of making choices by identifying a decision, gathering information, and assessing alternative resolutions.

Table 5. Perceptions of Respondents on Decision Making

	Mean	SD	QD

1.	I am subjective in decision making; opinion of others does not matter.	1.53	.96	Sometimes
2.	I let others decide for me for decision making is just a stressful matter.	1.08	1.02	Occasionally
3.	Before I decide, I always look at the pros and cons of the situation.	2.96	1.04	Usually
4.	Before deciding, I try to gather opinions and information that will help me choose the best one.	3.02	1.05	Usually
5.	I look for the fastest and simplest decision.	2.50	1.11	Usually
6.	I regret my decision in the end.	1.66	.98	Sometimes
7.	I am a type of person that changes my mind in the last minute of the day.	1.83	1.08	Sometimes
8.	I make sure that I am at peace and not controlled by anger or too much happiness when deciding.	2.59	1.05	Usually
9.	I avoid decision making.	1.03	.98	Occasionally
10.	I practice consistency in deciding what matters most	2.67	1.01	Usually
Overall mean		2.09	.45	Sometimes

Table 5 shows that the highest mean is 2.96 on the aspect of decision making, which indicates that the students were always looking for the pros and cons of any situation before deciding what to do. This conveys that the students look consider the consequences of their decisions. On the other hand, the lowest mean is 1.03 which indicates that most students were avoiding making decisions. The overall mean is 2.09 described as *sometimes*.

Based on the challenges encountered by the respondents stated in Section 3 of this chapter, the findings on this cognitive aspect perhaps showed that making a decision has a huge impact on the students and that having a decision was often preferable to not making one.

The general outcome of this study is supported by Galvis and Pedraza (2013). One of the definitions of tactic is strategy, technique, or method for achieving a desired goal or outcome. It is a matter of putting strategic investigation into practice in this situation. To that end, the paper provides guiding questions and principles for developing or revising instructional and organizational that can aid in decision-making. Making well-informed planning assessments helps decide on the right course of action for incorporating online learning as a supplement to other learning modalities.

3.2 Challenges Encountered by Students in Online Learning

3.2.1 Challenges in Terms of Memory

In terms of memory, the vast majority of the respondents expressed that they were experiencing poor information retention during online learning. In fact, among the 96 respondents, only three answered that they were not undergoing any challenges with their memory in online class. The challenges encountered by respondents in memory during online learning were clustered into four categories namely environmental distraction, plain forgetfulness, technological barriers/incapability and information overload. The most frequent challenges encountered in memory was categorized under information overload.

The responses may imply that some of the respondents experiencing problems with their memory during online learning were aware that there was a problem, but they were still not certain what was causing it in the first place. They just expressed their concerns but not able to explicitly point out the problem they were facing or experiencing.

3.2.2 Challenges Encountered in Terms of Critical Thinking

In terms of critical thinking, a greater number of respondents said they do not experience problems about it in online learning with 18 of them saying so as to only 3 who said they do not experience any problems at all in terms of memory. Still, majority of the respondents answered that they were indeed experiencing challenges in terms of critical thinking during online class. The challenges were clustered into four categories namely, time constraint, note and/or internet dependence, insufficient explanation/information about the lessons and lastly, environmental distractions.

Most of the responses fall under the category of insufficient explanation/information about the lessons with 28 out of 96 responses saying that the major problem the respondents were encountering in terms of critical thinking is the lack of explanation and/or information on lessons/topics.

3.2.3 Challenges Encountered in Terms of Comprehension

Regarding comprehension during online learning, the challenges encountered by the respondents were grouped into four categories. These were distraction, time constraint, difficulty in understanding complex reading materials, and technological barriers. Out of 96 respondents, 28 responded that they were not experiencing any challenge or problem with their comprehension in online class.

The failure of the teachers to provide supplementary and complementary information to the students who were expected to understand a reading material contributes to the difficulty of the students in exercising their comprehension to its maximum capacity

3.2.4. Challenges Encountered in Terms of Decision Making

In terms of decision making, 42 of the respondents answered that they were not facing any challenges in decision making in online learning while the remaining 54 respondents answered that they were facing at least one challenge in making their decision during online learning. For those who were experiencing problems, their responses of challenges were clustered into three categories namely, indecisiveness, pressure, and fear of making wrong decisions. For pressure, it involves peer, academic and time pressures experienced by the respondents.

3.3 Significant Difference of the Cognitive Effects When Grouped According to Profile Variables

3.3.1 Significant Difference of the Cognitive Effects in Terms of Sex

Table 6. Significant Difference of the Cognitive Effects in Terms of Sex

Cognitive Aspects	Sex	Mean	SD	QD	t	Mn Diff	Sig	Decision
Memory*	Male	2.16	.51	Sometimes	.876	.112	.383	Accept H_0
	Female	2.04	.55	Sometimes				
Critical Thinking	Male	2.31	.83	Sometimes	.533	.099	.595	Accept H_0
	Female	2.21	.74	Sometimes				
Comprehension	Male	2.50	.68	Usually	-.631	-.107	.529	Accept H_0
	Female	2.61	.70	Usually				
Decision Making*	Male	2.50	.58	Usually	.440	-.057	.661	Accept H_0
	Female	2.45	.52	Sometimes				

*Negative statements were reverse-scored.

The table reveals that there is no significant difference in the mean cognitive effects of the male and female respondents in memory (p = .383), critical thinking (p = .595), comprehension (p = .529), and decision making (p = .661). It can also be seen that there is an equal level in terms of memory, critical thinking, and comprehension in both male and female. However, in terms of decision making, there is a difference in levels where the level of males is described as *usually* while females fall under *sometimes.*

It greatly suggests that cognitive effects on both males and females are equal regardless of their biological differences hence they are both affected by the challenges brought by online learning to which everyone needs to adapt to in the new normal. In reference to the answers of the respondents to the open-ended questions, both male and female students were equally admitting that they are challenged cognitively.

The findings of the study are supported by Jäncke (2018) stating that both sexes are more similar in respect to many psychological functions, and it is also now clear how strong the influence of culture and social stereotypes is. In addition, the sex/gender differences in brain anatomy and brain function are less clear. There are some relatively strong but also many maybe moderate or even weak sex/gender differences in terms of brain anatomy and brain function.

3.3.2 Significant Difference of the Cognitive Effects in Terms of Program

Table 7. Significant Difference of the Cognitive Effects in Terms of Program

		Mean	SD	QD	ANOVA		df	F	Sig	Decision
Memory*	BSMLS	2.09	.633	Sometimes	Between Groups		2	.349	.706	Accept H_0

					df	F	Sig	Decision
	BSN	2.09	.525	Sometimes	Within Groups	93		
	BSP	1.98	.457	Sometimes				
	Total	2.06	.544	Sometimes	Total	95		
Critical Thinking	BSMLS	2.19	.656	Sometimes	Between Groups	2	2.910	.059	Accept H_0
	BSN	2.43	.829	Sometimes	Within Groups	93			
	BSP	1.97	.719	Sometimes					
	Total	2.24	.763	Sometimes	Total	95			
Comprehension	BSMLS	2.76	.660	Usually	Between Groups	2	1.970	.145	Accept H_0
	BSN	2.56	.681	Usually	Within Groups	93			
	BSP	2.40	.739	Sometimes					
	Total	2.59	.696	Usually	Total	95			
Decision Making*	BSMLS	2.58	.530	Sometimes	Between Groups	2	1.371	.259	Accept H_0
	BSN	2.39	.593	Sometimes	Within Groups	93			
	BSP	2.40	.409	Sometimes					
	Total	2.46	.534	Sometimes	Total	95			

*Negative statements were reverse-scored

The table shows that there is no significant difference in the memory, critical thinking, and decision-making functioning of the respondents with a common answer as *sometimes* and a mean score range of 1.50-2.49. In the comprehension aspect, there is no significant difference in the mean score ranges from 1.50-2.59 and 2.50-3.49 but there is difference between BSMLS and BSN with *usually* and BSP with *sometimes.* Nevertheless, based on the results, the computed p-values were all greater than 0.05 which relate that program has no bearing on the responses of surveyed students. This indicates that the cognitive challenges people face right now seem to be similar especially that everybody is facing the same circumstances today. In reference to the challenges encountered by the students in online learning, medical students have a limited amount of time through which to acquire working knowledge or an enormous amount of information.

The findings show that students belonging to health programs experience a wide variety of challenges in distance learning. According to the study of Al-Balas *et al.* (2020), technical and infrastructural resources reported as a major challenge for implementing distance learning, so understanding technological, financial, institutional, educators, and student barriers are essential for the successful implementation of distance learning in medical education. Another study claimed that wider integration of blended learning into pre-clinical undergraduate medical education could enhance the shift towards competency-based education and life-long learning among medical students. However, effective implementation would depend largely on student characteristics, as well as environmental and cognitive components of the delivery method (Venkatesh et al., 2019).

3.3.3 Significant Difference of the Cognitive Effects in Terms of Residence

Table 8. Significant Difference of the Cognitive Effects in Terms of Residence

		Mean	SD	QD	ANOVA		df	F	Sig	Decision
Memory*	Nueva Vizcaya	2.03	.529	Sometimes	Between Groups		2	1.497	.221	Accept H_0
	Quirino	2.50	.663	Usually						
	Ifugao/Mt.Prov	1.94	.723	Sometimes	Within Groups		92			
	Isabela	2.21	.324	Sometimes						
	Total	2.06	.544	Sometimes	Total		95			
Critical Thinking	Nueva Vizcaya	2.22	.77	Sometimes	Between Groups		3	.329	.804	Accept H_0
	Quirino	2.57	.56	Usually						
	Ifugao/Mt.Prov	2.30	.89	Sometimes	Within Groups		92			

		Mean	SD	QD		df			Decision
	Isabela	2.16	.64	Sometimes					
	Total	2.24	.76	Sometimes	Total	95			
Compre-hension	Nueva Vizcaya	2.60	.67	Usually	Between Groups	3	.612	.609	Accept H_0
	Quirino	2.87	.47	Usually					
	Ifugao/Mt.Prov	2.39	.92	Sometimes	Within Groups	92			
	Isabela	2.65	.64	Usually					
	Total	2.59	.69	Usually	Total	95			
Decision Making*	Nueva Vizcaya	2.42	.542	Sometimes	Between Groups	3	.438	.726	Accept H_0
	Quirino	2.45	.412	Sometimes					
	Ifugao/Mt.Prov	2.47	.635	Sometimes	Within Groups	92			
	Isabela	2.60	.441	Usually					
	Total	2.46	.534	Sometimes	Total	95			

*Negative statements were reverse-scored

The table above indicates that there are no differences between provincial residences for memory, critical thinking and decision making since the majority of their mean scores were in the scale of 1.5 to 2.49 which is described as *sometimes*. Except in comprehension wherein the responses from Nueva Vizcaya, Quirino and Isabela had mean scores inside the scale of 2.50 – 3.49 were described as *usually*. Respondents from Quirino province in terms of critical thinking also acquired a mean score falling under *usually*. Table 13 also shows that the computed p-values between groups are all greater than 0.05 which reveals that there is no significant difference of responses on the cognitive effects in terms of residence profile.

The data imply that the location of the students during their online class does not have any bearing on the challenges they face in terms of the four cognitive aspects. Furthermore, the results of the responses when grouped according to residence tells that students are more comfortable learning virtually in their own homes.

3.3.4 Significant Difference of the Cognitive Effects in Terms of Devices Used

Table 9. Significant Difference of the Cognitive Effects in Terms of Devices used

		Mean	SD	QD	ANOVA		df	F	Sig	Decision
Memory*	Smartphone only	1.91	.584	Sometimes	Between Groups		3	1.767	.159	Accept H_0
	Laptop only	2.25	.540	Sometimes						
	Smartphone & Laptop	2.05	.533	Sometimes	Within Groups		92			
	Others	2.31	.395	Sometimes						
	Total	2.06	.544	Sometimes	Total		95			
Critical Thinking	Smartphone only	2.19	.71	Sometimes	Between Groups		3	.233	.873	Accept H_0
	Laptop only	2.30	.88	Sometimes						
	Smartphone & Laptop	2.27	.72	Sometimes	Within Groups		92			
	Others	2.06	1.04	Sometimes						
	Total	2.24	.76	Sometimes	Total		95			
Compre-hension	Smartphone only	2.35	.78	Sometimes	Between Groups		3	1.348	.264	Accept H_0
	Laptop only	2.74	.74	Usually						
	Smartphone & Laptop	2.65	.61	Usually	Within Groups		92			
	Others	2.67	.82	Usually						
	Total	2.59	.69	Usually	Total		95			
Decision Making*	Smartphone only	2.29	.517	Sometimes	Between Groups		3	1.263	.292	Accept H_0
	Laptop only	2.40	.614	Sometimes						

Smartphone & Laptop	2.54	.532	Usually	Within Groups	92
Others	2.50	.424	Usually		
Total	2.46	.534	Sometimes	Total	95

*Negative statements were reverse-scored

The table showed that the computed mean of each of the cognitive aspects of online learning falls within ranges 1.84 to 2.08. Three of which namely; memory, critical thinking, and decision making were described as *sometimes* while the highest mean among the four cognitive aspects is comprehension that falls under *usually*. Overall, the computed p-values suggest that the devices used have no influence on any cognitive aspects of online learning.

These results may imply that the devices used by the respondents do not have any bearing on their responses about the cognitive effects. This may also suggest that the gadgets used during online class have the same or nearly similar performance and functions with each other even when they are of different kinds and models which is also supported by the answers of the respondents in the challenges, they encounter in online learning wherein there were no mentioned challenges concerning their gadgets.

This is contradicted by Ratnasari and Haryanto (2019) which found out that among all mobile devices used by students, smartphones proved to be the more favorable for the students for their online classes in the sense that they are more competent when they are using their mobile phones that when they are using laptops and desktop computers. These contradictions can be rooted on their time of publication when online classes are still novel and priorities for better gadgets are lower.

4. Conclusions

Majority of the respondents were female enrolled in the Bachelor of Science in Nursing program, residing in Nueva Vizcaya, and are using both smartphones and laptops in online learning. Overall, the respondents perceive that their memory, critical thinking and decision making are only affected by online learning sometimes while they perceive that their comprehension is more affected while learning online. Students' focus in online learning is highly influenced by their surroundings and they need more time in answering academic assessments/ tests and in comprehending their lessons. The students' perceptions on the cognitive effects of online learning along memory, critical thinking, comprehension, and decision making are not affected by the profile variables sex, program, residence, and devices used.

5. Recommendations

Future researchers can include additional profile variables such as socio-economic status which includes the ranges of monthly income, religion, ethnicity and the number of people living in the house which will help to identify the characteristics of population, their experiences, comfortability and availability of equipment. The inclusion of academic achievement will measure the cognitive ability of respondents and can be used to compare the students' performance of face-to-face class and distance learning. Since the respondents were only 11% of the population of School of Health and Natural Sciences in Saint Mary's University, the sample size can be increased. The study can be extended to other schools in the university. Teachers should be provided with online-learning-related trainings and seminars that can help them acquire better understanding about virtual education and their virtual students. These seminars can also help teachers be more technologically proficient that will help them continue to provide quality education online.

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