EDUCATUM JSMT Vol. 10 No.1 (2023)
ISSN 2289-7070 / e-ISSN 2462-2451 (71-79)
https://ejournal.upsi.edu.my/index.php/EJSMT/index

Regression model for students' learning style in distance statistics education

***Leomarich F. Casinillo**

Visayas State University, Baybay City, Leyte, Philippines

**Corresponding email: leomarichcasinillo02011990@gmail.com*

Published: 23 June 2023

To cite this article (APA): Casinillo, L. F. (2023). Regression model for students' learning style in distance statistics education. *EDUCATUM Journal of Science, Mathematics and Technology*, *10*(1), 71–79. https://doi.org/10.37134/ejsmt.vol10.1.8.2023

To link to this article: https://doi.org/10.37134/ejsmt.vol10.1.8.2023

Abstract

Students have different kinds of acquisition styles depending on their convenience in the learning environment. This study aims to look into the different kinds of learning styles (visual, auditory, and tactile) among students in learning statistics during the new normal at Visayas State University, Leyte, Philippines. In addition, the article tends to determine the various correlating factors that significantly influence their learning styles. Secondary data were utilized from an existing current paper in the literature and analyzed using standard descriptive statistics and ordinal regression. Results of the analysis showed that students' learning styles as visual, auditory, and tactile are rated "sometimes." This indicates that the learning ability of students is adversely affected by the pandemic. On average, students preferred a visual learning style during the new normal in their acquisition of distance statistics education. This means that students prefer to read visual representations like books, handouts, and modules, among others, of their lessons in statistics online. Regression revealed that younger students are more likely visual learners, higher family income governing the students to auditory learners, and the number of hours in studying and leisure time makes the students tactile learners. In conclusion, students must be provided with detailed learning materials for their statistics lessons, and encourage them to study by providing realistic and interesting activities. Furthermore, statistics teachers must show positive vibes to lessen the students' stress and advise the students a good time management on how to correctly study in that suits their learning styles during the new normal.

Keywords: Statistics education, learning style, regression analysis, college students, new normal

INTRODUCTION

During the COVID-19 pandemic, students at the college level are having a hard time understanding their lessons, especially in statistics [5], [6]. This is due to the obstacles brought by the health crisis wherein traditional face-to-face learning is changed to online learning. Online learning is a kind of distance education in which no proper interaction between students and professors [8]. In that case, the study habits of students are affected as well. Whence, a suitable and proper learning style is very vital to regaining the students' academic performance of students in statistics. In [17], a statistics course needs an analytical and logical mind which can be attained by the correct learning process. However, because of the challenges and distractions in the learning environment, students cannot focus, are less innovative, and are stressed in their current situation [24]. Study time is diminishing every time difficulties arise that includes internet problem connectivity, misuse of technology, household chores, online game influence, and many others. Apparently, the right study habits and learning styles may be a remedy for low performance in statistics. Therefore, studying the characteristics of the learning style of students might give useful information that can be an instrument to increase the productivity of learning statistics amid the pandemic.

Learning style is categorized into three types namely Visual, Auditory, and Tactile (kinesthetic) depending on the student's preferences [23]. It is stated in [11] that the learning style of students serves as a talent in identifying and processing the information in their meta-cognition. Apparently, students that have the capability to acquire a learning style that is convenient for them can easily improve their learning performance. In that case, a learning style that suits online learning can improve performance in statistics classes. In [7], statistics education at the college level is affected by the adverse impact of the COVID-19 pandemic wherein teachers cannot regularly and rigorously impart their knowledge. In fact, statistics is one of the courses at the tertiary level that is considered as difficult and technical to learn [6]. However, if a student is clever in studying their lessons despite the challenges and distractions amid the pandemic, they can still perform better and achieve logical mind in doing statistics problems. Students must determine their strength aspect and learning style that help them in doing their lesson activities by discovering their study procedures and ability. Therefore, to help these students, as well as the teachers, achieve successful statistics learning and teaching amid the pandemic, a study on learning styles is a good initiative to create elucidation and explanation of the current performance of students.

Learning style amid the COVID-19 pandemic is well-studied, however, it does not focus on the statistics online education. In addition, a study on the determinants of the learning style of students in statistics using the concept of statistical models has never been done especially in the University located in at rural area. Henceforth, to fill this research gap, this paper is realized. Generally speaking, this study aims to construct a statistical model that finds out the significant factors that influence the students' learning styles amid the new normal. In specific, the article looks into the answers to the following goals: (1) summarize the profile of students; (2) describe the learning styles of students statistics during online education; (3) construct a regression model to capture the factors that correlate the learning style in statistics online. The study hopes to provide insights that might be useful in enhancing the diminishing student performance in statistics online in the new normal. Results also may give useful information for statistics teachers in improving their strategies and in understanding their student's cognitive capability. Furthermore, this article may be used by other researchers in statistics education as a benchmark for another study and may serve as input to the body of educational assessment literature.

Conceptual Framework

Students' learning abilities can be categorized as visual, auditory, and tactile [23], [25]. Learning style is categorized into three types namely Visual, Auditory, and Tactile (kinesthetic) depending on the student's preferences [23]. Visual learning where students prefer graphical presentation, objects to visualize, color orientation, and can easily imagine things [15]. In [25], it is depicted that most of the international students in Malaysia prefer to learn visually, perhaps, because of language barriers. In auditory, a student is learning at their best in hearing they are good at remembering the concept based on what they hear [19]. According to the study in [20], auditory learners can easily learn and retain the lessons in their minds through the auditory presentation.

As tactile learners, they need physical activity to locate in order and learn the concept at their best by conducting a realistic activity or an experiment [2]. In fact, tactile is sometimes called multi-sensory learning since they hear and see to learn by conducting some physical activities and completing a task [19]. Generally, learning style is a variation of the ability of students to accumulate and assimilate knowledge [1]. During the pandemic, learning styles and satisfaction are affected by some factors during the pandemic that includes students' profiles and learning experiences [4]. Hence, the conceptual framework of this study aims to model the factors that govern the student's learning style amid the new normal. Furthermore, its goal is to provide a remedy on how to improve the student's academic performance and teaching strategies in statistics in the form of distance education.

METHODOLOGY

The Research Design

Complex-correlation research was used in this article to look into the determinants of the learning style of students in statistics online education. The of this design is to enable the researcher to model the best combination of predictors of learning style using cross-sectional data from the students. First, the research design describes the variables from the summarized version of the gathered data and used a statistical model to capture the significant correlates (independent variables) of the learning style as the dependent variable.

The Participants, Sampling procedure, and Ethics

The target participants in this article are the engineering students at Visayas State University (VSU) who took up "Engineering Data Analysis" subject in the academic year 2021-2022. Since the number of students is just manageable for the survey, then the researcher considered a complete enumeration as a sampling technique. However, students with no ideal age (24 and above) as sophomore college students were excluded. Hence, this study dealt with 127 students as participants. So that this study is morally right, an ethical procedure was strictly observed. First, the researcher made a letter of consent to the higher authorities at VSU to conduct the survey study. Next to that, personal permission to statistics teachers handling the said subject was done to officially conduct the survey to their students. Additionally, before the survey was conducted, students were informed about the purpose of the study, and they are also advised that no sensitive information will be collected. Moreover, they were educated that the data was only subject to research purposes and treated in high confidentiality to protect their reputations.

Research Instrument and Data Collection

Since the study was conducted during the pandemic lockdown of Universities, data collection was done through a Google form survey. The Google form questionnaire is in the form of semi-structured wherein it contains open-ended questions and questions with choices. There are two parts that the participants need to accomplish. First, they were asked about the demographic profile such as current age (years), sex (male or female), hometown (rural or urban), family income in Peso (monthly), having a laptop for online learning, number of hours in studying, leisure time to cope during pandemic (1 to 10 rating), social relationship with teachers (1 to 10 rating), and mental health in studying (1 to 10 rating). Secondly, students were asked about the learning style in statistics online in regard to visual, auditory, and tactile. The three types of learning styles were assigned eight (8) questions each which is a 3-point Likert scale and has the following option: Seldom, Sometimes, and Often. The three options for learning style were subjected to the following scoring guidelines [20]: “Seldom” is 1 point, “Sometimes” is 3 points, and "Often” is 5 points. Then the mean scores were obtained and the category with the higher mean perception score indicates what learning style a student belongs to. Table 1 shows the possible mean perception score and its corresponding students' responses.

Table 1 Students’ mean possible score and corresponding response

Mean possible score	Response
1.00 - 2.33	Seldom
2.34 - 3.67	Sometimes
3.68 - 5.00	Often

The questionnaire was validated by experts and found that it will capture the student's study habits and learning abilities. Plus, the questionnaire also underwent a reliability test and found that the three learning style questions obtained an acceptable [9] Cronbach's alpha (Table 1).

Table 1 Reliability test

Learning Style	Number of Items	Average Inter-item Covariance	Reliability Coefficient
Visual	8	0.43	0.72
Auditory	8	0.33	0.65
Tactile	8	0.22	0.71

After the students were informed about the purpose of the research, the Google form survey link was sent to students' email and they were given ample time to fill up the survey. In that case, they were given about two weeks, and then, the survey was stopped. Students who were not able to respond to the survey where automatically excluded from the list of participants.

Data Management and Analysis

When the Google survey was terminated, the data were extracted immediately and formatted to Microsoft Excel for clearing and removing outliers. After this, it was arranged to fit into the statistical program called STATA for the analysis. To give a description of the survey data, the standard statistical measures were computed such as mean average (M), a measure of dispersion called standard deviation (SD), minimum (Min), and maximum (Max) value. To capture the various determinants (Independent variables: students' profile) of three learning styles (Dependent variable: Overall mean visual, auditory, and tactile perception scores), linear regression analyses were constructed in the form of the ordinary least square (OLS) method. Moreover, in validating the results of the parameters of the model, diagnostic tests were obtained and tested at a 5% level of significance.

RESULTS AND DISCUSSION

Descriptive statistics for the profile of students

It can be gleaned from Table 2 that the engineering students' age is close to 20 (SD=0.89) years old and ranges from 18 to 23 years old. There are 62% female students and 38% male students in this engineering batch who took up statistics courses. Most (74%) of them are living in rural places and there are only 26% of these students who are residing in urban places wherein internet connection is more accessible. The monthly family income of these students is approximately 25444.09 (PHP) (SD = 32488.49 (PHP)), and the minimum and maximum are 2000.00 (PHP) and 250000.00 (PHP), respectively. About 83% of these students are now using laptops as their tool for online learning and a few (17%) of them are using cell phones for their lectures during the new normal setup. These students are studying their statistics lessons for about 6.85 hours (SD=9.72 hours) within a week, the least hour is 1, and the maximum number of hours is 70. These students are having some leisure time (M=6.63, SD=2.49) to cope with the stressful environment during the pandemic. And have an average relationship (M=6.19, SD=1.85) between them and their teachers concerning the classroom environment is a concern. Moreover, the pandemic and online class have impacted their mental health (M=4.87, SD=2.30) due to depression and anxiety.

Table 2 Descriptive measures for students' profile amid the pandemic

Independent variables	Mean	SD	min	max
Age of students in years	19.97	0.89	18	23
Sex: dummy variable (Male)	0.38	0.48	0	1
Hometown: dummy variable (Urban)	0.26	0.44	0	1
Family monthly income (PHP)	25444.09	32488.49	2000	250000
Availability of laptop: dummy variable (Yes)	0.83	0.38	0	1
Number of hours studying statistics (weekly)	6.85	9.72	1	70
Leisure time to cope from stress[a]	6.63	2.49	1	10
Social Relationship with statistics teacher[a]	6.19	1.85	1	10
Mental health[a]	4.87	2.30	1	10

Note: PHP - Philippine Peso; dummy variable - an indicator variable that is assigned with value 1 and 0 otherwise; a - 1 to 10 scaling.

The learning style of students

Table 3 presents that students often prefer visual aids (M=4.07, SD=1.42), taking down notes for visual studying (M=3.93, SD=1.44), and using to remember things in a picture representation (M=4.19, SD=1.27). This indicates that students are able to learn more about statistics if they have something to look at visually in their lessons. In [22], it is found that most students nowadays are visual learners who easily remember things through shapes, pictures, and other visual representations of the lessons. Likewise, it is also depicted in [10] that the visual learning style is preferred since students are more active and have experienced more engagement in the classroom as opposed to other learning styles. However, the rest of the characteristics of a visual learner is rated as "sometimes" by the students. Whence, as an overall result, students have rated their visual learning style as "sometimes" (M=3.53, SD=1.34) applied or preferred. Although visual learning style is the highest perceived by students in their statistics distance education, their study habits are affected by the adverse effect of the pandemic and some barriers to online learning [6]. As for auditory learning style, students "often" preferred to listen to a lecture-discussion in statistics (M=3.83, SD=1.22), to have explanations of visual figures and graphs (M=4.04, SD=1.40), and to listen to a lecture discussion rather than reading (M=3.66, SD=1.31) (Table 3). This implies that aside from visual representation, students need to listen to their teachers' discussions to grasp the statistics topic fully. It is worth noting that students can easily remember things if they hear them verbally to their teachers [18]. In the auditory learning style, teachers also can easily improve their teaching strategies through their speech and students can more likely improve their performance due to class interaction [21]. Apparently, other characteristics of auditory learning were rated as "sometimes" (Table 3). On average, these students have rated auditory learning as "sometimes" (M=3.36, SD=1.34) and come second to visual learning. This goes to infer that students need to have lecture discussions aside from the materials provided by their statistics teachers during the new normal. Table 3 also reveals that students can easily remember information by writing the concepts down (M=3.96, SD=1.31) which is considered a tactile learning style. This means that they can learn better if they do something to their lessons that involves kinesthetic. However, students do not prefer to chew gum or eat snacks while reviewing (M=2.21, SD=1.58) their lessons because it distracts them and hinders their understanding. And the rest of the tactile learning characteristics are rated as sometimes. This indicates that students need to do physical activities to learn effectively during the new normal. Note that online learning is quite boring since there is no proper interaction between students and teachers, hence, students need to be encouraged to participate in class discussions to do physical activities like writing and reciting which develops their creativity [8]. Plus, the tactile learning style is a multi-sensory learning since students need to hear and see things, and then, interact and execute a task to accomplish the learning process [14]. Overall, tactile learning is rated as "sometimes" by students and it is the lowest perceived among the other learning styles. This indicates that online learning during the pandemic has minimized the tactile learning activities in the classroom and students are more experiencing in reading and listening.

Table 3 Students learning style statistics online during the new normal

Statement	Mean	SD	Description[a]
Visual Learning Style			
1. I prefer to look at information written on the board, that is, by using visual aids	4.07	1.42	Often
2. I prefer to write information and take notes for visual studying.	3.93	1.44	Often
3. I prefer making graphs representations, tables and other charts	2.89	1.19	Sometimes
4. It is convenient for me to follow directions on a map representation.	3.09	1.28	Sometimes
5. I reading news article with pictures of maps and graphs	3.32	1.34	Sometimes
6. The best way to remember things is to make a picture representation	4.19	1.27	Often
7. I like working and solving mazes and jigsaw puzzles	3.13	1.35	Sometimes
8. I prefer reading to obtain the necessary information	3.63	1.28	Sometimes
Total	**3.53**	**1.31**	**Sometimes**

Auditory Learning Style			
1. I can easily remember by listening to a lecture-discussion.	3.83	1.22	Often
2. I prefer to have explanations of visual directions and graphs.	4.04	1.40	Often
3. I can easily recognize the sounds.	2.89	1.22	Sometimes
4. I can perform better on academic subjects by listening to lectures.	3.41	1.32	Sometimes
5. I can quickly learn and remember better by repeating words out loud.	2.89	1.54	Sometimes
6. I prefer to listen to a lecture and speeches.	3.66	1.31	Often
7. I prefer listening to the information on the radio	3.05	1.39	Sometimes
8. I can easily follow oral directions than written materials.	3.09	1.31	Sometimes
Total	**3.36**	**1.34**	**Sometimes**
Tactile Learning Style			
1. I prefer to make posters and practice in class.	3.65	1.42	Sometimes
2. I used to enjoy working with my hands or doing experiments.	3.66	1.43	Sometimes
3. I can easily remember information by writing things down.	3.96	1.31	Often
4. I used to play with coins in my pocket as a mind exercise.	2.59	1.56	Sometimes
5. I used to chew gum or eat snacks while reviewing.	2.21	1.58	Seldom
6. I easily learn the spelling of some words by "finger spelling".	2.56	1.45	Sometimes
7. I used to clench objects during learning periods.	3.05	1.58	Sometimes
8. I feel comfortable touching other people by hugging and handshaking.	2.83	1.51	Sometimes
Total	**3.06**	**1.48**	**Sometimes**

Note: a - See Table 1.

Regression Model for Students' Learning Styles

Table 4 shows the three regression models for the different learning styles of students in statistics during the new normal. Firstly, the models were subjected to diagnostic tests for ensuring their validity [3], [16]. The first two models (dependent variable: Visual (X^2=3.53) and Auditory (X^2=2.34)) are not heteroscedastic which indicates that their variances are homogeneous based on Breusch-Pagan test (p-values>5% level). However, the third model (dependent variable: Tactile) is found to be heteroscedastic (X^2=5.45, p-value=0.019), hence, the robust command was applied to correct the model. It is revealed by the Ramsey RESET method that the three models as no omitted variable bias (p-values>5%). Plus, the said models do not have a problem with multicollinearity between the pairwise of possible predictors, that is, the mean-variance inflation factor is less than 10. Furthermore, the first model (dependent variable: Visual (W=0.97, p-value=0.02)) possesses a non-normal residual while the other models (dependent variable: Auditory (W=0.99, p-value=0.97) and tactile (W=0.99, p-value=0.50)) has revealed a normal residuals. However, the K-density graph of residuals for the first model shows a close normality. Hence, the three constructed models for learning styles in statistics online are expected to provide reliable and valid results for argument. The three models (Model 1: F=0.99, p-value=0.45, R^2=0.07; Model 2: F=1.33, p-value=0.23, R^2=0.09; Model 3: F=1.38, p-value=0.20, R^2=0.08) is not significant at 10% level, however, the individual T-test revealed some significant factors governing the three learning styles of students in learning statistics online. In model 1, it shows that younger age (at a 10% level of significance) is a predictor of a visual learning style. This means that a younger student is more preferred to read information and concepts in statistics. In other words, these types of students can easily learn through reading and are more likely to perform in class [10]. For model II, a large family income can contribute to their auditory learning style (at a 1% level of significance) in statistics online. It is worth noting that students who have good family incomes can afford gadgets and other instruments that are suitable for auditory learning. Auditory learning is very important since they can easily remember the lessons through the speech or lecture-discussion of their teachers [18]. It is worth noting that teachers have a vital impact on the learning of students through their words of wisdom in actual discussions in statistics lessons [7]. Model 3 presents that the number of hours studying statistics (at a 10% level of significance) is influencing their tactile learning style. This implies that while they are studying, they used to do

something physical activities related to their statistics lesson. In that case, they preferred studying statistics in the way of hands-on and actual practice. In [14] and [12], it is depicted that students are interested to study their lessons if they are involved in human interaction and involve kinesthetic activities in their lessons such as monitoring and recording. Lastly, leisure activities to cope with stress (at a 5% level of significance) are also governing the tactile learning of students in statistics distance education. This goes to infer that leisure time is helping their studies in statistics to unwind and divert their attention from anxiety and depression due to the adverse impact of the pandemic on the educational system [13].

Table 4 Linear regression (OLS) models for the three types of learning styles in statistics distance education and its governing factors

Factors of Learning Styles	Multiple Linear Regression (OLS)		
	Model I (Visual)	***Model II (Auditory)***	***Model III (Tactile)***
Age of students in years	-0.154*	-0.025^{ns}	-0.007^{ns}
	(0.083)	(0.076)	(0.077)
Sex: dummy variable (Male)	0.171^{ns}	0.130^{ns}	0.106^{ns}
	(0.153)	(0.140)	(0.141)
Hometown: dummy variable (Rural)	0.072^{ns}	-0.011	0.159^{ns}
	(0.166)	(0.152)	(0.153)
log (Family monthly income (PHP))	0.226^{ns}	0.402**	0.211^{ns}
	(0.189)	(0.175)	(0.185)
Availability of laptop: dummy variable (Yes)	0.200^{ns}	0.245^{ns}	0.141^{ns}
	(0.186)	(0.171)	(0.187)
Number of hours studying statistics (weekly)	0.005^{ns}	-0.002^{ns}	0.008*
	(0.007)	(0.007)	(0.004)
Leisure time to cope from stress[a]	-0.004^{ns}	0.028^{ns}	0.055**
	(0.029)	(0.027)	(0.027)
Social Relationship with statistics teacher[a]	0.003^{ns}	-0.031^{ns}	-0.007^{ns}
	(0.041)	(0.037)	(0.039)
Mental health[a]	0.012^{ns}	0.038^{ns}	-0.010^{ns}
	(0.034)	(0.032)	(0.034)
Constant	5.328***	1.748^{ns}	1.782^{ns}
	(1.958)	(1.801)	(1.777)
Observation	127	127	127
F-test	0.99	1.33	1.38
p-value	0.453	0.231	0.203
Goodness-of-fit (R^2)	0.071	0.093	0.078

Note: PHP - Philippine Peso; Dummy variable - an indicator variable that is assigned with values 1 and 0 otherwise; a - 1 to 10 scaling; ns- not significant; *p-value<0.10; **p-value<0.05; ***p-value<0.01.

CONCLUSION

This study aimed to look into an argument that explains the learning style of students in distance statistics education during the new normal and captures its significant predictors. The results of this research depicted that students rating about visual, auditory, and tactile learning style is sometimes applied in their acquisition of statistics during the new normal. This indicates that the study habits of students are somehow affected by the adverse effect of the health crisis and the direct shift of the educational system into distance learning. Among the three types of learning styles, visual learning is the most perceived by students in studying their statistics lessons. This goes to infer that students are preferred to read visual materials for their lessons in statistics. On the face of it, they are more likely to learn when they read books, handouts prepared by their teachers, and other reading materials. The regression model (I) depicted that younger students are more likely visual learners in distance statistics education. In addition, the second model revealed that higher family income is a predictor of an auditory learner. This means that students who can afford gadgets that are suitable for auditory learning are more likely comfortable to learn statistics as opposed to students who cannot afford them. Moreover, the third model showed that the

number of hours in studying statistics lessons and leisure time makes the students tactile learners during the new normal. Students who spend more time studying statistics involve some physical activities while learning their lessons. Plus, students who apply leisure time to cope with stress are more likely to learn statistics in the way of doing practical things that involve kinesthetic activities. Conclusively, teachers must provide detailed learning materials for their statistics lessons and encourage them to study by providing realistic and interesting activities to accomplish for themselves. Additionally, teachers must show positive vibes or attitudes to lessen the student's anxiety and stress in distance learning. And teachers must give advice to the students regarding the right time management on how to study well in which suits their learning styles during the new normal. It is highly recommended that teachers must apply varieties of teaching strategies to motivate students learning engagement in corresponds to learning styles. Furthermore, in future research, one may investigate the students' interest and motivation in learning statistics online as a potential weakness of this current article.

REFERENCES

[1] Abante, M. E. R., Almendral, B. C., Manansala, J. R. E., & Mañibo, J. (2014). Learning styles and factors affecting the learning of general engineering students. *International Journal of Academic Research in Progressive Education and Development*, *3*(1), 16-27. http://dx.doi.org/10.6007/IJARPED/v3-i1/500

[2] Alhourani, A. Q. (2021). Investigating the match and mismatch between students' learning styles and teacher's teaching styles in a Saudi school: A case study. *Journal of World Englishes and Educational Practices*, *3*(2), 10-20.

[3] Allison, P. D. (2012). *Logistic regression using SAS: Theory and application*. SAS Institute. Retrieved from https://mycourses.aalto.fi/pluginfile.php/889996/mod_resource/content/2/Paul%20D.%20Allison%20-%20Logistic%20Regression%20Using%20SAS%20-%20Ch%202.pdf

[4] Basuony, M. A., EmadEldeen, R., Farghaly, M., El-Bassiouny, N., & Mohamed, E. K. (2021). The factors affecting student satisfaction with online education during the COVID-19 pandemic: an empirical study of an emerging Muslim country. *Journal of Islamic Marketing*, *12*(3), 631-648.

[5] Cassibba, R., Ferrarello, D., Mammana, M. F., Musso, P., Pennisi, M., & Taranto, E. (2020). Teaching mathematics at a distance: A challenge for universities. *Education Sciences*, *11*(1), 1-20. https://doi.org/10.3390/educsci11010001

[6] Casinillo, L. F. (2022). Modeling determinants of challenge in learning statistics in time of the COVID-19 pandemic. *Philippine Social Science Journal*, *5*(3), 131-139. https://doi.org/10.52006/main.v5i3.536

[7] Casinillo, L. F. (2022). On modelling student's resilience in learning statistics at a distance. The Palawan Scientist 14 (2), 85-93. https://www.palawanscientist.org/tps/on-modelling-students-resilience-in-learning-statistics-at-a-distance-2/

[8] Casinillo, L. F. (2022). Modeling creativity and enjoyment in learning statistics online in the new normal. *Philippine Social Science Journal*, *5*(4), 100-108. https://doi.org/10.52006/main.v5i4.601

[9] Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika, 16*, 297–334. https://doi.org/10.1007/BF02310555

[10] Halif, M. M., Hassan, N., Sumardi, N. A., Omar, A. S., Ali, S., Aziz, R. A., ... & Salleh, N. F. (2020). Moderating effects of student motivation on the relationship between learning styles and student engagement. *Asian Journal of University Education*, *16*(2), 93-103.

[11] Janakiraman, B. (2018). Assessment of visual, auditory, and kinaesthetic learning styles among postgraduate management students. *Asian Journal of Management*, *9*(2), 1031-1037. https://doi.org/10.5958/2321-5763.2018.00161.0

[12] Kayalar, F., & Kayalar, F. (2017). The effects of auditory learning strategy on learning skills of language learners (students' views). *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, *22*(10), 04-10.

[13] Lines, K. (2021). Quality lecturing is like a walk in the park: making learning more tactile and fun through location-based strategies. In *Games, Simulations and Playful Learning in Business Education* (pp. 216-225). Edward Elgar Publishing. https://www.elgaronline.com/display/edcoll/9781800372696/9781800372696.00026.xml

[14] Luo, Y., Li, Y., Sharma, P., Shou, W., Wu, K., Foshey, M., ... & Matusik, W. (2021). Learning human–environment interactions using conformal tactile textiles. *Nature Electronics*, *4*(3), 193-201. https://www.nature.com/articles/s41928-021-00558-0

[15] Machromah, I. U., Ishartono, N., Mirandhani, A., Samsudin, M., & Basry, W. (2021). PISA Problems Solving of Students with a Visual Learning Styles. In *Journal of Physics: Conference Series*, 1720(1), 012010. https://doi.org/10.1088/1742-6596/1720/1/012010

[16] Mátyás, L., & Sevestre, P. (Eds.). (2013). *The econometrics of panel data: Handbook of theory and applications* (Vol. 28). Springer Science & Business Media. Retrieved from https://link.springer.com/book/10.1007/978-94-009-0375-3

[17] Miñoza, S. B., & Casinillo, L. F. (2022). Profiling Bachelor of Science in Statistics (BSS) students under the open enrolment policy. *IJIET (International Journal of Indonesian Education and Teaching)*, *6*(1), 1-24. https://doi.org/10.24071/ijiet.v6i2.3723

[18] Moore, D. R., Halliday, L. F., & Amitay, S. (2009). Use of auditory learning to manage listening problems in children. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1515), 409-420. https://doi.org/10.1098/rstb.2008.0187

[19] Mourtzis, D., Angelopoulos, J., & Panopoulos, N. (2021). Smart manufacturing and tactile Internet based on 5G in industry 4.0: challenges, applications and new trends. *Electronics*, *10*(24), 3175. https://doi.org/10.3390/electronics10243175

[20] Moussa, N. (2018). Learning Styles and the Adoption of Modern Technology among Adult Learners. *Institute for Learning Styles Journal*, *1*, 11-21. https://www.auburn.edu/academic/cla/ilsrj/latestissue.htm

[21] Munna, A. S., & Kalam, M. A. (2021). Teaching and learning process to enhance teaching effectiveness: a literature review. *International Journal of Humanities and Innovation (IJHI)*, *4*(1), 1-4. https://doi.org/10.33750/ijhi.v4i1.102

[22] Muslim, F., Ekawarna, E., Ramalia, A., Wirayuda, R. P., & Chen, D. (2022). Learning Intensity and Visual Learning Style on Learning Outcomes. *Journal of Education Research and Evaluation*, *6*(2)., 385-396. https://doi.org/10.23887/jere.v6i2.40312

[23] Syofyan, R., & Siwi, M. K. (2018, July). The impact of visual, auditory, and kinesthetic learning styles on economics education teaching. In *First Padang International Conference On Economics Education, Economics, Business and Management, Accounting and Entrepreneurship (PICEEBA 2018)* (pp. 114-121). Atlantis Press. https://www.atlantis-press.com/proceedings/piceeba-18/25902648

[24] Valenzona, J. V., Casinillo, L. F., & Casinillo, E. L. (2022). Modeling students' innovativeness and its factors in learning mathematics amidst COVID-19 pandemic. *The Palawan Scientist*, *14*(1), 43-50.

[25] Wahyudin, A. Y., & Rido, A. (2020). Perceptuals learning styles preferences of international Master's students in Malaysia. *BAHTERA: Jurnal Pendidikan Bahasa Dan Sastra*, *19*(1), 169-183. https://doi.org/10.21009/bahtera.191.10