Evaluating Tertiary Learners' Learning Preferences in Post-Pandemic Era

Surindar Kaur A/P Gurmukh Singh[1], Yeoh Hong Beng[1], Wei Chooi Yi[1], Malvin Kaur a/p Kunden Singh[1], A.Avene a/p Atputharaj[1]

[1] Universiti Tunku Abdul Rahman, Malaysia
surindar@utar.edu.my

Abstract. The rapid expansion of new online teaching and learning technologies has led to a change in the learning and teaching process of tertiary learners particularly during Covid-19 pandemic. With this paradigm shift, tertiary learners' learning preferences are to be re-evaluated in this research. The research design deployed is quantitative research via questionnaire adapted from VARK inventory. A total of 165 tertiary learners from Science and Social Science streams in a northern region of Malaysia were identified using multi-staged cluster sampling technique and involved in the research fieldwork. The research concludes that tertiary learners irrespective of their gender and areas of study prefer only one domain instead of the mixture of visual, audio, read/write and kinesthetics learning preferences. More specifically, they prefer to learn via kinesthetics related activities, including hands on and problem- solving tasks. Besides, the distribution of visual, audio, read/write and kinesthetics learning preferences among tertiary learners are not significantly related to their gender and areas of study. These research results provide an insight to educators to plan and execute more effective teaching methods in order to facilitate more effective learning among tertiary learners in the post pandemic era.

Keywords: VARK inventory, Learning preferences, Tertiary learners.

1 Introduction

There have been significant changes in the education field since the infusion of technology. With the paradigm shift, the conventional teaching method is no longer applicable to the current generation whose lives revolve around social media. Online teaching and learning technologies have been utilized by educators and learners mainly to share resources apart from face-to-face learning. On the other hand, Covid-19 pandemic has accelerated reliance of learners on technology in their learning process over the past three years.

Teaching and learning have always taken place within the confines of the classroom before the pandemic. However, there was a temporary shift to emergency remote learning during the pandemic. Learners were forced to quickly adapt to online learning. Educators who were not technology savvy were also pressured to be familiar with the online tools. In the turmoil of the crisis, learners were the ones who had to bear the

brunt of the sudden change that took place. There were many challenges learners faced during the pandemic such as lack of communication [1-2], overloaded tasks and technical difficulties [3-4] and anxiety [5]. Digitalisation is indeed unavoidable and there is no right and wrong in how one adapts to the changes. Only non-stop trying with trial and error can ensure one stays on track and learns accordingly.

After being exposed to online teaching and learning during Movement Control Order (MCO) by Malaysia governments, tertiary learners have to adjust their modes of learning preferences in order to adapt to virtual presentations facilitated by online teaching and learning technologies. Thus, it is vital to reinvestigate tertiary learners' learning preferences in the post pandemic era so that more effective teaching and learning presentations can be incorporated in the lectures and tutorials to facilitate and motivate learning among tertiary learners.

Hence, this study aims to evaluate tertiary learners' learning preferences in the post pandemic era. Besides, the distributions of unimodal and multimodal styles of visual, aural, read/write and kinesthetics learning preferences among tertiary learners are investigated in accordance to their gender and fields of study.

Section 2 presents the related past studies pertaining to the learning styles and online educational platform. Section 3 presents methodology including the population, sampling technique, sample size and research instrument deployed. Section 4 presents the results of descriptive and inferential analysis on the sample data collected. Section 5 discusses the research findings while Section 6 concludes the study.

2   Literature Review

2.1   Learning styles vs learning preferences

Learning style refers to the approach that best suits a learner's learning. According to [6], learning style is the method used by individuals to retain and absorb new information. There are learners who learn according to their own approach but they do not realize the approach used is different compared to others [7]. Learners may be inclined to use more than one learning styles depending on the content they are learning. On the other hand, learning preference is considered to be a multifaceted notion, whereby the learners distinguish, process, store and recollect what they are attempting to learn [8]. It is of utmost importance that educators understand which approach suits the learners the most to maximize the retention of new information. A learner's learning preference is unique and might be different from other learners [9].

In general, there are many different learning styles. This can be seen in the availability of a variety of learning style frameworks. The models that are often used by educators to understand learning styles are Kolb's [10-11] model and VARK model by Fleming [12].

Kolb's model [10] listed four learning styles which are known as the converger, diverger, assimilator, and accommodator. The convergers are unemotional and good with applying ideas in practical. Divergers are creative and good in brainstorming ideas. Assimilators are great in inductive reasoning and creating theoretical models whereas accommodators are willing to take risks to try new experiences.

2.2   VARK Learning Model

Fleming's VARK model [12] categorises learners into four types of learning preferences which are visual, auditory, read/write and kinesthetic. Visual learners favor charts, colors and diagrams, auditory learners like discussing topics and ideas with their friends and educators, read/write learners prefer textbooks, manuals and taking notes and kinesthetic learners enjoy hands-on approaches and finding solutions to problems. On top of it, VARK model facilitates the analysis of mixture of these learning preferences among learners studied.

2.3   Learning Preferences, Gender, and Field of Studies

The interplay between learning preferences, gender and field of studies has been the most researched element in determining the importance of identifying learning style preferences of learners at primary, secondary or tertiary levels. Several studies in the past have stated the lack of correlation between gender and learning preferences and how it impacts learners' academic performance [13-15]. According to a study conducted by [16] in a nursing college, female learners prefer auditory learning whereas male learners prefer kinesthetic learning. Though there has been a slight difference in the presence of learning methods, implementing the correct teaching method to cater to needs of learners from both genders has proven to improve the academic achievement of the learners [16].

Furthermore [17] tested the learning preferences and achievement of learners in learning mathematics. Their research found that the most preferred learning style by both genders is auditory learning, while the second highest preference is visual learning style. These learning preferences played an essential role in improving learners' engagement in mathematics lessons and their academic achievement.

Educators have to be conscious about their learners' learning preferences [18]. Although it is challenging to conduct a lesson that fulfills the needs of all learners in one go, being aware of the differences and expanding their teaching styles accordingly will help learners to learn better irrespective of their gender. Based on studies from the past, it is evident that the role of gender in determining learners' learning preference is minimal and at the same time, it is crucial to identify which learning style is suitable for every classroom setting and course to facilitate a better learning experience for the learners.

2.4   Conceptual Framework

Figure 1 indicates the research framework for this study. VARK Learning model is deployed in this study to examine the tertiary learner's learning preference. The learners' learning preferences are moderated gender and field of studies. The following alternative hypotheses have been initiated in this research.

H_1: Unimodal learning preference is more dominant than multimodal learning preferences among tertiary learners.
H_2: The modality of tertiary learners' learning preferences and their field of studies are related.

H_3: The modality of tertiary learners' learning preferences and their gender are related.

H_4: The distribution of visual, audio, read/write and kinesthetic learning preferences is different between Science and Social Science tertiary learners.

H_5: The distribution of visual, audio, read/write and kinesthetic learning preferences is different between male and female tertiary learners.
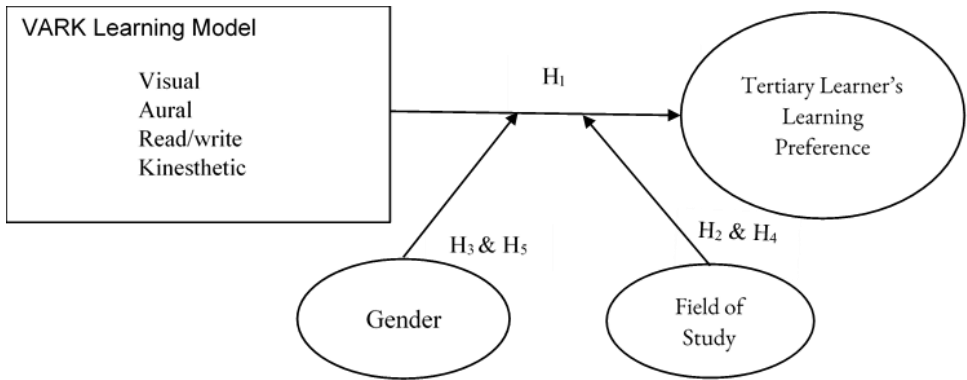

Fig 1. Research Framework

3 Research Methodology

3.1 Sampling Design

This quantitative study aims to examine learner's learning preferences in their tertiary studies. A total of 165 learners were selected from science and social sciences streams in a private higher education institution in Northern region of Malaysia. This institution has been selected as the research location due to its large number of learners from a variety of study disciplines.

In this study, a multistage cluster sampling is applied to locate samples of learners in the research fieldwork. The sampling of respondents was carried out in a few stages with the sampled clusters being sub-sampled to locate samples from the target population [19]. At the first stage of sampling, selection of one out of three Science related faculties and one out of three Social Sciences related faculties. Then, a degree program is selected randomly from all degree programs offered by these two selected faculties. Next, one subject of the degree program selected will be randomly chosen. Finally, all learners in a specific lecture time of the chosen subject are involved as the respondent in this study. A total of 68 and 97 learners in the academic year 2021/2022 were surveyed from the Faculty of Science and Faculty of Business and Finance respectively.

3.2 Research Procedure

The research questionnaire has been adopted from VARK inventory version 8.01 and reached to the respondent via Google link. The questionnaire comprises two sections.

The first section is related to the tertiary learner's demographic profile. It is followed by 16 items adopted from VARK 8.01 inventory that examine preferences of the respondent when he/she carries out 16 different activities. This inventory is utilized as it is validated [20] and widely used to analyse learning issues related to learners' learning preferences. On top of it, the inventory caters for unimodal and multi-modal sensory preferences of the learners [21]. The collected sample data was then analysed descriptively and inferentially using IBM SPSS version 28.0.

4   Data Analysis

Table 1. Demographic profile of the respondents

Respondent's demographic profile	Categories	Frequency	Percentage
Gender	Male	53	32.1
	Female	112	67.9
Faculty	Faculty of Science	68	41.2
	Faculty of Business and Finance	97	58.8

As shown in Table 1, a total of 165 learners were involved in the research survey. 67.9% of them were female. The sample comprised 58.8% of Faculty of Business and Finance learners and the rest were from the Faculty of Science.

Table 2. Distribution for unimodal and multimodal learning preference of the respondents

Respondent's learning preference	Frequency	Percentage
Unimodal learning preference	136	82.4
Multimodal learning preference	29	17.6

Referring to Table 2, 82.4% of respondents have a specific learning preference, namely visual, audio, read/write or kinesthetics whereas the rest have a mixture of two or more of these domains of learning preferences. From Chi-square Goodness-of-fit test conducted ($\chi^2 = 69.388, df = 1, p = .000$), unimodal learning preferences still pre-dominant among learners. In other words, most learners preferred only one domain instead of the mixture of visual, audio, read/write and kinesthetics learning preferences.

Table 3. Distribution for unimodal learning preference of the respondents

Learning Preference	Sample size	Percentage
Visual	8	5.88

Audio	28	20.59
Read/Write	6	4.41
Kinesthetics	94	69.12
Total	136	100.00

With reference to Table 3, 69.12% of respondents having unimodal learning preference have more inclination toward learning via kinesthetics related activities. It is followed by audio, visual and read/write learning preference with 20.59%, 5.88% and 4.41% respectively. From Chi-square Goodness-of-fit test conducted $\chi^2 = 149.882, df = 3, p = .000)$, learners' unimodal learning preference is significantly dominated by kinesthetics learning preference as they tend to learn better via hands-on and practical exercises that involve movements of their body parts.

Table 4. The distribution for modality of respondents' learning preference and their gender

	Unimodal Learning Preference	Multimodal Learning Preference	Subtotal
Male	96	16	112
Female	40	13	53
Subtotal	136	29	165

As summarized in Table 4, 85.7% and 75% of male and female respondents incline toward either visual, audio, read/write or kinesthetics learning preference respectively. From Chi-square Independence Test conducted ($\chi^2 = 2.605, df = 1, p = .083$), the modality of learners' learning preference and gender are not significantly related.

Table 5. The distribution for modality of respondents' learning preference and their areas of study

	Unimodal Learning Preference	Multimodal Learning Preference	Subtotal
Science	80	17	97
Social Science	56	12	68
Subtotal	136	39	165

As indicated in Table 5, 82.5% and 82.4% of Science and Social Science respondents prefer to learn via either visual, audio, read/write or kinesthetics presentation respectively. From Chi-square Independence Test conducted ($\chi^2 = 0.000, df = 1, p = 0.992$) , the modality of learners' learning preferences and their fields of study, namely Science and Social Science, are also not significantly related.

Table 6. Learning preference scores of the respondents

Learning Preference	Mean	Std. Deviation
Visual preference	7.21	3.472
Audio preference	8.18	3.589
Reading/Writing preference	6.28	3.183
Kinesthetics preference	10.33	3.288

Table 6 shows that the sample involved in the research fieldwork preferred to learn via hands-on and practical activities with movement of their body parts. It was followed by audio and visual learning. They had least inclination to learn via reading and/or writing related activities.

Table 7. Learning preference scores of the respondents with respect to their fields of study

Field of studies	Learning preference	Mean	Standard deviation
Science	Visual	7.32	3.348
	Audio	8.32	3.427
	Read/Write	6.46	3.044
	Kinesthetics	10.37	3.359
Social Science	Visual	7.12	3.571
	Audio	8.07	3.712
	Read/Write	6.16	3.287
	Kinesthetics	10.31	3.254

In Table 7, both Science and Social Science learners most prefer to learn via kinesthetics activities, followed by audio and visual presentation. They have the least preference to learn via reading/writing related activities.

Table 8. Learning preference scores of the respondents with respect to their gender

Gender	Learning preference	Mean	Standard deviation
Female	Visual	7.15	3.308
	Audio	8.25	3.455
	Read/Write	6.40	3.109
	Kinesthetics	10.43	3.193
Male	Visual	7.32	3.827
	Audio	8.02	3.885
	Read/Write	6.04	3.351

Kinesthetics	10.13	3.503

Table 8 indicates that similar patterns of learning preference apply for male and female respondents. Both males and females prefer to learn via kinesthetics activities, followed by audio and visual activities. They least prefer to learn via reading/writing related activities.

Table 9: Independent Samples Mann-Whitney U Tests for the distribution of tertiary learners' learning preferences in accordance to their fields of study

Null Hypothesis	p value of the test	Decision
The distribution of visual sensory preference in learning is the same across Science and Social Science tertiary learners.	0.679	Retain null hypothesis.
The distribution of audio sensory preference in learning is the same across Science and Social Science tertiary learners.	0.707	Retain null hypothesis.
The distribution of read/write sensory preference is the same across Science and Social Science tertiary learners.	0.570	Retain null hypothesis.
The distribution of Kinesthetics sensory preference is the same across Science and Social Science tertiary learners.	0.743	Retain null hypothesis.

Table 10. Independent Samples Mann-Whitney U Tests for the distribution of tertiary learners' learning preferences in accordance to their gender

Null Hypothesis	p value of the test	Decision
The distribution of visual sensory preference in learning is the same across male and female tertiary learners.	0.879	Retain null hypothesis.

The distribution of audio sensory preference in learning is the same across male and female tertiary learners.	0.575	Retain null hypothesis.
The distribution of read/write sensory preference is the same across male and female tertiary learners	0.275	Retain null hypothesis.
The distribution of Kinesthetics sensory preference is the same across male and female learners.	0.641	Retain null hypothesis.

From the results of Independent Samples Mann-Whitney U Tests summarized in Table 9 and Table 10, there is no significant difference on the distribution of visual, audio, read/write and kinesthetic learning preferences between Science and Social Science learners as well as male and female learners.

5   Discussion

Most respondents have a unimodal learning preference. [13] found majority of pre-clinical medical learners preferred unimodal learning preference that is not gender specific and did not contribute to their academic outcome. While some learners prefer multimodal learning preference, it is evident that focus is on kinesthetics that is more hands on and not gender specified. [14] have proved through their study that identifying learners' learning preferences is vital to prepare and execute a fruitful lesson. The overall results from science major learners have indicated that there is no significant correlation between gender and learning preferences, thus concluding that educators have to be able to distinguish these differences and eventually broaden their style of teaching accordingly [14]. This study reveals that learning preference is not gender specific. Hence it is found to be consistent with study conducted by [14-15][17-18]. However, it contradicts study by [16] carried out in a nursing college that found learning preference gender specific.

6   Conclusion

The research concludes that unimodal learning preference is still pre-dominant among tertiary learners irrespective of their gender and areas of study. Besides, most of tertiary learners prefer to learn via kinesthetics related activities. On top of it, the distribution of visual, audio, read/write and kinesthetics learning preferences among tertiary

learners are not related to their gender and areas of study. These research results provide an insight to educators to plan and execute more effective teaching methods in order to facilitate more effective learning among tertiary learners in the post pandemic era.

References

1. Tang, T., Abuhmaid, A. M., Olaimat, M., Oudat, D. M., Aldhaeebi, M., & Bamanger, E.: Efciency of fipped classroom with online-based teaching under COVID-19. *Interactive Learning Environments*, 1–12 (2020).
2. Suryaman, M., Cahyono, Y., Muliansyah, D., Bustani, O., Suryani, P., Fahlevi, M., & Munthe, A. P.: COVID-19 pandemic and home online learning system: Does it afect the quality of pharmacy school learning? *Systematic Reviews in Pharmacy*, 11, 524–530 (2020).
3. Fawaz, M., Al Nakhal, M., & Itani, M.: COVID-19 quarantine stressors and management among Lebanese students: A qualitative study. *Current Psychology*, 1–8 (2020).
4. Khalil, R., Mansour, A. E., Fadda, W. A., Almisnid, K., Aldamegh, M., Al-Nafeesah, A., & Al-Wutayd, O.: The sudden transition to synchronized online learning during the COVID-19 pandemic in Saudi Arabia: A qualitative study exploring medical students' perspectives. *BMC Medical Education*, 20(1), 1–10 (2020).
5. Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., & Chouhan, P.: Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal. India. *Children and Youth Services Review*, 116, 105194 (2020).
6. Ishak, N.B, & Awang, M.M.: The Relationship of Student Learning Styles and Achievement in History Subject. *The International Journal of Social Sciences and Humanities Invention*, *4*(3), 3372-3377 (2017).
7. Chik, Z., & Abdullah, A. H.: Effect of Motivation, Learning Style and Discipline Learn about Academic Achievement Additional Mathematics. *International Journal of Academic Research in Business and Social Sciences*, 8(4), 772–787 (2018).
8. Khan, S. A., Arif, M. H., & Yousuf, M. I.: A Study of Relationship between Learning Preferences and Academic Achievement. *Bulletin of Education and Research, 41*, 17-32 (2019).
9. Samarakoon et al,: Learning styles and approaches to learning among medical undergraduates and postgraduates. *BMC Medical Education*, *3* (42), 1-6 (2013).
10. Kolb, D. A.: Learning styles and disciplinary differences. *The modern American college*, 232-255 (1981).
11. Kolb, D. A.: Experiential learning: Experience as the source of learning and development , 1. Englewood Cliffs, NJ: Prentice-Hall (1984).
12. Fleming, N. D.: *Teaching and learning styles: VARK strategies*. Christchurch, New Zealand: N.D. Fleming (2001).
13. Liew, S.C., Sidhu, J., & Barua, A.: The relationship between learning preferences (styles and approaches) and learning outcomes among pre-clinical undergraduate medical students. BMC Medical Education. 15:44. https://doi.org/10.1186/s12909-015-0327-0 (2015).
14. Nasution, H.D., Sipahutar, H., & Gultom, T.: Gender Differences in Learning Style Preferences among Eleventh Grade Science Major High School Students. *International Journal of Humanities Social Sciences and Education (IJHSSE),* 6 (11), 51-56. http://dx.doi.org/10.20431/2349-0381.0611008 (2019).
15. Eid, A., Almizani, M., Alzahrani, A., Alomair, F., Albinhamad, A., Albarrak, Y., Alzuaki, M., Alyahya, S., & Abdulrahman, K.: Examining Learning Styles with Gender Comparison Among Medical Students of a Saudi University. *Advances in Medical Education and Practice,* 2021:12 309–318 (2021).

16. Ibrahim, R. H., & Hussein, D. A.: Assessment of visual, auditory, and kinesthetic learning style among undergraduate nursing students. International Journal of Advanced Nursing Studies, 5(1), 1–4. https://doi.org/10.14419/ijans.v5i1.5124 (2015).

17. Rahman, A., & Ahmar, A. S.: Relationship between learning styles and learning achievement in mathematics based on genders. World Transactions on Engineering and Technology Education, (March). https://doi.org/10.26858/wtetev15i1y2017p7477 (2017).

18. Slater, J.A., Lujan, H. L., & DiCarlo, S. E.: Does gender influence learning style preferences of first-year medical students? *Adv Physiol Educ* 31: 336–342. https://doi:10.1152/advan.00010.2007 (2007).

19. Scheaffer R.L., Mendenhall, W.M., R.L. Ott, R.L., & Gerow, K.G.: Elementary Survey Sampling,7th Edition, Duxbury Press (2011).

20. Liete, W.L., Svinicki, M & Shi Y.: Attempted Validation of the Scores of the VARK: Learning Styles Inventory with Multitrait-Multmethod Confirmatory Factor Analysis. Educational and Psychological Measurement, *70*(2),323-339 (2010).

21. Fleming, N. D.: I'm different; not dumb: Modes of presentation (VARK) in the tertiary classroom, In A. Zelmer (Ed.), Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and research Development Society of Australasia (HERDSA), HERDSA 18, 308-313 (1995).