Research Article

Predicting Preferred Learning Styles on Teaching Approaches Among Gen Z Visual Learner

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Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published Online: 20 April 2021.

Abstract: This study was carried out to confirm that Malaysian Gen Z visual learners preferred technological inclined teaching approach in their learning style. It involved respondents from a private university college in Malaysia which has 9 branches all over the country. A total of 500 questionnaires were distributed and 486 were analysed. The findings showed that 169 cases were identified as visual learners. These cases were then, used to test in confirming the prediction. Based on the analyses using Smart PLS, it was confirmed that Gen Z in Malaysia are visual learners who preferred active learning activities which are technological inclined. This confirmation was made based on the outcome of two predictive ability using the Stone-Geisser's Q^2 and PLS Predict Q^2. Since the prediction accuracy of the proposal was established, therefore, it was concluded that Malaysian Gen Z Visual Learners prefer technological inclined approaches in their learning.

Keywords: Gen Z, learning style, visual learners, technology-based, teaching approach, IR4.0, education 4.0

1 INTRODUCTION

It is crucial to understand the types of learners involve in the teaching and learning process as the outcome of a successful teaching and learning process relies on the appropriate method used in delivering the learning content. Education is less about the transfer of knowledge from teacher to student but more about helping students make sense of the over-abundance of information available to them (Seemiller and Grace, 2016). Therefore, in order to teach effectively, it is vital to tailor what the students' habits and needs are to the approach applied in the process (University of British Columbia, 2019). With that, being asserted, the underpinning concept of learning is that the approach or method use in the process must be appropriate with the learners' learning style.

Throughout the years the VAK Model has been widely used in many studies in identifying the learners' type, as it matches with the nature of the learner individually in the classroom (Heekstall, 2016).

VAK stands for visual, auditory and kinesthetic learning style. Sometimes the word tactile is used with the acronym to become VAKT. Yet in most cases tactile is merged with physical interactions and tactile in this manner refers to tangible feel that is associated with the kinesthetic style. Gen Z learners are no exception from such categorization. They may fall under the visual, auditory or kinesthetic any each has different learning preferences.

Such conventional categorization of learner combined with the Gen Z learning preferences has posed an intriguing direction of the teaching approach that is expected by them in the learning process. Teachers must be able to determine the best possible approach to be applied in teaching these learners as they preferred handheld multifunctional mobile devices with the ability to watch videos, snap photos, connect to the internet, play games and listen to music (Renfo, 2012). Gen Z's use of multimedia gadgets as stated by Rothman (2016) has impacted their leaning expectations and values. A study by Chun et.al (2016) stresses that Gen Z learning styles can be divided into two distinct themes; one being technology based and non-technology based being the other.

2 PROBLEM STATEMENT

Gen Z learners are assumed to have different traits or preferences in learning compared to their predecessor. The impact of technology in our daily activities as stated earlier is believed to have an influence to the statement to certain extent. Based on studies Gen Z tend to prefer technology than conventional method in carrying out their daily

tasks including learning. They are known to be fast decision makers, and highly connected (Consultancy UK, 2015; Danksericute, 2016). In addition, Rothman (2016) stated that the brain of Gen Z has become wired to sophisticated, complex visual imaginary and as a result the brain is more developed for visual ability making visual learning more effective.

It is important to determine the type of teaching approach which Gen Z prefers. Danksevicuite (2016) states that typical Gen Z were born into globally connected world and therefore "live" and "breathe" technology. Hence, the use of internet, computer and smart phone should be incorporated in the teaching approaches as a proactive movement with the development of varies technology and gadgetry. This study intended to confirm the assumption that Gen Z visual learners preferred technological inclined teaching approach more as compare to other approaches. Hence, this statement is used as the foundation of the assumption in this study.

Moreover, as the literature on Generation Z is still limited, therefore, this study will also provide additional knowledge to support the current literature on Gen Z learning style and preferred teaching approaches.

3 LITERATURE REVIEW

The teaching and learning process is the result of two words combine together that are teaching and learning. Teaching on its own means intervention that involved the planning and implementation of instructional activities and experience to meet attended learner outcomes according to the teaching plan while learning is the relatively permanent change in an individual's behavior that can occur at any time or pace as a result of consciously exposed to the learning material. Therefore, the teaching and learning process is the most powerful instrument of education to bring about desired changes in the students (Daber, 2013). That is why determining the learner type in Gen Z to deliver meaningful learning experience is important.

Learners' learning style indicates an individual's preferential focus on different types of information. The different ways of perceiving information and the rate of understanding information or in other words an individual's mode of gaining knowledge (Dictionary.com, 2012).

Traditionally, learners learning style is assessed using KOLB learning style inventory (LSI) (Manocheri & Young, 2006). It is used to measure the degree to which individuals displays the learning derived from experiential learning theory.

However, more recent studies now are more familiar with the VAK which was developed by psychologists in 1920s to classify the most common ways people learn (Mindtools, 2019). The classification is being labelled into three main models; the visual, auditory and kinesthetic. At times, researchers used an additional model which is the tactile. Due to the overlaying elements - tactile is often being absorbed into the kinesthetic style.

Gen Z are those born between 1995 – 2012. They are given many names such as 'Sharing Generation, The generation that is "All technology All the Time" and "Born Digital" (Barnes & Noble College, 2019), the digital natives, Generation 2020, iGen, Gentech, Gen Wii and also the Net Gen. The oldest of this generation born in 1995 are now 24 years old and are leaving colleges and universities to enter the working world. Gen Z are seen as more independent than their predecessors, the Millennials. They are tech-savvy, are the "all technology all the time" people among other things. They are passionate about the importance and value of higher education; particularly in the way it provides access to career that interest them and reward them financially as well as sensitive to the preservation of the environment. According to Beal (2019) Gen Z are also focused, multi-taskers, bargainers, early-starter, more entrepreneurial, high expectation, individualistic and global compared to their brothers and sisters the Millennials. Therefore, meeting Gen Z expectations will be quite a big challenge as the gap between the learners and the educators are wide.

Moreover, as the educator and the learner generation is wide apart, educator being born in the era of non-technology based and learner born with computers and the internet. Of course, the challenges are well expected.

Type of Learning Model

There are three types of learning model; visual, auditory and kinesthetic model. Each model represents the type of learners' style.

The VARK model which was developed by Fleming and Mills [3] provides the learners with a profile of their learning styles, based on the sensory modalities which are involved in taking in information. VARK is an acronym for the Visual (V), Auditory (A), Read/Write (R) and the Kinesthetic (K) sensory modalities. The visual learners process the information best if they can see it. The auditory learners like to hear information. The read-write learners prefer to see the written words. The kinesthetic learners like to acquire information through experience and practice.

The first type of learners is the visual learner have two sub-channels that are linguistics and spatial. Learners who are visual-linguistic like to learn through written language such as reading and writing tasks. They remember what they have written down even though they do not learn read it many times. Meanwhile, the visual spatial learners usually have difficulty in written language but they perform better in dealing with charts demonstrations, videos and other visual materials. They recognize faces and their surrounding easily

Secondly is the auditory learners. This type of learners often talks to themselves. They tend to move their lips and read out loud. They have difficulties when dealing with reading and writing tasks yet have an advantage when it comes to talking to colleagues or learning what was said.

The last type of learners is the kinesthetic learner. These learners tend to have advantage from both ends. They perform best when it comes to touching and moving. They also have to sub-channels that are the actual kinesthetic which involves movement and tactile that is reflecting the touching aspect a learner's preference. This is in reference to the statement stressed earlier that sometimes tactile is not needed in isolation but rather being combined with kinesthetic.

Kinesthetic learners tend to lose concentration if there is little or no external stimulation or movement when listening to lectures they tend to take down notes for the sake of moving their hands or scan the reading material before they actually read it. They normally used color highlighters and take down notes by drawing pictures, diagrams or at times doodling (nw link.com., 2019).

Learning Approaches

There are seven types of learning approaches which are active cooperation, active learning, experiential and experimental learning, exploratory, flipped-learning, self-assessment and technology-based delivery.

The first one is the cooperative learning where this learning approach puts student together to solve problems or discuss concepts that leads to greater understanding. Group activities also give students better social skills. Group work can be out of class projects, but this site concentrates on activities that can be done in the classroom. Groups can be informal (those students who happen to be sitting together) or formal (assigned by the instructor). Groups can be short-term (for one or a few activities) or long-term (for one semester to a number of years) (McConnell, (2005).

The second learning approach is the active learning approach which refers to a broad range of teaching strategies which engage students as active participants in their learning during class time with their instructor. Typically, these strategies involve some amount of students working together during class, but may also involve individual work and/or reflection. These teaching approaches range from short, simple activities like journal writing, problem solving and paired discussions, to longer, involved activities or pedagogical frameworks like case studies, role plays, and structured team-based learning (CEI. 2019).

The third is the experiential learning approach which encompasses a variety of activities including internships, service learning, undergraduate research, study abroad, and other creative and professional work experiences. Well-planned, supervised and assessed experiential learning programs can stimulate academic inquiry by promoting interdisciplinary learning, civic engagement, career development, cultural awareness, leadership, and other professional and intellectual skills (ELC,2019).

The fourth is the exploratory learning approach. This is a method of teaching in line with constructivist teaching theories. In exploratory learning the students learn new information either through experimentation or using their

prior knowledge and guidance from the instructor. Exploratory learning is an alternative to the traditional method of instruction where students are told the information and asked to memorize it (Answers, 2019).

The fifth is the flipped learning approach. This is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter (Flipped Learning Network (FLN), 2014).

The sixth approach is the student self-assessment approach which involves students in evaluating their own work and learning progress. It is a valuable learning tool as well as part of an assessment process. Through self-assessment, students can identify their own skill gaps, where their knowledge is weak, see where to focus their attention in learning, set realistic goals, revise their work, track their own progress, if online, decide when to move to the next level of the course. This process helps students stay involved and motivated and encourages self-reflection and responsibility for their learning (Stanford University, 2015).

Lastly, the seventh learning approach is the technology-based learning is the learning of content via all electronic technology, including the Internet, intranets, satellite broadcasts, audio and video tape, video and audio conferencing, Internet conferencing, chat rooms, e-bulletin boards, webcasts, computer-based instruction, and CD-ROM.3 TBL also encompasses related terms, such as online learning and web-based learning that only include learning that occurs via the Internet, and computer-based learning that is restricted to learning using computers. E-learning is synonymous with TBL and has largely replaced it in scholarship and industry as the term of choice. Therefore, the report uses these terms interchangeably (SPR,2015).

4 RESEARCH METHODOLOGY

This is a quantitative research whereby a set of questionnaire was distributed to 486 respondents all over 8 campuses of Kolej Poly-Tech MARA all over Malaysia which include one university college.

The instrument used is the VAK questionnaire where it consists of two sections with Section A for the demographic factors while Section B is for the VAK 30 items. Section C consist of items measuring the learning approaches variables which students may prefer and like to be practice in the classroom.

PLS-SEM was used to assess the proposed path model. Using SmartPLS 3 (Ringle et al., 2015), data were subject to four procedures, which are PLS algorithm, bootstrapping, blindfolding and PLS predict. The procedures generate estimates for assessing the quality of criteria of the model, its significance, and its predictive relevance.

PLS-SEM requires assessing the proposed path model at two stages. The measurement model assessment is assessed first, and followed by assessment of the structural model. Because all latent variables were modelled reflectively in this study, the assessment criteria used are those of reflective measurement model.

According to Hair et al. (2017), a reflective measurement model is assessed based on four criteria. First, outer loading of an indicator is assessed. The suggested cut-off value is 0.707. If an outer loading value falls short of this threshold, one has to decide to retain or to remove it. This decision has to take into consideration the internal consistency reliability and convergent validity values.

Internal consistency reliability, which is the second criteria in evaluating a reflective measurement model, is assessed by referring to the Cronbach's alpha and composite reliability values. The cut-off value for both criteria is 0.70. Average variance extracted or AVE is the measure used to assess a model's convergent validity. The value has to be at least 0.50, which indicates that the latent variable explains 50 percent of the variance in its items. If both internal consistency reliability and the convergent validity values are above their recommended threshold, then the low outer loading should be kept. Nevertheless, Hair et al. (2014) suggest that an indicator must be removed when its outer loading is too low (i.e., below 0.40).

The last criterion for assessing a reflective measurement model is discriminant validity. It measures whether a latent variable is empirically unique, and thus is different from the other latent variables included in the model. Using

Henseler et al.'s (2015) suggestion, the discriminant validity of the reflective model in this study was assessed using the heterotraitmonotrait ratio of correlations or HTMT. The cut-off value is below 0.85.

Once a reliable and valid measurement model is established, the next stage in the PLS-SEM is structural model assessment. At this stage, the relationships among the latent variables are examined. Hair et al. (2017) suggest the following assessment criteria: collinearity assessment (VIF < 5), magnitude and significance of the path coefficient, coefficient of determination (R^2), effect size (f^2), and predictive relevance (Q^2).

5 RESULTS

In this study, 486 cases where analysed and 169 cases were found to be visual learners and were used to test the proposed model. Table 1 shows the results of reflective measurement model assessment. Outer loadings for all indicators included in this model range from 0.538 to 0.913. Although there were 14 values that fall short from 0.707, values for both composite reliability and AVE were above 0.70 and 0.50, respectively.

Therefore, all indicators were retained in this study. The lowest value for Cronbach's alpha was 0.868 (Active Learning) and the highest value was 0.933 (Technology-based Delivery). The lowest and highest values for composite reliability correspond to the Cronbach's alpha values. That is, Active Learning has the lowest value of 0.877 and Technology-based Delivery has the highest value of 0.942. Flipped learning explains the most in its item's variance, with an AVE value of 0.825. The lowest AVE value was 0.522 (Active Learning).

Table 1. Results of reflective measurement model

Latent Variables	Items	Items Deleted	Outer Loadings	Cronbach's Alpha	Composite Reliability	AVE
Active Cooperation	AC1 - AC8	AC9 & AC10	0.618 - 0.796	0.902	0.919	0.508
Active Learning	AL1 - AL3	AL4	0.648 - 0.815	0.868	0.897	0.522
Experiential	EXPE1 - EXPE5	None	0.848 - 0.904	0.914	0.936	0.744
Exploratory	EXPL1 - EXPL10	None	0.757 - 0.806	0.93	0.941	0.613
Experimental	EXPM1 - EXPM7	None	0.741 - 0.885	0.923	0.938	0.684
Flipped learning	FLIP1 - FLIP3	None	0.900 - 0.913	0.894	0.934	0.825
Self-assessment	SA1 - SA10	None	0.706 - 0.830	0.92	0.933	0.584
Technology-based Delivery	TBL1 - TBL14	None	0.538 - 0.828	0.933	0.942	0.541

Note. AC = active cooperation, AL = active learning, EXPE = experiential, EXPL = exploratory, EXPM = experimental, FLIP = flipped learning, SA = self-assessment, TBL = technology-based learning.

Table 2 shows the result of discriminant validity using the HTMT ratio of correlations. The highest HTMT value was 0.800, which belongs to the correlation between technology-based delivery and self-assessment. Other HTMT values were below than the conventional threshold of 0.85. Therefore, the discriminant validity was established in this study.

Table 2. HTMT ratio of correlations

Latent Variables	1	2	3	4	5	6	7	8
1. Active Cooperation 2. Active Learning	0.780							
3. Experiential	0.607	0.360						
4. Experimental	0.574	0.502	0.572					
5. Exploratory	0.755	0.693	0.522	0.753				
6. Flipped Learning	0.619	0.484	0.600	0.714	0.680			
7. Self-Assessment	0.799	0.682	0.561	0.653	0.768	0.660		
8. Technology-based Delivery	0.794	0.672	0.583	0.620	0.732	0.657	0.800	

Note. 1 = active cooperation, 2 = active learning, 3 = experiential, 4 = experimental, 5 = exploratory, 6 = flipped learning, 7 = self-assessment, 8 = technology-based delivery.

Table 3. Results of hypothesized relationships

Hypothesized Relationships	Path Coefficients	*p*-Values	95% CIs	Decisions
Active Cooperation -> Experiential	0.380	0.004	0.114, 0.626	Supported
Active Cooperation -> Experimental	0.057	0.676	-0.203, 0.336	Not supported
Active Cooperation -> Exploratory	0.206	0.021	0.021, 0.375	Supported
Active Cooperation -> Flipped Learning	0.161	0.241	-0.106, 0.428	Not supported
Active Learning -> Experiential	-0.209	0.110	-0.465, 0.046	Not supported
Active Learning -> Experimental	0.042	0.750	-0.222, 0.292	Not supported
Active Learning -> Exploratory	0.177	0.041	0.017, 0.353	Supported
Active Learning -> Flipped Learning	-0.034	0.770	-0.255, 0.190	Not supported
Self-Assessment -> Experiential	0.172	0.105	-0.046, 0.372	Not supported
Self-Assessment -> Experimental	0.359	0.000	0.155, 0.551	Supported
Self-Assessment -> Exploratory	0.308	0.000	0.144, 0.474	Supported
Self-Assessment -> Flipped Learning	0.294	0.005	0.085, 0.491	Supported
Technology-based Delivery -> Experiential	0.263	0.024	0.041, 0.495	Supported
Technology-based Delivery -> Experimental	0.247	0.031	0.024, 0.472	Supported
Technology-based Delivery -> Exploratory	0.198	0.025	0.017, 0.367	Supported
Technology-based Delivery -> Flipped Learning	0.287	0.006	0.074, 0.491	Supported

Following a reliable and valid reflective measurement model, the structural model was assessed next. The inner collinearity values were assessed by inspecting the VIF values. All VIF values were below than 5; hence, it indicates that there was no collinearity issue. Then, the other criteria were assessed. Table 3 shows the results of the hypothesized relationships. Six out of sixteen hypothesized relationships were not supported. Specifically, the relationship between active cooperation and experimental (β = 0.057, p = 0.676), active cooperation and flipped learning (β = 0.161, p = 0.241), active learning and experiential (β = -0.209, p = 0.110), active learning and experimental (β = 0.042, p = 0.750), active learning and flipped learning (β = -0.034, p = 0.770), and self-assessment and experiential (β = 0.172, p = 0.105) were found to be not statistically significant. The remaining hypothesized relationships were supported.

Table 4. Coefficient of determination and effect sizes

	Effect				
	Active Cooperation	Active Learning	Self-Assessment	Technology-based Delivery	R Square
Experiential	0.078	0.034	0.017	0.041	0.372
Experimental	0.002	0.001	0.08	0.039	0.412
Exploratory	0.037	0.039	0.089	0.038	0.611
Flipped Learning	0.015	0.001	0.055	0.053	0.425

The amount of variance explained by the predictors in each outcome was shown in Table 4. The highest R^2 was 0.611, which means that 61.1 percent of the variance in exploratory teaching approach was explained by the four learning styles. The lowest R^2 was 0.372, which means that 37.2 percent of the variance in experiential was explained by the four learning styles.

The strength of the predictor in predicting the outcome is assessed by inspecting the effect size. According to Hair et al.'s (2017) rule of thumb, an effect size is classified as substantive, medium or small if the value is 0.35, 0.15, and 0.02, respectively. As shown in Table 4, the highest effect size value was 0.089, which means that the effect size is small. Also, a large number of effect size values were smaller than 0.02. This indicates that the strength of active cooperation and active learning in explaining experimental and flipped learning were very weak. Similarly, self-assessment could not explain experiential teaching approach well.

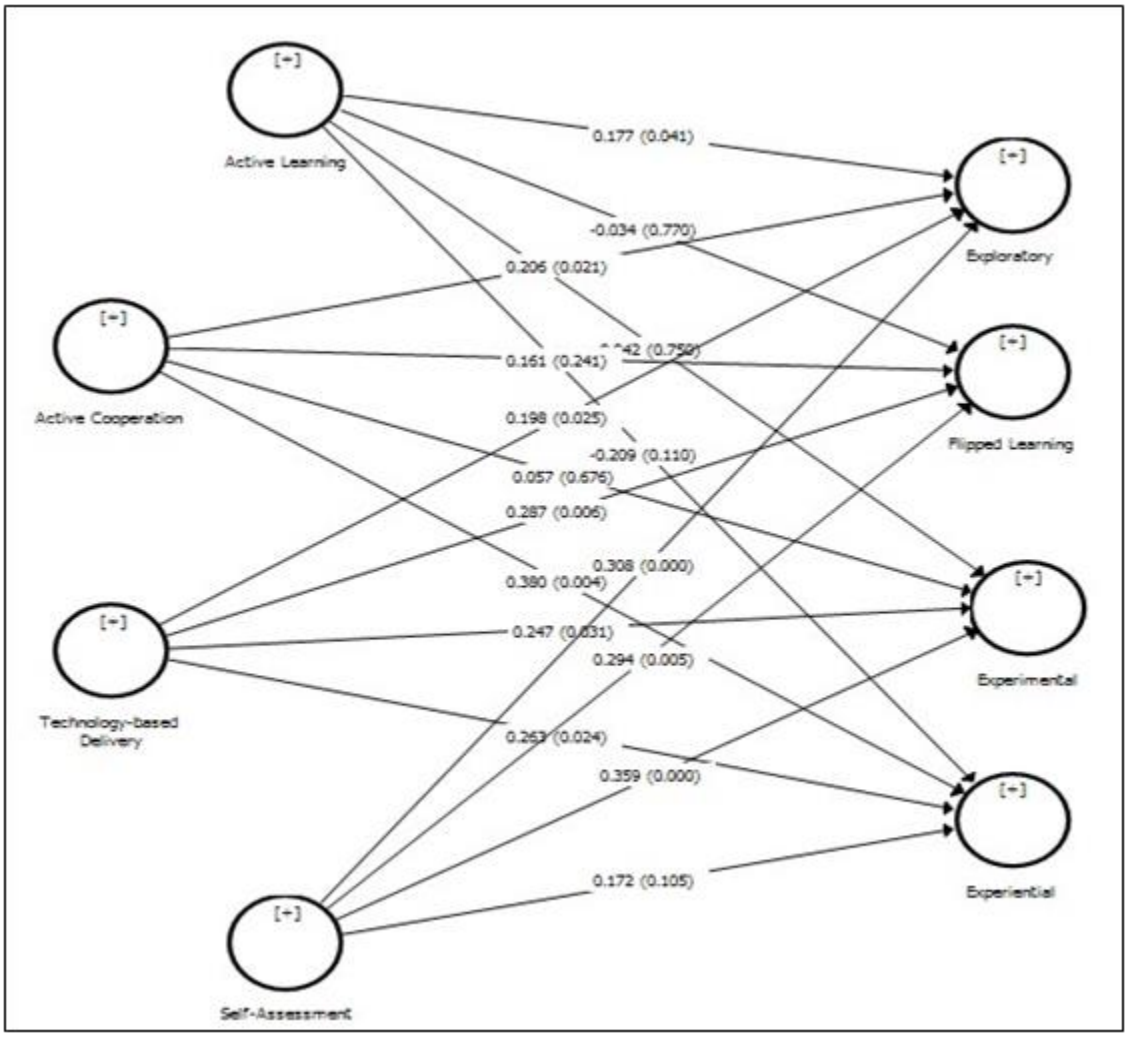

Figure 1. Results of path model

Figure 1 shows the results of the structural model assessment that include the magnitude and significant of path model. It reflects the findings as discussed above.

Predictive ability of this model was assessed using two criteria, which are Stone-Geisser's Q^2 and PLS predict Q^2. Although both criteria were intended for a same purpose, the analysis follows a different procedure. Stone-Geisser's Q^2 is estimated using a same sample but certain data points are taken out from it. The systematic removal of data point is based on a selected omission distance. On the contrary, PLS predict Q^2 is estimated using a same sample but it is then divided into two data sets known as training sample and hold-out sample. In this study, both criteria were used to assess a model's predictive ability.

Table 5 shows the results of model's predictive ability using both criteria. According to Hair et al. (2017), a Q^2 value larger than zero indicates a model's predictive ability. Therefore, results that were obtained from PLS-SEM analysis showed that the model of this study has good predictive ability because both criteria values were above zero.

Table 5. Predictive ability estimates

	Stone-Geisser Q^2	PLS Predict Q^2
Experiential	0.256	0.147
Experimental	0.254	0.293
Exploratory	0.342	0.572
Flipped Learning	0.315	0.319

In addition, a comparison between prediction values generated by PLS and those of naïve benchmark was made to further identify the predictive accuracy of the model. According to Hair et al. (2019), the prediction errors obtained through PLS estimation should be lower than the prediction errors obtained from a naïve linear regression. As shown in Table 6, there were improvements in the prediction error values obtained through PLS estimation than linear model estimation for both RMSE and MAE. Therefore, the results indicate that predictive accuracy of the model was established.

Table 6. Comparison between PLS and naïve benchmark for key endogenous construct

	RMSE			MAE
	PLS	LM	PLS	LM
EXPE1	0.710	0.764	0.498	0.568
EXPE4	0.683	0.742	0.498	0.545
EXPE3	0.688	0.831	0.497	0.603
EXPE2	0.743	0.878	0.526	0.618
EXPE5	0.708	0.793	0.492	0.568
EXPM2	0.888	1.090	0.577	0.726
EXPM4	0.734	0.912	0.567	0.677
EXPM6	0.681	0.798	0.529	0.593
EXPM5	0.693	0.816	0.530	0.598
EXPM7	0.696	0.849	0.524	0.626
EXPM1	0.715	0.917	0.539	0.659
EXPM3	0.697	0.872	0.541	0.646
EXPL10	0.611	0.711	0.484	0.546
EXPL2	0.658	0.840	0.519	0.632
EXPL4	0.627	0.759	0.490	0.583
EXPL5	0.630	0.792	0.500	0.594
EXPL3	0.588	0.704	0.442	0.536
EXPL8	0.719	0.898	0.562	0.662
EXPL6	0.641	0.791	0.512	0.604
EXPL9	0.602	0.696	0.465	0.541
EXPL1	0.552	0.693	0.428	0.522
EXPL7	0.695	0.907	0.530	0.675
FLIP1	0.792	0.939	0.610	0.688
FLIP3	0.660	0.812	0.523	0.612
FLIP2	0.691	0.882	0.528	0.647

6 CONCLUSION

Based on the findings, it was confirmed that Gen Z learners are visual learners and they prefer technology-based learning approach as proven from the test carried out using PLS SEM. As Barnes and Noble College (2019) suggests that Gen Z in the US are more to kinesthetic learners, therefore, this finding suggests that Malaysian Gen Z learners are not kinesthetic learners but actually, visual learners instead. Hence, the findings from the western and the eastern countries are different and should not be globally generalized.

The different findings could be due to the culture and education system of the countries involved. Perhaps the Malaysian education system is a bit rigid and conventional compared to the US. The education system in Malaysia is

still teacher-centred as compared to the western education system where technology and exploratory learning style is more celebrated.

As the results suggest that the visual learners prefer technology-based delivery and the supported teaching approach are experiential, experimental, exploratory and flipped learning therefore, it is suggested that the government should adopt these teaching approaches in the education system from now on to prepare Gen Z to embrace technology and exploratory learning. This is deemed crucial as to meet their needs and expectation and simultaneously preparing them for the Industrial Revolution 4.0. Thus, applications like Padlet, Cahoot, MyEdu and Hangout should be taught to the students to encourage them to be more interested in learning.

Future research on learning and teaching approaches should be conducted as the alpha generation's needs and expectations will be far more challenging for the educators.

ACKNOWLEDGEMENTS

The research was carried out and completed under the Internal/Seed Research Grant of Kolej University Poly-Tech MARA (KUPTM) Kuala Lumpur.

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