Journal of Theoretical and Applied Information Technology
15th September 2021. Vol.99. No 17

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

PROPOSED EFFECTIVE LEARNING DESIGN MODEL ON LANGUAGE SKILLS USING PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING (PLS-SEM)

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ABSTRACT

The success in learning is the most significant issue in the realm of language learning such as lack of studies focusing on the efficacy of fully online language learning. Mostly existing researches were conducted for face-to-face and blended learning modes. Activities are an important part in language learning which involve skills for reading, writing, listening, and speaking. Existing studies also mostly focus only on partial skill activities. Therefore, this study proposes an effective learning design model based on the relationship between learner's characteristics and their self-efficacy in language skills. A survey design was developed to collect data and test the proposed model. A Partial Least Squares Structural Equation Modeling (PLS-SEM) was used in order to answer research questions. The survey was conducted on-line involving 130 respondents after completing Mandarin MOOC course. The results of the model shows two constructs from learner characteristics have positive relationships and significant to the effective learning design model, that one dimension for learning styles (visual, p value = 0.000) and one dimension for cognitive styles, (thinking, p value = 0.000). The findings show that visual and thinking dimensions contribute to the effective learning design model that shows improvement in student performance for all language skills: listening, speaking, reading and writing.

Keywords: *MOOCs, learner characteristics, learning design, student performance, self-efficacy*

1. INTRODUCTION

Massive Open Online Course (MOOC) is a new online learning method in education that is currently developing [1]. The design of MOOCs inevitably involves a focus on complex pedagogical, technological, and organizational issues [2]. Authors proposed ten dimensions for MOOC design model: general structure, resources, vision, learner background and intention, pedagogy, communication, assessment, technologies, learning analytics data and support.

Assessment in learning is used as an indicator of the level of skill acquisition [1]. Previous researchers mentioned assessment consists of five sections that address different skills related to content knowledge; (i) interpretive listening, (ii) interpretive reading, (iii) cultural knowledge, (iv) interpersonal and presentation writing, and (v) interpersonal and presentation speaking [3].

Language is an important instrument of

communication among human beings in a community. Previous researchers listed there are four type skills in language; speaking, reading, writing, and listening [4], [5], [6], [7] [8] [9] [10]. The language skills of listening, reading, writing, and speaking are distinct from one another [11]. In this paper, we propose an effective learning design model based on the relationship between learner's characteristics and their self-efficacy in language skills. Figure 1 shows the conceptual framework for this study.

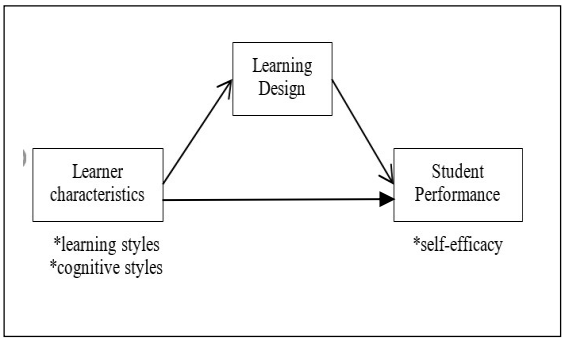

Figure 1: Conceptual framework for this study

Figure 2 illustrates the conceptual model to support the effective learning design model based on the relationship between learner's characteristics and their peformance (self-efficacy) in language skills.

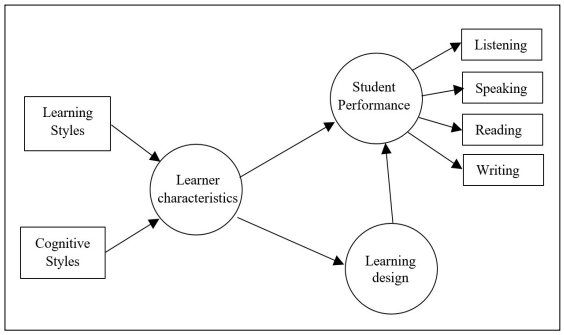

Figure 2: Conceptual Model That Contributed To This Study

1.1 Learner Characteristics

Learner characteristics can be personal, academic, social/emotional and/or cognitive in nature [12]. A Learner's characteristics are defined as an individual mental factor, suggested to impact on the learning activities of students. Authors listed three-factors may affect learning outcome of distance education i) motivation, ii) self-regulated learning and iii) self-efficacy [13]. Previous researchers listed three types of learner characteristics; (i) learning styles, (ii) cognitive styles, and (iii) multiple intelligent [14], [15].

Learning style refers to learners favored approaches to learning [16]. The previous researcher listed popular learning style models to build up a pedagogical hypothesis: (i) Kolb Experiential Learning Theory; (ii) VARK Model; (iii) Felder & Silverman Learning/Teaching Style Model and (iv) Dunn and Dunn Learning Style Model [17]. The Felder Silverman model was the most preferred model of learner style used in the learning theories compared to others learning styles [16], [18], [19]. Previous studies found that eight dimension learning styles; active, reflective, sensing, intuitive, visual, verbal, sequential, global [16], [17], [18], [20],[21], [22], [15]. Learning styles are innate preferences of individuals as to how they prefer to go about the process of learning and it is one of the dominant factors which affect the academic success of students [23].

Table 1 : Item for this study

Dimension	Description	Element
Visual	Learners who remember best what they have see	Learn best from what they see
		Prefer pictorial materials
		Learn a lot through different interactive activities
Active	Active learners prefer to learn by trying things and working with others	Trying things
		Not prefer lecturer
		Prefer group work
		Risk-takers
		Participate immediately
		Interpersonal
		Can be impulsive
Thinking	Thinking styles prefer the decision making process.	Analyzing fact
		Structure and function
		Make logical and rational decisions
Intuitive	Intuitive learners prefer the way of gathering information.	Possibilities and personal meaning
		Hidden potential and possible existence intuitive types
		They have a tendency to make speculations

Cognitive styles are the characteristic, self-consistent mode of functioning which individuals show in their perception and intellectual activities [24]. Cognitive style is described as the way individuals imagine, perceive, distinguish, recognize, think and remember information [25]. The previous studies found eight (8) dimension

cognitive styles; introversion, extraversion, sensing, intuitive, thinking, feeling, judging, and perceiving [14], [25], [26]. Previous study assumes that student's activity in e-learning courses differ based on their cognitive style preference. They may be equally satisfied and perform at the same level. However, they may prefer different activities and benefit from different activities depending on their cognitive style [27]. Cognitive Styles as a main factor that affect on students' achievement [28] [24] [29]. Cognitive style is considered as one of the most important variables affecting the students in academics [25]. Table 1 shows the list of learner characteristics dimension in MOOC language learning.

1.2 Student Performance

Students performance is very important to get good grading in those processes which decide the quality of institutes [30]. Previous researchers listed approaches to assessing student performance include the use of individual difference measures such as (i) demographics, (ii) content knowledge, and (iii) literacy skills [31]. S. Freeman [32] stated two outcome variables used to evaluate student performance; (i) scores, or (ii) failure rates. Previous researchers listed two issues student performance on learning outcomes; (i) lecturer do not have a clear picture of how to pinpoint how well students learn, and (ii) do not use assessment information to improve students' success [33]. In order to address this issue, a MOOC usage approach is used to monitor student performance within a semester with appropriate learning activities [34]. According to P. Jayarekha [35], two tools used to measure student performance; (i) direct, and (ii) indirect assessment. L. Havola [36] mentioned the main purpose type of assessment is to make a judgment regarding each student's performance.

According to C. Gbollie [37], students' motivations and strategy use have some impact on student performance. An important variable factor has been identified on student performance, that is student satisfaction [38]. In addition, learning style is one of the important factors to ensure that the various skills required are available to improve student performance [39].

1.3 Learning Design

According to H. Walmsley-Smith [40], learning design is important to i) help online tutors and learning designers analyse and innovate, ii) facilitate software developers to instantiate lessons in software and iii) share designs with others. Authors mentioned, the variety of learning activity terminology is challenging for learning designers when evaluating the effectiveness of learning designs. Therefore, the learning design and efficacy of their results have been issues for social success of courses [41]. Learning design is methodology for improving teaching and learning based on pedagogical theory and insights into students' activity and achievements [42]. The authors listed three learning design approaches used in teaching & learning (i) learning design models, (ii) key features of the learning design model, and/or (iii) other learning design features. Through the learning design can monitor student academics through several indicators such as: (i) students' online activity, (ii) online interaction, (iii) academic performance (e.g., quiz scores), and (iv) the utility of the LMS in terms of diversity of tools used and time flexibility [42].

1.4 Self-efficacy

Self-efficacy refers to people's beliefs in their abilities to complete specific tasks to get goals and what people believe they can achieve rather than what is objectively true [43]. According to D. H. Kim [44], self-efficacy is defined as a person's judgment of his/her capabilities to complete a specific task with the skills he/she possesses and is usually described as being task and context specific. The validity of learners' self-efficacy for explaining their academic performance for example learners having a strong academic self-efficacy are more likely to undertake challenges. While mean, students who possess low self-efficacy feel reluctant to deal with challenges and often choose not to engage in difficult tasks [9].

According to N. H. Mustapha [45], self-efficacy will determine the issue in learning a language such as choice of the (i) task, (ii) effort, (iii) perseverance, (iv) resilience, and (v) achievement. To measure student performance, self-efficacy is one of the factors that may influence students' sense of ability to perform such as self-assessment [46]. Authors mentioned self-assessment is described as an individual's ability to identify and self-evaluate their own skills in a particular area of expertise. K. M. Torres [47] mentioned self-efficacy involves students' self-assessment about their own competence, particularly "judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. In this study, four (4) language skills are used to measure student performance; (i) listening, (ii) speaking, (iii) reading, and (iv) writing. Table 2 shows the definition of each skill.

Table 2: Definition Of Each Skill.

Skill	Definition	Author
Listening	Ability to identify and understand what others are saying.	[4]
Speaking	Ability to the interact between the others.	[48]
Reading	A cognitive ability which a person is able to use when interacting with the written text.	[49]
Writing	Ability to generate ideas for writing.	[50]

The main issue to be accentuated is with regards to the poorly designed MOOC assessments and lack of studies focusing on the efficacy of fully online language learning. Thus, this paper is proposing an effective learning design model based on the relationship between learner's characteristics and their self-efficacy in language skills. To assist the study, the following research questions were constructed:

Based on the above discussion, we hypothesize the following:

H_1: There is a positive relationship between visual and self-efficacy for student performance.

H_2: There is a positive relationship between visual and effective learning design for student performance.

H_3: There is a positive relationship between active and self-efficacy for student performance.

H_4: There is a positive relationship between active and effective learning design for student performance.

H_5: There is a positive relationship between thinking and self-efficacy for student performance.

H_6: There is a positive relationship between thinking and effective learning design for student performance.

H_7: There is a positive relationship between intuitive and self-efficacy for student performance.

H_8: There is a positive relationship between intuitive and effective learning design for student performance.

H_9: There is a positive relationship between effective learning design and self-efficacy for student performance.

2. METHODOLOGY

This research has adopted a quantitative research design with a cross-sectional survey approach and using second generation data analysis that is the PLS-SEM approach.

2.1 Instrument

The e-activities consist of the quiz, listening assessment, forum, test, and project. The questionnaire consists of the item to evaluate self-efficacy towards an effective learning design model. The survey questionnaire was used to measure student perception to get students' feedback on self-efficacy after using the effective learning design model. In this study, four (4) self-efficacy in language skills are used to measure student performance; (i) listening, (ii) speaking, (iii) reading, and (iv) writing. Table 3 show the item for this study.

Table 3 : Item for this study

Variable	Construct	Item
Learner Characteristics	Visual	LSV1 – LSV7 * LSV – Learning Style (Visual)
	Active	LSA1 – LSA9 * LSA – Learning Style (Active)
	Thinking	CST1 – CST6 * CST – Cognitive Style (Thinking)
	Intuitive	CSI1 – CSI6 * CSI – Cognitive Style (Intuitive)
Learning Design	Learning Design	LD1 – LD9 * LD – Learning Design
Self-Efficacy	Listening	LS1 – LS5 * LS – Listening Skill
	Speaking	SS1 – SS6 * SS – Speaking Skill
	Reading	RS1 – RS5 * RS – Reading Skil
	Writing	WS1 – WS6 * WS – Writing Skil

2.2 Data collection

Data collection was conducted for one year. Coursework assessments were conducted throughout the one-semester duration (one cohort) in Semester 1 2018/2019. The MOOC lessons and e-activities were implemented as online learning conducted by the language teachers. Some of the assessments were conducted via face-to-face and some of it via MOOC. This research adopted a quantitative approach for collecting data using a structured survey instrument. A total of 130 questionnaires were distributed to the students enrolled in Mandarin MOOC in a public university in Malaysia.

2.3 Statistical Technique

Partial least squares structural equation modeling (PLS-SEM) was used to perform structural model analysis. PLS was chosen because of the exploratory nature of this study. First, the measurement model (outer model) is tested to ensure its validity and reliability. Measurement properties of multi-item constructs, including convergent validity, discriminant validity, and reliability, are examined by conducting exploratory analysis. The bootstrapping is used to test the significant level construct in this study. The study model included 60 reflective measurement items (manifest variable or indicator) for six (6) variables (latent variable) including independent variables (IV), dependent variable (DV), which constitute eight (8) relationships between them based on the hypotheses proposed study in the effective learning design model as shown in Figure 3.

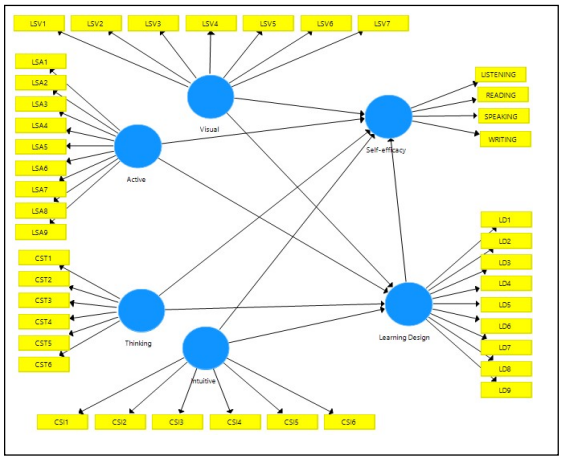

Figure 3: Effective Learning Design Model

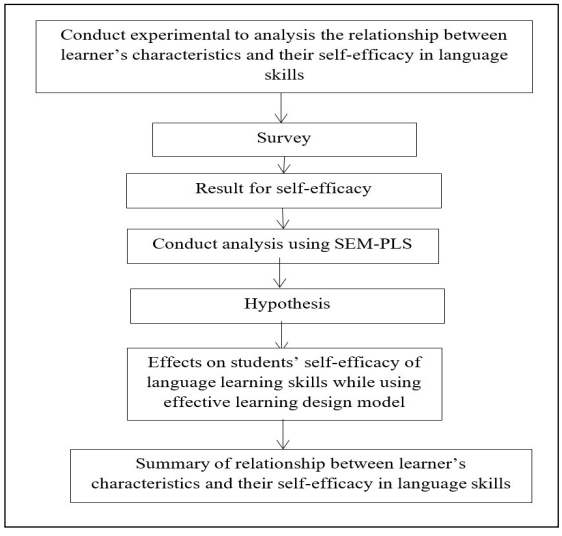

Figure 4: Flow Chart

In order to answer research questions, a flow diagram has been developed as shown in Figure 4.

3. RESULT

This section explains the results of the objectives for this paper. The result divide by three (3) parts: (i) data analysis and result, (ii) measurement model assessment and (iii) structural model assessment.

3.1 Data Analysis And Result

The demographic profiles of the respondents revealed that the majority of respondents were male (62.1%) and 36.9% of respondents were female. Table 4 shows the student participation in this study.

Table 4: Student Participation.

Gender	Number	Percentages (%)
Male	82	62.1
Female	48	39.9
Total	179	100

In SmartPLS, the analysis was undertaken in two stages: (1) validating the measurement model (i.e. confirmatory factor analysis 'CFA', and (2) validating the structural model.

3.2 Measurement Model Assessment

To validate the measurement model (i.e. CFA) in SmartPLS, item loadings, average variance extracted (AVE) and composite reliability (CR) were assessed by running the PLS algorithm. Figure 5 depicts the measurement model in SmartPLS. As shown in Figure 3, all the items loadings should be over the recommended value of 0.7 [51]. The author recommended composite reliability values should be greater than 0.7. In this study, all the composite reliability values ranged from 0.934 to 0.964.

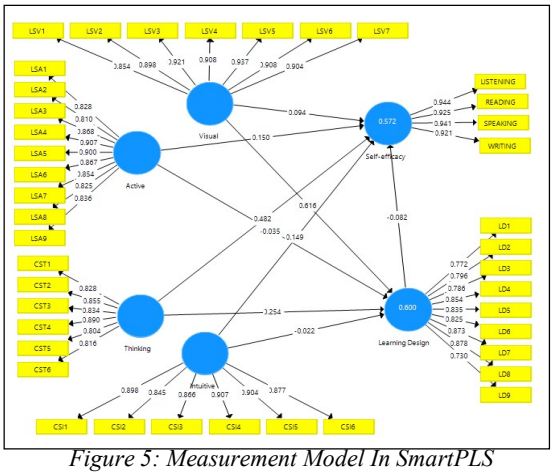

Figure 5: Measurement Model In SmartPLS

The average variance extracted (AVE) measures the variance encapsulated by the indicator relative to measurement error and this should be higher than 0.5 in order to justify the use of construct [51]. In this study, the value AVE ranged from 0.669 to 0.870, which were all within the recommended range. In addition, the discriminant validity of the constructs was measured using the square root of the average variance extracted (AVE). Overall, the measurement model (i.e. CFA) was assessed and confirmed by examining convergent validity and discriminant validity.

Table 5: Results Of Indicators Reliability And Convergent Validity

Measurement Model Construct	Item	Item Loading	AVE	CR	α
Visual	LSV1	0.854	0.818	0.969	0.963
	LSV2	0.898			
	LSV3	0.921			
	LSV4	0.908			
	LSV5	0.937			
	LSV6	0.908			
	LSV7	0.904			
Active	LSA1	0.828	0.732	0.961	0.954
	LSA2	0.810			
	LSA3	0.868			
	LSA4	0.907			
	LSA5	0.900			
	LSA6	0.867			
	LSA7	0.854			
	LSA8	0.825			
	LSA9	0.836			
Thinking	CST1	0.828	0.703	0.934	0.915
	CST2	0.855			
	CST3	0.834			
	CST4	0.890			
	CST5	0.804			
	CST6	0.816			
Intuitive	CSI1	0.898	0.780	0.955	0.943
	CSI2	0.845			
	CSI3	0.866			
	CSI4	0.907			
	CSI5	0.904			
	CSI6	0.877			
Learning Design	LD1	0.772	0.669	0.948	0.938
	LD2	0.796			
	LD3	0.786			
	LD4	0.854			
	LD5	0.835			
	LD6	0.825			
	LD7	0.873			
	LD8	0.878			
	LD9	0.730			
Self-Efficacy	Listening	0.944	0.870	0.964	0.950
	Reading	0.925			
	Speaking	0.941			
	Writing	0.921			

The construct validit which consists of convergent and discriminant validity was assessed followed by reliability analysis. For convergent validity: All the items loadings should be over the recommended value of 0.7, CR over than 0.7 and AVE more than 0.5 (Table 5). For discriminant validity: The results of cross loadings and it is found that indicator loadings on its own construct is higher than all of its cross loadings with other constructs (Table 6). Table 7 shows the result for Smarts-PLS Measurement Model Validity Test.

Table 6: Loading And Crossloadings

Item	Visual	Active	Thinking	Intuitive	Learning Design	Self-efficacy
LSV1	0.854	0.641	0.636	0.558	0.649	0.600
LSV2	0.898	0.719	0.719	0.684	0.708	0.595
LSV3	0.921	0.757	0.656	0.636	0.690	0.523
LSV4	0.908	0.725	0.679	0.608	0.699	0.552
LSV5	0.937	0.795	0.705	0.662	0.705	0.540
LSV6	0.908	0.761	0.628	0.629	0.697	0.514
LSV7	0.904	0.773	0.648	0.651	0.657	0.562
LSA1	0.609	0.828	0.623	0.659	0.491	0.490
LSA2	0.611	0.810	0.666	0.660	0.561	0.563
LSA3	0.712	0.868	0.596	0.633	0.538	0.561
LSA4	0.758	0.907	0.666	0.685	0.590	0.547
LSA5	0.774	0.900	0.697	0.722	0.616	0.581
LSA6	0.753	0.867	0.653	0.681	0.631	0.524
LSA7	0.695	0.854	0.699	0.695	0.514	0.631
LSA8	0.655	0.825	0.674	0.661	0.507	0.613
LSA9	0.704	0.836	0.713	0.703	0.527	0.615
CST1	0.713	0.729	0.828	0.742	0.576	0.620
CST2	0.710	0.715	0.855	0.757	0.644	0.581
CST3	0.548	0.562	0.834	0.653	0.428	0.592
CST4	0.641	0.677	0.890	0.721	0.568	0.660
CST5	0.441	0.572	0.804	0.586	0.455	0.666
CST6	0.639	0.644	0.816	0.592	0.639	0.574
CSI1	0.630	0.719	0.764	0.898	0.529	0.663
CSI2	0.547	0.688	0.748	0.845	0.484	0.636
CSI3	0.587	0.681	0.746	0.866	0.526	0.651
CSI4	0.662	0.714	0.677	0.907	0.536	0.548
CSI5	0.665	0.693	0.673	0.904	0.532	0.566
CSI6	0.617	0.707	0.652	0.877	0.492	0.485
LD1	0.542	0.468	0.491	0.462	0.772	0.353
LD2	0.684	0.553	0.591	0.539	0.796	0.472
LD3	0.615	0.548	0.584	0.520	0.786	0.446
LD4	0.649	0.546	0.505	0.473	0.854	0.369
LD5	0.618	0.512	0.506	0.437	0.835	0.368
LD6	0.590	0.502	0.569	0.463	0.825	0.457
LD7	0.662	0.572	0.542	0.502	0.873	0.351
LD8	0.646	0.546	0.567	0.473	0.878	0.365
LD9	0.556	0.505	0.507	0.425	0.730	0.430
Listening	0.607	0.663	0.680	0.665	0.465	0.944
Reading	0.483	0.570	0.639	0.558	0.362	0.925
Speaking	0.643	0.687	0.711	0.679	0.538	0.941
Writing	0.549	0.561	0.704	0.607	0.465	0.921

Table 7: Smarts-PLS Measurement Model Validity Test.

Convergent Validity	Discriminant validity
Indicator loadings > 0.70 Composite Reliability (CR) > 0.7 Average Variance Extracted (AVE > 0.5)	AVE > square of inter-construct correlation No substantial cross-loadings

3.3 Structural Model Assessment

To assess the structural model, a bootstrapping approach was applied in SmartPLS to determine the significance of the paths in the model. More specifically, the T value accompanying each path coefficient was generated using the bootstrapping technique and subsequently, the P values were generated, as reported in Table 8. Figure 6 and Figure 7 shows the results of bootstrapping with 500 samples.

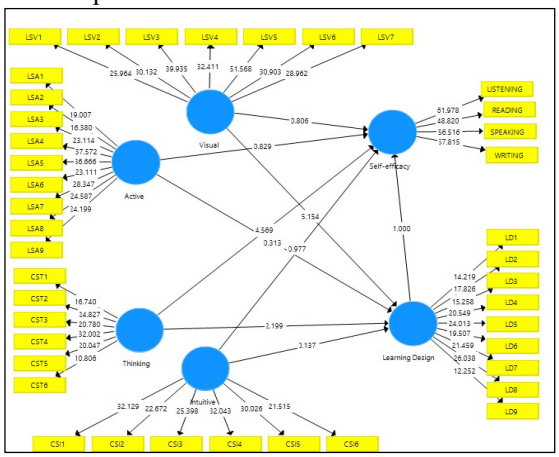

Figure 6: Structural Effective Learning Design Model Results

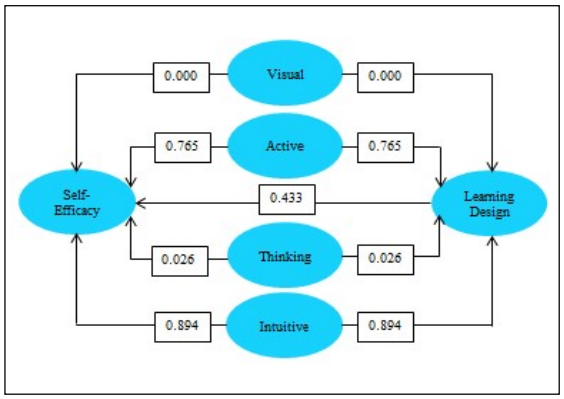

Figure 7: Bootstrapping result

Based on Figure 7, the results of the model show two constructs from learner characteristics have positive relationships and significant to the effective learning design model, that one dimension for learning styles (visual) and one dimension for cognitive styles (thinking). The p value for both contructs is 0.000 ($p< 0.01$).

Table 8 shows a summary of the structural model analysis. As we can see in Table 4, among the nine hypotheses advanced in this study, three H_1, H_5 and H_6 were supported at $p<0.01$ confidence level. Therefore, six hypotheses were not supported (H_2, H_3, H_4, H_7, H_8 and H_9).

Table 8: Summary Of The Structural Model Analysis.

Hypothesis		Path Co-efficiency	T Value	P Value	Result
H_1	Visual -> Self-efficacy	0.094	0.786	0.433	Not supported
H_2	Visual -> Learning Design	0.616	4.876	0.000	Supported
H_3	Active -> Self-efficacy	0.150	0.849	0.396	Not supported
H_4	Active -> Learning Design	-0.035	0.299	0.765	Not supported
H_5	Thinking -> Self-efficacy	0.482	4.282	0.000	Supported
H_6	Thinking -> Learning Design	0.254	2.231	0.026	Supported
H_7	Intuitive -> Self-efficacy	0.149	0.967	0.334	Not supported
H_8	Intuitive -> Learning Design	-0.022	0.133	0.894	Not supported
H_9	Learning Design -> Self-efficacy	-0.082	0.915	0.361	Not supported

The result from Table 8, first hypothesis, H_2 supported at $p<0.01$ confidence level. Visual will have a positive and significant effect on effective learning design of model for student performance. However, the second hypothesis, H_4 not supported at $p<0.01$ confidence level. Active will have a negative and not significant effect on effective learning design of model for student performance. For cognitive styles dimension, the third hypothesis, H_6 supported at $p<0.01$ confidence level. Thinking will have a positive and significant effect on effective learning design of model for student performance. However, fourth hypotheses, H_8 not supported at $p<0.01$ confidence level.

Intuitive will have a negative and not significant effect on effective learning design of model for student performance. The findings show two constructs from learner characteristics have positive relationships and significant to the effective learning design model, that one dimension for learning styles (visual) and one dimension for cognitive styles (thinking).

Hypothesis H_1, H_3, H_5 and H_7 is the relationships between learner characteristics and self-efficacy to improvement in student performance for all language skills: listening, speaking, reading and writing. H_1 not supported at $p<0.01$ confidence level. Visual will have a negative and not significant effect on self-efficacy. H_3 not supported at $p<0.01$ confidence level. Active will have a negative and not significant effect on self-efficacy. H_5 supported at $p<0.01$ confidence level. Thinking will have a positive and significant effect on self-efficacy. H_7 not supported at $p<0.01$ confidence level. Intuitive will have a negative and not significant effect on self-efficacy. Hypothesis H_9 is testing the significant design learning model to improve in student performance for all language skills: listening, speaking, reading and writing. In this study, H_9 was not supported at $p<0.01$ confidence level. Effective learning design will have a significant negative effect on listening to model for student performance.

Based on the result from hypothesis test for student achievement and online learning indicates that there are no significant differences in oral production, and minimal statistical differences for writing, reading, and listening [52]. Therefore, the result has reinforced that these (2) two dimensions (visual and thinking) contribute to the effective learning design model which shows improvement in student performance for all language skills (listening, speaking, reading and writing).

However, from experimental, the findings show that there is a strong relationship between language learning skills and student performance (listening, speaking and writing) in student performance using the learning design model. To conclusion, there is increasing student performance in listening, speaking and writing using learning design model. The finding shows that e-activity is based on an learning design model to increase student performance in Mandarin MOOC assessment.

Figure 8 shows a comparison of students' test results between two cohorts (Cohort 1 and Cohort 2). Cohort 1 consists of 267 students that took the test using MOOC without the SA-MOOC model. Cohort 2 consists of 306 students that took the test using MOOC with the SA-MOOC model. The test consists of two (2) sections (Section A and Section B) and each section consists of 20 questions. Comparison of the two test results revealed that, on average, there is an increment of 14.6 percent of students' marks in Section A and 11.91 percent in section B. This reflects an improvement of the students that used the learning design model. These results also suggest that the online assessment method applied to the learning design model such as quiz, listening assessment, forum, test and project helps in increasing the students' performance in this course. This result supports the nation that assessment design through the MOOC platform is able to increase the students' performance.

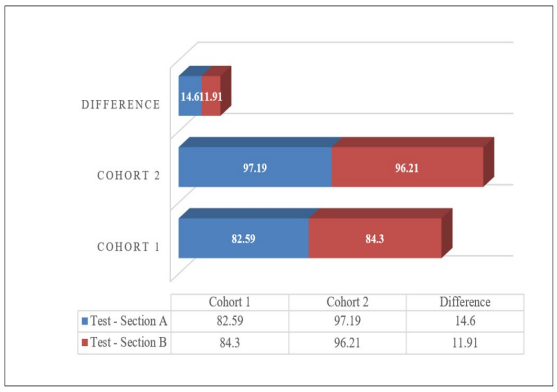

Figure 8: Comparison Of Student Result

4. CONCLUSION

This study presents findings on the implementation of an online learning approach in learning a second language. The findings show nine hypotheses, three (3) hypotheses supported the P value (significant) and six (6) hypotheses not supported. The finding shows that visual and thinking dimensions contribute to the effective learning design model that shows improvement in student performance for all language skills: listening, speaking, reading and writing ($p<0.01$). However, an effective learning design model that is not significant to all constructs from all language skills: listening, speaking, reading and writing. This result shows the relationships between learner characteristics and student performance using a learning design model through activities in second language courses. In the future, we will further analyze the student performance after using the MOOC assessment model.

5. ACKNOWLEDGEMENT

The authors would like to express their appreciations to Universiti Teknikal Malaysia Melaka (UTeM) for supporting this study.

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