

A Best Practice Model of Open and Distance Learning (ODL) for Studio-Based Architectural Design Courses

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Abstract: In March 2020, distance education was enforced as a proactive procedure to control the spread of coronavirus. However, the COVID-19 circumstances provide evidence of the possibility of teaching architecture in other ways. This research explores various aspects that contribute to the success factors of ODL for studio-based architectural design courses which then forms the fundamentals to develop the best practice model of ODL for studio-based architectural design courses to improve the quality of teaching and learning process. This research used a quantitative design. Data was collected through surveys from thirty-four (34) respondents with expertise in conducting studio based architectural design courses to identify the success factors of ODL for the courses. Data was analysed using SmartPLS3 software for Partial Least Squares Structural Equation Modeling (PLS SEM) to assess the measurement and structural for reflective-formative model based on the significant value of the items studied. The results of the research revealed that the path coefficient analysis score of the teaching and learning approach is the highest, which is 0.892, while the design skills is 0.626. It has been shown that the relationship between indicators and constructs is highly correlated. This is then followed by the communication approach at -0.187, while the design-studio management strategies is -0.111, digital tools is 0.018 and comprehensive design is -0.007. The results also highlighted that the teaching and learning approach and design skills is the best practice for ODL. Overarchingly, this research provides insights into ODL in studio-based architectural design courses as a future direction in teaching architecture.

Keywords: *Open and Distance Learning (ODL), Studio-Based, Architectural Design Courses, Partial Least Squares Structural Equation Modeling (PLS-SEM)*

1. INTRODUCTION

The architectural design studio as a learning environment, including its pedagogy, history, and interaction, focuses on what makes the architectural design studio unique. Dutton (1984) stated that compared to typical classroom scenarios, studios are active sites where students are engaged intellectually and socially, shifting between analytic, synthetic, and evaluative models of thinking in different sets of activities (drawing, conversing, model-making). Although scholars have long praised the design studio as being a unique environment, there have also been criticisms (Ledewitz, 1985). By the end of the year 2019, COVID-19 pandemic attacked the world and significantly impacted all aspects of life such as economic, social and environment including education. Many higher education institutions worldwide switched to open and distance learning and put on-campus or face to face classes on hold. Despite the presence of distance and online classes before the pandemic, their utilization was marginal compared to the dominant on-campus classes. However, ODL became an ubiquitous approach to address the challenges of the pandemic situation. ODL advantages are mainly related to openness, flexibility, volume, and accessibility. The courses embrace the culture of the architectural design studio which traditionally embeds the inherent unique requirements related to high focused interactivity between the instructors and students as well as among the respective peers. For its practical nature, the in-studio approach is the most dominant acceptable way of teaching architecture. Therefore, there are several teaching and learning approaches that can be used in running the ODL by using a synchronous approach which is physical design studio, asynchronous which is virtual design studio and blended synchronous which is a mixture of physical design studio and virtual design studio.

2. PROBLEM STATEMENT

Most of the participants of the architectural design studio, which involved students and instructors, have a broad understanding of the culture of the architectural design studio (Khodeir & Nessim, 2020). Therefore, the perceptions and descriptions that are influenced by the interaction that occurs among these participants, the assignments, and the environment have been taken for granted rather than studied. Study is warranted because participants' perceptions have had a strong impact on the discussion surrounding the architectural design studio, and knowledge of students' learning experiences in that setting is important since these experiences contribute to architectural student learning. Without understanding their experiences, it may be difficult to facilitate positive change in the architectural design studio environment (Ozorhon & Lekesiz, 2021). The COVID-19 pandemic which necessitates online teaching and learning further emphasises the need to understand how these kinds of courses can be conducted using the ODL approach to enhance the teaching and learning experience in the studio.

Despite the growing importance of digital applications in studio-based architectural courses (de Araujo Lima, 2018), teaching architecture in an online format is rare due to the nature of the field. Most core courses in studio-based architecture programs need high interactivity between the instructors and students in-presence interaction between the student and the instructor seem naturally suited to this requirement. The extent to which the ODL approach can model the reality of actual physical studio face to face approach to facilitate high interactivity between participants in the studio has not been much researched (Ibrahim et al., 2021). The appropriate approaches need to be identified to make sure the studio-based architectural design courses are not lagging behind on the currently open and distance learning process. Teaching architecture in an online format is rare due to the nature of the field. Most core courses in architecture programs need in-presence interaction between the student and the instructor. What issues have distance education replacing face-to-face education raised in terms of

the architectural design studio? The major change in the transition to online education is the physical removal of the studio environment and participants (Yorgancıoğlu, 2020). While the physical studio environment is a shared place equipped with social interactions, each student or participant in remote education is available in their personal space (Yorgancıoğlu, 2020). The model is crucial in the light of technical difficulties, lack of training, and the psychological circumstances resulting from the uncertain situation in the ODL teaching process (Ibrahim, 2021).

This research will explore the context of success factors for teaching studio-based architectural courses focusing on the unique requirements of high focus and interactivity between instructors and learners and peers. Investigations will then be geared towards investigating how the various aspects of teaching studio-based architectural design courses and their parameters can be modelled into success factors of ODL format taking into consideration all the unique interactivity requirements of a traditional studio context. The model will then be validated by investigating the inter relationship among the parameters and respective variables.

3. RESEARCH QUESTIONS

The research questions are as follows.

- 1) What are the success factors of ODL for studio-based architectural design courses?
- 2) How can the various aspects and parameters of teaching studio-based architectural design courses and their parameters be modelled into a best practice ODL approach taking into consideration all the unique interactivity requirements?

4. OBJECTIVES OF THE RESEARCH

The aim of the research is to propose a best practice model based on success factors of ODL for studio-based architectural design courses. Based on the above aim, the objectives of this study are centered on the following:

- 1) To identify the success factors of ODL for studio-based architectural design courses.
- 2) To develop the success factors model of ODL for studio-based architectural design courses.

5. LITERATURE REVIEW: SUCCESS FACTORS OF OPEN AND DISTANCE LEARNING (ODL) FOR STUDIO BASED ARCHITECTURAL DESIGN COURSES

This research explored several success factors that support the effectiveness of ODL for studio-based architectural design courses. Researchers have identified six (6) success factors involved, namely (i) develop a comprehensive design process, (ii) design a good communication approach between learners, students, and peers, (iii) design practical teaching and learning approaches, (iv) design skills, (v) design-studio management strategies, and (vi) digital tools. Therefore, this research needs to see which success factors are important to ODL approaches whether through synchronous, asynchronous and blended synchronous.

5.1 DEVELOP A COMPREHENSIVE DESIGN PROCESS

Developing a comprehensive design process is a success factor of ODL for studio-based architectural design courses that needs to be given focus. Creativity is one of the most important aspects of design-based projects such as creativity has been at the heart of the business (Amabilie & Khaire, 2008). Creativity also explains creative ideas or analyzing drawings and gestures systematically. Comprehensive design process also involves integration of a building into the landscape to produce a holistic design based on the uniqueness of the site and also integrating theoretical (Soliman, 2017) and practical courses into the design studio to deal with theoretical, historical, and social subjects (Turkan et al., 2010).

5.2 DESIGN A GOOD COMMUNICATION APPROACH BETWEEN LEARNERS, STUDENTS, AND PEERS

Designing a good communication approach between learners, students, and peers is an important factor in helping the ODL process for studio-based architectural design courses (Soliman, 2017). In order to ensure good communication between learners, students and peers, several approaches have been used including the use of technology as design communication tools, high-end digital techniques have a vital impact on the form creation phase of the design process (Abdelhameed, 2011). For the purpose of sketching and communicating a design, it allows a designer to present potential ideas and solutions in many design phases such as conception, perception, evaluation, decision making, and representation. Meanwhile, physical modeling involves verifying that physical models are also effective during the form creation phase of conceptual design (Abdelhameed, 2011).

5.3 DESIGN PRACTICAL TEACHING AND LEARNING APPROACHES

Design practical teaching and learning approaches is an important factor that applies elements of discussion of experiences of well-known architects to understand in-depth on experiences of well known architects raises student acuity of a site, first, as users of a built environment, and second, as designers who will integrate building forms into landscapes (Soliman, 2017). In addition, site visit is the best approach to develop their perception of a place (Veronica, 2013) and also through experimental learning based on design education theory (Demirbas & Demirkan, 2007).

5.4 DESIGN SKILLS

Design Skills are a very important factor to ensure success in ODL for studio-based architectural design courses. Design skills emphasize domain-relative experience, creativity-relevant skills, and motivation (Mattingly, 2011). Therefore, the concept of allowing the students to judge and synthesize collected data using their creativity-relevant skills and apply their technical knowledge based on their domain-relative experience. On the other hand, an educator should use motivational methods to initiate the design problem and sustain the design process (Huber et al., 2012).

5.5 DESIGN-STUDIO MANAGEMENT STRATEGIES

Design-studio management strategies is a very important factor that emphasizes the element of group discussions to manage collected data and use them to form informative visions, generate the shapes of a built environment, provide support for user activities, create attractive nodes, and prevent disturbances and violations (Galil & Kandil, 2015). Next, the element of interdisciplinary teamwork is essential for firms in the construction industry (Sebastian, 2006) and also a realistic design problem that focuses on the characteristics of real projects and how these projects can influence the learning situation in a design studio (Veronica, 2013).

5.6 DIGITAL TOOLS

The use of distance learning in higher education institutions has expanded globally (Poon, 2013). Digital tools also play a role in managing the ODL process for studio-based architectural design courses. Digital tools are used to support creative design thinking. Digital tools are also used to support creative design communication and also for collaboration and mutual learning (Noh et al., 2021).

5.7 OPEN AND DISTANCE LEARNING (ODL) APPROACHES

This research has identified approaches for ODL. Researchers have found that there are three (3) approaches in ODL which consist of (i) Synchronous (Physical Design Studio), (ii) Asynchronous (Virtual Design Studio), (iii) Blended Synchronous (Mixture of Physical Design Studio and Virtual Design studio) (Mukhopadhyay, 2020; Brahimi & Sarirete, 2015). This approach is very important to ensure that the quality of teaching and learning can be improved to produce competitive students even though they gain knowledge through ODL.

6. RESEARCH METHODOLOGY

The research methodology used in this research is a quantitative method. A literature review has been conducted to identify the success factors involved in ODL for studio-based architectural design courses. This

research conducted a quantitative analyses. The sampling technique that has been used is purposive sampling because the target respondents are those who have experience consisting of instructors involved in teaching and learning through ODL for studio-based architectural design courses. Data was collected through survey to identify the success factors of ODL for studio-based architectural design courses. Additionally, data was gleaned from return questionnaire survey forms from thirty-four (34) respondents with expertise in conducting studio-based architectural design courses. Data was analysed using SmartPLS 3 software for PLS-SEM to assess the measurement and structural for reflective-formative model based on the significant value of the items studied. The assessment done on the developed model involves the evaluation of the reflective model and the evaluation of the structural model.

7. FINDINGS OF THE RESEARCH

Findings for this research have been divided into two (2) parts according to the objectives that have been formulated. These are based on literature review and analysis using PLS-SEM.

7.1 OBJECTIVE 1: LITERATURE REVIEW TO IDENTIFY THE SUCCESS FACTORS OF ODL FOR STUDIO-BASED ARCHITECTURAL DESIGN COURSES.

The results of the literature review to identify the success factors of ODL for Studio Based Architectural Design Courses are as in Table 1. There are six (6) main variables involving seventeen (17) indicators in this research.

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Success Factors ODL for Studio-Based Architectural Design Courses	Coding
1. Communication Approach	
1.1 The use of technology	CA1
1.2 Sketching	CA2
1.3 Physical modeling	CA3
2. Comprehensive Design	
2.1 Creativity	CD1
2.2 Intergration of a building into the landscape	CD2
2.3 Integrating theoretical and practical courses into the design studio	CD3
3. Design Skills	
3.1 Domain-relative experience, creativity-relevant skills, and motivation	DS1
3.2 Students judge and synthesize collected data using their creativity-relevant	DS2
4. Digital Tools	
4.1 Creative design thinking	DT1
4.2 Creative design communication	DT2
4.3 Collaborative and mutual learning	DT3
5. Design-Studio Management Strategies	
5.1 Group discussions	MS1
5.2 Interdisciplinary teamwork	MS2
5.3 Realistic design problem	MS3
6. Teaching and Learning Approach	
6.1 Discussion of experiences of well-known architects	TL1
6.2 Site visit	TL2
6.3 Experimental learning	TL3

Table 1. Indicator Reliability (Outer Loadings)

7.2 OBJECTIVE 2: PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING (PLS-SEM) TO DEVELOP THE SUCCESS FACTORS MODEL OF ODL FOR STUDIO-BASED ARCHITECTURAL DESIGN COURSES.

This research has carried out an evaluation of the developed model. The evaluation of the model consists of the assessment of the reflective model and also the assessment of the structural model. Using reflectively measured constructs, the indicator loadings are examined. Standardised loadings over 0.70 are desirable (Chin, 2010). Based on the findings in Table 1, it has been found that there are eight (8) score indicators that exceed 0.7 for outer loadings, consisting of (i) physical

modeling (0.818), (ii) creativity (0.816), (iii) students judge and synthesize collected data using their creativity-relevant (0.983), (iv) collaborative and mutual learning (0.836), (v) interdisciplinary teamwork (0.910), (vi) realistic design problem (0.703), (vii) discussion of experiences of well-known architects (0.879), (viii) experimental learning (0.884). This shows that these indicators are important and need to be emphasized to ensure the success of ODL for studio-based architectural design courses.

The internal consistency reliability is obtained by ensuring that Cronbach's α , ρ_A , and the composite reliability are higher than 0.70 and below 0.95 (Hair et al., 2017). In the assessment of the convergent validity. For this purpose, the average variance extracted (AVE) is used. If the AVE is above 0.50, the construct explains an average of at least 50% of its items' variance (Chin, 1998). Based on the results of the findings in Table 2, it has been found that the value from the internal consistency realism assessment shows that the teaching and learning approach is a dominant and very important factor in the development of the success factors model of ODL for studio-based architectural design courses.

The results of convergent validity using redundancy analysis (path coefficients) (refer Table 3 and Figure 1) has shown the model developed for success factors model of ODL for studio-based architectural design courses which consists of show that the construct teaching and learning approach scores above 0.7 which is 0.892 and this indicate that this construct has a great impact in helping the success of ODL for studio-based architectural design courses.

The discriminant validity assessment has the goal to ensure that a reflective construct has the strongest relationships with its own indicators for example in comparison with than any other construct in the PLS-SEM (Hair et al., 2022). Much research relies on the Fornell-Larcker criterion and cross loadings when investigating discriminant validity (Hair et al., 2022). They are relative to the (geometric) mean of the average correlations of the indicators measuring the same construct. High Heterotrait-Monotrait (HTMT) values indicate a problem with discriminant validity. Based on

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simulation and previous research, Henseler et al. (2015) recommend that HTMT values should not exceed 0.90 if the path model includes constructs that are conceptually. When the constructs are conceptually more distinct, a more conservative threshold value of 0.85 is recommended. As a result of this research, it has been found that the results of the assessment of discriminant validity are positive for the relationship between constructs that show a strong relationship, that is between digital tools and comprehensive design get a score of 0.8925 while for teaching and learning approach with comprehensive design get 0.986. Conclusively, for this reflective evaluation, the construct for the teaching and learning approach consisting of indicators like discussion of experiences of well-known architects, site visit and experimental learning are factors and sub-factors that are very important to be given attention in carrying out the ODL implementation process.

Items	Outer Loadings
Communication Approach	
CA1: The use of technology	0.650
CA2: Sketching	0.374
CA3: Physical modeling	0.818
Comprehensive Design	
CD1: Creativity	0.816
CD2: Intergration of a building into the landscape	0.645
CD3: Integrating theoretical and practical courses into the design studio	0.465
Design Skills	
DS1: Domain-relative experience, creativity-relevant skills, and motivation	0.075
DS2: Students judge and synthesize collected data using their creativity-relevant	0.983
Digital Tools	
DT1: Creative design thinking	-0.092
DT2: Creative design communication	-0.458
DT3: Collaborative and mutual learning	0.836
Design-Studio Management Strategies	
MS1: Group discussions	0.122
MS2: Interdisciplinary teamwork	0.910
MS3: Realistic design problem	0.703
Teaching and Learning Approach	
TL1: Discussion of experiences of well-known architects	0.879
TL2: Site visit	-0.075
TL3: Experimental learning	0.884

Table 1. Indicator Reliability (Outer Loadings)

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Communication Approach	0.403	0.255	0.657	0.410
Comprehensive Design	0.325	0.351	0.686	0.433
Design Skills	0.408	-1.588	0.521	0.486
Design-Studio Management Strategies	0.317	0.617	0.644	0.446
Digital Tools	0.288	-0.239	0.038	0.305
Teaching and Learning Approach	0.375	0.714	0.664	0.520

Table 2. Internal Consistency Realibility

Construct	Convergent Validity
Communication Approach	-0.187
Comprehensive Design	-0.007
Design Skills	0.626
Design-Studio Management Strategies	-0.111
Digital Tools	0.018
Teaching and Learning Approach	0.892

Table 3. Path Coefficients

	Communication Approach	Comprehensive Design	Design Skills	Design-Studio Management Strategies	Digital Tools	Teaching and Learning Approach
Communication Approach						
Comprehensive Design	1.157					
Design Skills	1.941	1.300				
Design-Studio Management Strategies	1.591	1.439	1.619			
Digital Tools	1.282	0.825	1.011	1.950		
Teaching and Learning Approach	1.389	0.986	1.053	1.678	1.172	

Table 4. Discriminant Validity

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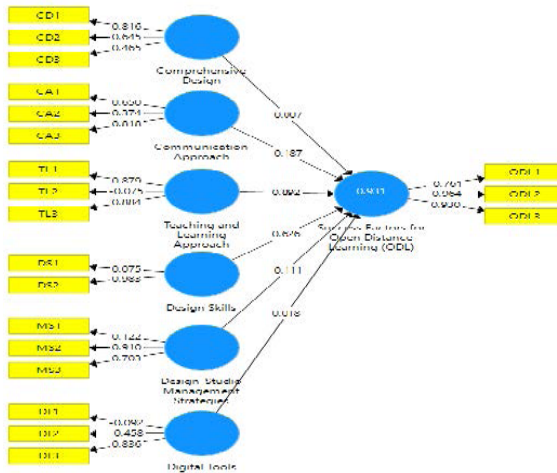


Fig. 1 Success Factors Model of Open and Distance Learning (ODL) for Studio-Based Architectural Design Courses

Following a structural model assessment by analyzing Collinearity assessment inner variance inflation factor (VIF) values, significance and relevance of path coefficients, level of R² of endogenous latent variables, and effect size f² of path coefficients to identify the strength of the model that has been developed and highlighted constructs that need to be given focus to support the teaching and learning process in ODL for studio-based architectural design courses.

The purpose of collinearity for inner VIF values is to assess the relationships between constructs for the interpretation of the path coefficients. These are the collinearity among the constructs involving communication approach, comprehensive design, design skills, design-studio management strategies, digital tools and teaching and learning approach. Table 5 shows the inner VIF scores which recorded values of less than 5 (<5) i.e. communication approach recorded a value of 2.250, followed by comprehensive design at 2.114, digital tools at 1.589 respectively. Hair et al. (2017) and Diamantopoulos and Siguaw (2006) were of the opinion that where the VIF values are consistently below the threshold values of 5 and also 3.3,

it can be concluded that collinearity does not reach critical levels in any of the formative constructs. However, the findings have found that there are constructs that record inner VIF values that exceed 5, which consist of design skills that record a value of 5.211, design-studio management strategies at a value of 12.664, and teaching and learning approach at a value of 7.887. This shows that there are some constructs that have issues with collinearity in critical levels. However, it does not show that the constructs involved are not important in this developed model. Researchers formulating all the constructs involved in this research is very important and should be emphasized when conducting ODL.

Construct	Inner VIF Value
Communication Approach	2.250
Comprehensive Design	2.114
Design Skills	5.211
Design-Studio Management Strategies	12.664
Digital Tools	1.589
Teaching and Learning Approach	7.887

Table 5. Inner VIF Values

Significance and relevance of path coefficients can be identified from Figure 2 it can be seen that in terms of the relationship between the structural model that has been developed, only the construct teaching and learning approach has a strong relationship with the of success factors of ODL for studio-based architectural design courses at 0.892 from the path coefficient score. All the other constructs do not have a strong relationship with the dependent variable that is the success factor of ODL for studio-based architectural design courses. The researcher found that the construct a design skills is at the second highest place with a path coefficient score of 0.626, followed by the construct design-studio management strategies at -0.111, digital tools at 0.018 and the last place is a comprehensive design which has a low path coefficient result score of -0.007. Thus, the results of the scores obtained found that the construct of a teaching and learning approach is the most significant and has a strong relationship with the higher order constructs.

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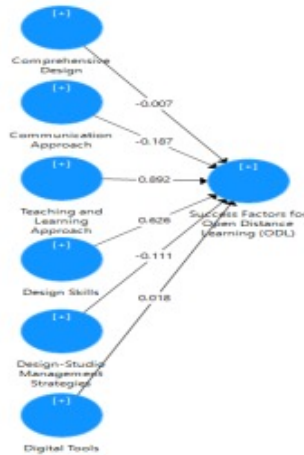


Fig. 2 Structural Model for Success Factors Model of Open and Distance Learning (ODL) for Studio-Based Architectural Design Courses

Level of R² of endogenous latent variables with reference to Table 6, the researcher found that the level value of R-square (R²) of endogenous latent variables are very good and the R-square value for the success factors model of ODL for studio-based architectural design courses is 0.931. This indicates that the development of model for success factors model of ODL for studio-based architectural design courses is capable of making predictions with 93.1% accuracy respectively. R-square is a measure of a model's explanatory power (Hair et al., 2021).

Endogenous Latent Variables	R Square	R Square Adjusted
Success Factors for Open Distance Learning (ODL)	0.931	0.916

Table 6. Level of R-Square (R²) of Endogenous Latent Variables

Effect size f^2 of path coefficients is the next step in structural model evaluation is to assess the effect of a specific exogenous construct on the endogenous construct if it is deleted from the model. The effect size (f^2) measures the contribution of each particular exogenous in explaining endogenous variables. According to Cohen (1988), f -square values of 0.02, 0.15, and 0.35 for significant exogenous indicates weak, moderate and strong effects, respectively.

Table 7 shows that significant exogenous constructs for communication approach are in the moderate category because it obtains a score of more than 0.15 which is 0.225. Meanwhile, it was found that the exogenous construct for comprehensive design, design-studio management strategies, and digital tools achieved a score of less than 0.02, which indicates that no effect will occur if this exogenous construct is removed from the model development. For the exogenous construct design skills, and teaching and learning approach, the researcher found that the identified score was above 0.35 and this indicates that it has strong effects on the model development. The results of this finding have explained that design skills, and teaching and learning approach are very important constructs and have a big impact on the model developed if they are not taken into account.

Construct	f^2
Communication Approach	0.225
Comprehensive Design	0.000
Design Skills	1.089
Design-Studio Management Strategies	0.014
Digital Tools	0.003
Teaching and Learning Approach	1.463

Table 7. Effects Size F-Square (f^2) of Path Coefficients

8. CONCLUSION

It can be concluded that the developed best practice model based on success factors of ODL for studio-based architectural design courses in this research is significant and important and should be taken into account where it has shown that each of the indicators involved physical modeling (CA3), creativity (CD1), students judge and synthesize collected data using their creativity-relevant (DS2), collaborative and mutual learning (DT), interdisciplinary teamwork (MS2), realistic design problem (MS3), discussion of experiences of well-known architects (TL), experimental learning (TL3) recorded high and significant loadings based on the PLS-SEM analyses. The findings that have been found as a result of this research, constructs teaching and learning approach and design skills are main variables that should be given a holistic focus to ensure the sustainability of the ODL process for studio-based architectural design courses.

9. SUGGESTIONS

Based on the the most crucial factors that have been identified in this research. Researchers suggest that future studies focus more on other factors, other than those discussed in this research paper which examines the effect of success on quality ODL for studio-based architectural design courses through the implementation of these success factors in this research.

10. CO-AUTHOR CONTRIBUTION

The authors affirmed that there is no conflict of interest in this article. Author1 has contributed suggestions, ideas and research frameworks that have been carried out. Author2 carried out the statistical analysis and interpretation of the results. Author3 carried out the field work, prepared the literature review and overlook the writeup of the whole article. Author4 carried out contextualise aspects of curriculum, distance learning and unique requirements of studio-based architectural design courses and Author5 conducted elicit and structure ODL framework within curriculum.

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