



## Research Article

# The mediating impact of assessment process in the relationship between project-based learning and teamwork skills' development

Shola Francis Bakare<sup>1\*</sup>, Rotimi Williams Ojulokunrin<sup>2</sup>, Zainab Toyin Jagun<sup>3</sup>,  
Olowoleru Olaitan Adedeji<sup>4</sup>, Alalade Olugbenga<sup>5</sup>

<sup>1,2</sup>Department of Vocational and Technical Education, Adekunle Ajasin University, Akungba-Akoko, Nigeria.

<sup>3</sup>Department of Real Estate, Faculty of Build Environmental and Surveying, Universiti Teknologi Malaysia, 81310 Johor Bahru, Johor, Malaysia.

<sup>3,4</sup>Department of Estate Management, Federal Polytechnic Offa, Kwara State, Nigeria.

<sup>5</sup>Department of Estate Management, Kaduna Polytechnic, Nigeria.

\*Corresponding Author email: [zainy4real@yahoo.com](mailto:zainy4real@yahoo.com)

Submission: 09 November 2020

Revised: 03 January 2021

Accepted: 06 January 2021

## ABSTRACT

The significance of teamwork skills has been acknowledged in most professions and many organizations make performance evaluation judgments based on learners' teamwork skills. Project-based learning (PBL) has the ability to harness the ability of students to work together. Consequently, this study evaluated the PBL based on the workshop/laboratory experiences of students by measuring the mediating effect of assessment process to which PBL is employed to enhance students' teamwork skills. A set of structured questionnaires was purposively administered to 205 students in technology and vocational education-related courses in tertiary institutions of South-Western States in Nigeria. The key analytical methods for the reliabilities test, normality measurements, composite average, explorative factor analysis, confirmative factor analysis, calculation, and structural model analyzes were structural equation modeling (SEM), using version Statistics Package for Social Sciences (SPSS) Version 22.0 and 22.0 of Movement Structures Analysis (AMOS). The outcomes of the analysis revealed that PBL in relation to teamwork skills were statistically insignificant. Though, assessment process on learners' teamwork skills was found to be significant. Thus, it implies there is a need to reinforce learners' assessment process in influencing PBL towards the development of students' teamwork skills in their various institutions.

**Keywords:** *Project-Based Learning, Sustainability, Teamwork Skills, Mediating Effect, Technology and Vocational Education*

## 1. INTRODUCTION

The consequences of learning and development in the knowledge industry need to be implemented, using specific approaches to achieve subjective success. Singh, Warriar, & Bharti. (2019), the key goals of knowledge and innovative learning are to gain unique skills, to improve character and abilities all-inclusive and to educate the human capital. Elaborations are made on how these principles can be used in higher education institutions to improve the teaching-learning process and help them develop more cutting-edge skills in the fields of learning delivery (Aboobaker et al., 2019; Hilt, Riese, & Søreide, 2019). Nelson (2013) submitted that technology and vocational education remains vital for economic development in Nigeria. As one of the innovative quality structures in Nigeria, in order to

be effective in the workplace, it is expected that graduates possess generic skills such as teamwork skills that could assist them to fully utilise their job-related knowledge and professional competencies. Therefore, as noted by Purumasur and Govendar (2013) teamwork skills and several other generic skills have become increasingly essential in the world of work. Teamwork is willing and able to work with individuals from various backgrounds (Griffin and Annulis, 2013; Kadam, Rao, Kareem Abdul, and Jabeen, 2020; Raftopoulos, Coetzee, and Visser, 2009). This was supported by Robles (2012) who thought that the capacity of the person to cooperate with others was very important at work. Teamwork includes adaptability, flexibility, cooperativeness, and respectfulness. According to Ju, Zhang, and Pacha (2012) displaying respect for others was considered one of four essential skills recognised as important for employment. Teamwork is the same as working collaboratively in groups. Buntat (2004) believes that teamwork is a skill that someone possessed which enables him/her to work cooperatively with co-workers to perform a certain task. Strom et al. (2013) perceive teamwork as an important skill that needs co-dependent in the place of work. According to Purumasur and Govendar (2013), teamwork has turned to be an essential element of management as well as working culture that employers of labour always demand from prospective employees.

It is evident that teamwork could complement the discipline-related skills to increase the chances of graduates' employability and also necessary for promoting productivity at workplace (Buntat (2004). This implies that workplace can have a very positive impact on the well-being of employees, their families, communities, and society at large. Based on these foregoing, it has become extremely essential to investigate the impact of project-based learning (PBL) on the sustainable development of teamwork skills in the Nigerian context of technology and vocational education. In a project-based learning activity, learners not merely synthesize and apply the knowledge attained in project-based learning, but they can as well exercise their inventiveness through teamwork under the constraints of learning by doing.

Project-based learning (PBL) is a creative approach to project learning (Huang 2010). PBL is an estimable strategy for instilling generic skills such as teamwork in the students (Aworanti et al. 2015; Putri, Artini, and Nitiasih (2017). This study presents the findings of quantitative research conducted to measure the impact of project-based learning (PBL) on the sustainable development of teamwork in technology and vocational education. In other words, the study evaluated the effectiveness of PBL in enhancing teamwork skills. The study takes into account the joint project works the students have been involved in their respective schools' workshop/laboratory in relative to assessment process to evaluate the impact of project-based instructional strategies on sustainable development of teamwork skills. The assessment instrument consists of three (3) constructs to measure various features of students' learning activities such as project-based learning activities, assessment process of learning, and teamwork skills.

## 1.1. THEORETICAL FRAMEWORK OF THE STUDY

This study derives its theoretical basis from Human Capital Theory as concisely explain below.

## 2. HUMAN CAPITAL THEORY

The human capital theory has connected general education, skills development, work experience, and entrepreneurship with economic footing of a person. Most scholars have agreed with this opinion of human being's capacity of entrenching knowledge and skills in him (Becker, 2009). The Human Capital theory by Mincer (1989) emphasized job training potentials of filling certain gaps substantially in the realistic investigation of human capital investment and associated wage structures. The human capital theory revealed the general idea of what is required to be contented in employment (Nafukho, Hairston, & Brooks, 2004).

The human capital theory emphasizes the role of training in economic and social accomplishments of the individual and the society in general. In the study of Holden and Biddle (2017), the application of Human Capital Theory in Education Policy in the United States of America showed that public spending on education as an investment activity has a high rate of benefit and the potential to contribute to the nation's target. The human capital theory, Becker (1964) maintains that education or training increases the productivity of individuals, which subsequently improves performance at work. As such, education offers saleable skills and capabilities that are interconnected with job performance, enabling highly educated people to be more successful in labor markets in terms of profit and job opportunities. Marginson (2015) is of the opinion that the policies made in the direction of stimulating education have what it takes to advancing goal. The theory expresses a positive connection between investments in education and labour market returns, as well as how the machinery of education have an impact on employment. Robinson and Garton (2008) also reinforced that education and the increase of a productive workforce among students is a practice of human investment. This means that education and training are tactical or strategic to preparation of labour for socio-economic development.

Human capital preparation is very imperative in a profession in order to guarantee career progression which is the desire of individuals after securing employment (Robinson & Garton, 2008). The sustainable development of teamwork skills by technology and vocational education students will facilitate both their employability and productivity. Consequently, the theory is considered relevant to this study because all the teamwork skills developed through Project-based learning during the institutional training will be used for job acquisition, adaptation, and career development purposes.

### 2.1. OBJECTIVE OF THE STUDY

The objective of the study was to investigate or measured the efficiency of PBL for the purpose of boosting/ sustainable development of teamwork skills among students.

## 2.2. HYPOTHESES

1. There is a significant relationship between project-based learning and teamwork skills.
2. There is a significant relationship between project-based learning and the assessment process of learning.
3. There is a significant relationship between the assessment process of learning and teamwork skills.

## 3. METHODOLOGY

The survey was conducted in six southwestern states of Nigeria. The research consisted of data collection using structured questionnaires from tertiary institutions administered to students. The research goal is to assess the effect of project-based learning in technology and vocational education on the feasibility of improving teamwork skills. Several studies have looked at the value of project-based learning to enhance different learning practices and skills development, including (Fernández-Sá, Ramírez, & Vásquez, 2013; Musa, Mufti, Latiff, & Amin, 2012; Nation, 2008; Yasin & Rahman, 2011). However, it should be noted that studies on the measurement of the impact of project-based learning have been rather inadequate or insufficient to enhance teamwork, particularly in the field of technology and vocational training. Therefore, in this analysis, evaluation standards were used to produce a more reliable and valid construct to respond to research hypotheses. In this research, purposive sampling techniques have been employed. Because in tertiary institutions the technology and vocational education students were targeted because of the intricate technicality in the research. Two hundred and forty-seven (247) questionnaires were produced and administered, 232 of which were retrieved, after all the necessary data screening, 205 were finally used for analysis. The retrieval rate for the survey response was 82.99 percent, which was considered adequate (Saunders, et al., 2009). The test of reliability was carried out to calculate the internal accuracy of the testing instruments that stood at 0.86. Using SPSS v22 and SEM-AMOS v22 the data were analysed.

## 4. DATA ANALYSIS

Data analysis was performed using IBM SPSS 22 Statistics tools and Structural Equation Modelling (SEM) using Analysis of Moment Structure (AMOS) software. To test the hypotheses, analysis of both the measurement model (pool model) and the structural model were performed (Awang, 2015).

### 4.1. RELIABILITY ANALYSIS

The reliability analysis of the constructs was carried out purposely to consider the internal consistency of the Cronbach alpha measurement instrument. Table 1 presents the results of the reliability analysis for Project-Based Learning (PBL) activities, Teamwork skills (TWS), and Assessment process of learning (APL). The Cronbach alpha for PBL, TWS, and APL, are 0.93, 0.88, and 0.76, respectively. The Cronbach alpha values were in agreement with

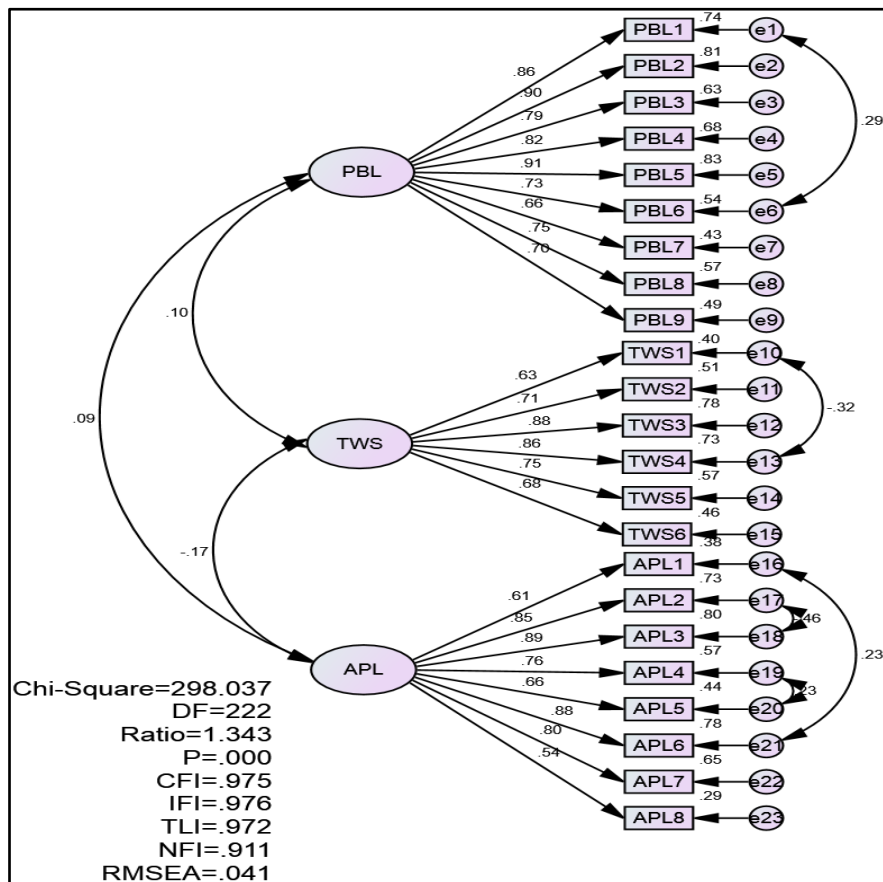
Pallant, (2011) which exceeded 0.60. Indicate that the items are reliable for each construct to be measured, respectively.

**Table 1. Reliability Analysis**

Constructs	Cronbach Alpha
Project-based learning activities	0.93
Teamwork skills	0.88
Assessment process of learning	0.76

**4.2. MEASUREMENT MODEL**

The measurement model evaluation is considered a notable phase of SEM analysis (Awang 2014). In measurement model analysis, the reliability and validity of the constructs are determined. The measurement model can be assessed through the values of discriminant validity, composite reliability (CR), convergent validity, and average variance extracted (AVE). Similarly, the indicator reliability can be determined through the factor loadings value (Hair et al. 2013). In this study, internal consistency reliability was measured by observing composite reliability (CR). Therefore, the obtained values after the necessary modification are: Chi-Square =298.037, DF =222, Ratio= 1.343, P=.000, CFI=.975, IFI=.976, TLI .972, NFI=.911, and RMSEA= .041.



**Fig. 1. Measurement Model**

Table 2 shows the values of the average variance extracted (AVE) as presented in diagonally across the table while the correlation between the constructs is the values in the cells

underneath. The values illustrated in the diagonal axis should be greater in importance than those in columns and rows in order to gain discriminant validity.

**Table 2.** Correlation matrix for the research constructs

	<b>PBL</b>	<b>TWS</b>	<b>APL</b>
PBL	0.79		
TWS	0.10	0.75	
APL	0.09	-0.03	0.75

#### 4.3. FACTOR LOADINGS, COMPOSITE RELIABILITY (CR) AND AVERAGE VARIANCE EXTRACTED (AVE)

As suggested by Hair, Ringle, and Sarstedt (2011), all the reflective factors are above 0.6 after screening the data through a reliability test (Cronbach alpha) and exploratory factor analysis (EFA). The composite reliability (CR) values of all the reflective concepts are above 0.6. Similarly, the AVE for the individual construct is greater than 0.5 as shown in Figure 1.

**Table 3.** Factor Loadings, Composite Reliability (CR) and Average Variance Extracted (AVE)

<b>Code</b>	<b>Construct Items</b>	<b>Factor Loading</b>	<b>CR</b>	<b>AVEs</b>
Project-Based Learning Activities (PBL)			0.94	0.63
PBL1	The speed of execution of laboratory activity	0.86		
PBL2	The accuracy of execution	0.90		
PBL3	Quality of work produced	0.79		
PBL4	Operation of machines/equipment	0.82		
PBL5	Planning of work/time management	0.91		
PBL6	Specifying system requirements/ specifications	0.73		
PBL7	Explain the working principle of machine tools	0.66		
PBL8	Identifying/ Analysing problems	0.75		
PBL9	Identifying solutions/quality of execution,	0.70		
Teamwork Skills (TWS)			0.89	0.57
TWS1	Work cooperatively with others.	0.63		
TWS2	Contribute ideas in a Teamwork.	0.71		
TWS3	Have regard for the opinions of others.	0.88		
TWS4	Work with others regardless of differences in culture and religion.	0.86		
TWS5	Access resources and share with co-workers	0.75		
TWS6	Work cooperatively with others.	0.68		
Assessment process of Learning (APL)			0.91	0.58
APL1	Direct observation of the student at work	0.61		
APL2	Assessment of student's logbook	0.85		
APL3	Backup assessment	0.89		
APL4	Assessment of Student final report	0.76		
APL5	Oral tests at work from the project-based learning.	0.66		
APL6	Grade the process, not just the product.	0.88		
APL7	Job evaluations learner's role in their team.	0.80		
APL8	Students should be evaluated on the final product.	0.54		

1. Composite Reliability (CR) = (square of the factor loading summation) / {(square of the factor loading summation) + (square of the error variance summation)}.

2. Average Variance Extracted (AVE) = (summation of the factor loading square) / {(summation of the factor loading square) + (summation of the error Variance)}

2	$AVE = \sum \xi / n$	$\xi$ = Factor loading of every item
2	$2 CR = (\sum \xi) / *(\sum \xi + (\sum 1 - \xi^2))$	n = Number of items in a model

Source: Awang 2014

### 4.4. STRUCTURAL MODEL

The evaluation of the structural model was carried out after evaluation of the measurement model which is a prerequisite for this analysis. In line with SEM-AMOS requirements, the model was adjusted successively to improve the factor loading and other required modification indices, the Chi-square ratio, and the RMSEA. Consequently, the values attained are: Chi-Square =196.179, DF =147, Ratio= 1.335, P=.004, CFI=.979, IFI=.979, TLI .975, NFI=.920, and RMSEA= .040.

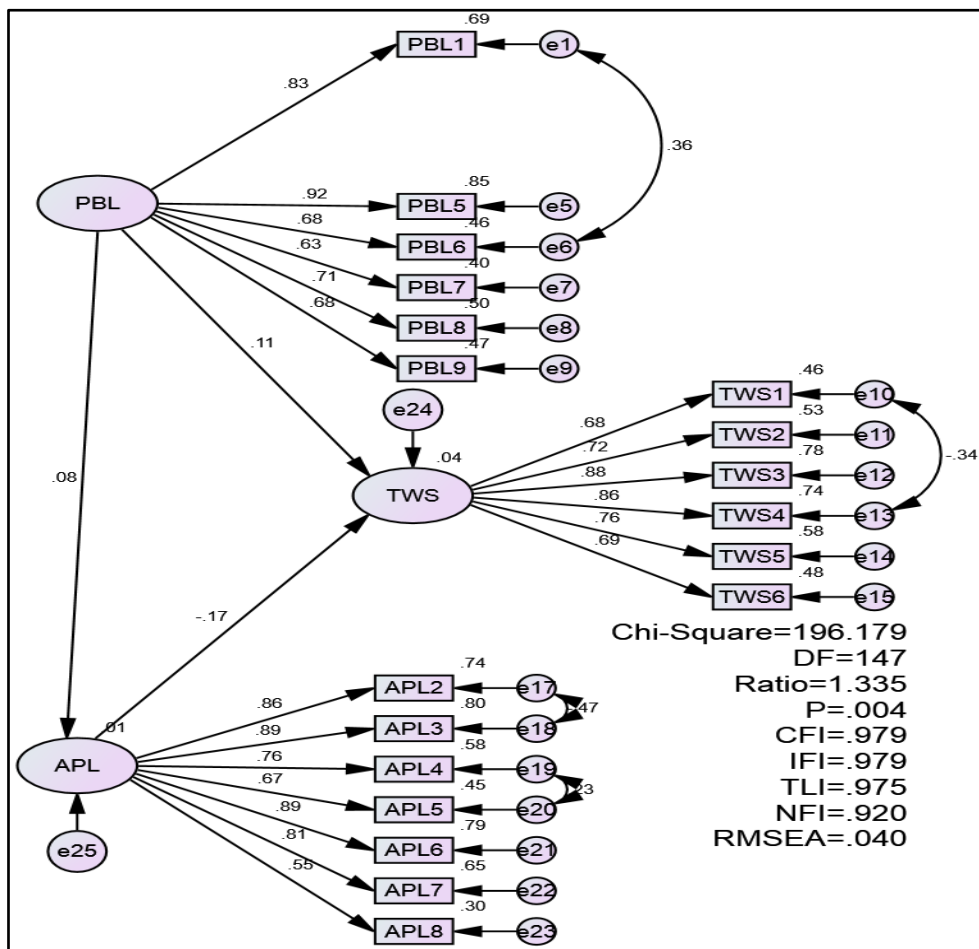


Fig. 2. Structural model

In furtherance of testing the hypotheses relating to mediating effects of the variables, a multivariate technique using structural equation modelling (SEM) was adopted. According to Awang (2015); Pallant (2011), the use of SEM in the situation of mediating analysis is advantageous. Among such advantages is that SEM allows easiness of interpretation and estimation. It also simplifies the testing of complicated mediating hypotheses in a single analysis. Figure 3 Path diagram presents the causal relationships between the variables used in this study. Similarly, Table 4 shows the standardized weight of the regression and its significance for all paths in the model.

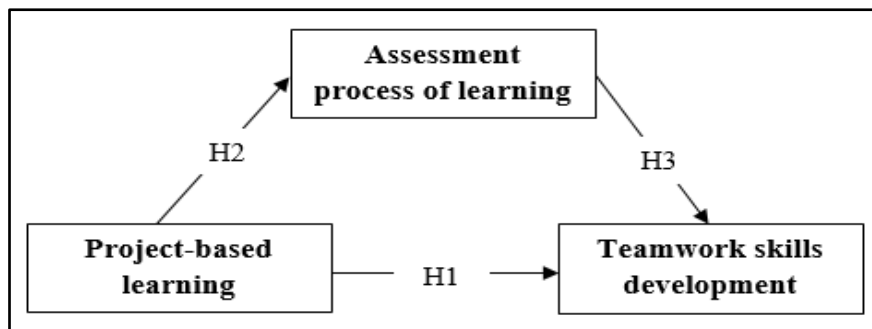


Fig. 3. Path diagram showing the causal relationships between the variables

Table 4. The standardised regression weight and its significance for the entire path in the Model

Constructs	Paths	Constructs	Estimate	S.E.	C.R.	P-value	Decision
TWS	<---	PBL	.113	.074	1.540	.124	Not Supported
APL	<---	PBL	.082	.072	1.136	.256	Not Supported
TWS	<---	APL	-.176	.076	-2.305	.021	Supported

## 5. FINDINGS AND DISCUSSION

The significance of the study was to determine the mediating effect of the evaluation process in PBL on the sustainable development of teamwork skills among technology and vocational education students in high schools in southwestern Nigeria. The analysis result found that the hypothesis H1 is not supported; hence, project-based learning has no significant effect on learners' teamwork skills with p-value ( $p=0.124 > 0.005$ ). Likewise, project-based learning has no significant effect on the assessment process of learning ( $p=.256 > 0.005$ ) which implies that H2 is not supported. Moreover, H3 is supported as there is a positive effect of the assessment process of learning on learners' teamwork skills ( $p=0.021 < 0.005$ ). The research results based on the perceptions of technology and vocational education students, therefore confirms that the assessment process of learning is a factor to be considered as critical in using PBL for developing students' teamwork skills. Therefore, this research finding is in support of Bell (2010) who posited that implementation of PBL makes student drive their own learning through inquiry.

### 5.1. CONCLUSION

Employers are indisputably in unceasing search of employable graduates who are not only ready to exhibit employability skills but are capable of demonstrating these skills to create a progressive working atmosphere for the inclusive advanced performance of the organization. This study was planned to measure the effect of assessment process in using project-based learning (PBL) approach in the students' sustainable development of teamwork skills. The findings suggest that PBL meaningfully enhances and ease the learning of students. Therefore, it is suggested that lecturers or trainers can make use of a project-based learning approach to facilitate teamwork skills among the students as well as considering the assessment process as vital. Moreover, combining efforts to carry out any particular project improves students' teamwork skills. This is an indication that PBL is

an effective method that could support students to develop and sustain teamwork skills for maximum practice of their profession at any future workplace. By implication, TVE graduates who have competency in teamwork skills that are associated with their related performances will place them in an advantageous position to stay and progress in the future place of work. This study implies to policymakers and lecturers that there is a need to reinforce learners' assessment process in influencing technology and vocational education learners while using PBL towards the development of students' teamwork skills in their various institutions.

## 5.2. LIMITATIONS OF THE STUDY

There is no study without its limitations. Consequently, in this current study, the researchers have no claim of flawless. The research limitations are presented below:

This research only focused on students in the field of technology and vocational education on the selected variables at the data collecting time and not concerned with the other issues that are outside the boundaries of the discipline. Therefore, future research should investigate alternative students as well as any other factors. Also, it is uncertain whether students perceived the PBL approach as essential in enhancing other employability/soft skills; hence, further investigation is required. Future research could adopt a combination of both quantitative and qualitative methods to investigate, which will give an opportunity to compare, as this current study is limited to only quantitative approach. It is expected that future studies can be conducted in relation to this study in other parts of the country since it is limited to the southwestern part.

## Reference:

- Aboobaker, N. & K.A., Z. (2019), Influence of digital learning orientation and readiness for change on innovative work behaviour: reflections from the higher education sector, *Development and Learning in Organizations*, 34 (2), 25-28.
- Awang, Z. (2014). A Handbook on SME: For Academicians and Practitioners: MPWS Rich Resources.
- Awang, Z. (2015). SEM made simple: a gentle approach to learning structural equation modeling: MPWS Rich Publication
- Aworanti, O., Taiwo, M. & Iluobe, O. (2015). Validation of Modified Soft Skills Assessment Instrument (MOSSAI) for Use in Nigeria. *Universal Journal of Educational Research*, 3(11), 847-861.
- Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education*: University of Chicago press.
- Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The clearing house*, 83(2), 39-43.
- Buntat, Y. (2004). *Integrasi kemahiran"employability"dalam program pendidikan vokasional pertanian dan industri di Malaysia*. Universiti Teknologi Malaysia,

- Fernández-Sá, L., Ramírez, J. M., & Vásquez, J. E. (2013). Assessing the impact of project-based learning in engineering courses by using multiple correspondence analysis. *Ingeniería y competitividad*, 15(2), 77-89.
- Griffin, M., & Annulis, H. (2013). Employability skills in practice: the case of manufacturing education in Mississippi. *International Journal of Training and Development*, 17(3), 221-232.
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.
- Hilt, L. T., Riese, H., & Søreide, G. E. (2019). Narrow identity resources for future students: the 21st century skills movement encounters the Norwegian education policy context. *Journal of Curriculum Studies*, 51(3), 384-402.
- Holden, L., & Biddle, J. (2017). The introduction of human capital theory into education policy in the United States. *History of Political Economy*, 49(4), 537-574.
- Ju, S., Zhang, D., & Pacha, J. (2012). Employability skills valued by employers as important for entry-level employees with and without disabilities. *Career Development and Transition for Exceptional Individuals*, 35(1), 29-38.
- Kadam, R., Rao, S.A., Kareem Abdul, W. and Jabeen, S.S. (2020), Diversity climate perceptions and its impact on multicultural team innovation and performance, *Measuring Business Excellence*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/MBE-04-2019-0037>.
- Marginson, S. (2015). *Rethinking education, work and 'employability'* Foundational problems of human capital theory. Paper presented at the Keynote address to Society for Research in Higher Education conference.
- Mincer, J. (1989). Human capital and the labor market: A review of current research. *Educational researcher*, 18(4), 27-34.
- Musa, F., Mufti, N., Latiff, R. A., & Amin, M. M. (2012). Project-based learning (PjBL): inculcating soft skills in 21st century workplace. *Procedia-Social and Behavioral Sciences*, 59, 565-573.
- Nafukho, F. M., Hairston, N., & Brooks, K. (2004). Human capital theory: Implications for human resource development. *Human Resource Development International*, 7(4), 545-551.
- Nation, M. L. (2008). Project-based learning for sustainable development. *Journal of Geography*, 107(3), 102-111.
- Nelson, O. A. (2013). A viable vocational technical education curriculum: A tool for economic and technology development in Nigeria. *Scholarly Journal of Education*, 2(2), 22-26.
- Pallant, J. (2011). *SPSS survival manual 4th ed.*. Crows Nest. *New South Wales: Allen & Unwin*.

- Purumasur, S. B., & Govendar, P. (2013). The Importance of Teamwork, Continuous Top Management Support and Training in bringing about TQM *Journal of Economics and Behavioral Studies*, 5( 9 ), 639-651.
- Putri, N. L. P. N. S., Artini, L. P., & Nitiasih, P. K. (2017). Project-based Learning Activities and EFL Students' Productive Skills in English. *Journal of Language Teaching and Research*, 8(6), 1147-1155.
- Raftopoulos, M., Coetzee, S., & Visser, D. (2009). Work-readiness skills in the Fasset Sector. *SA Journal of Human Resource Management*, 7(1), 8 pages.
- Robinson, J. S., & Garton, B. L. (2008). An Assessment of the Employability Skills Needed by Graduates in the College of Agriculture, Food and Natural Resources at the University of Missouri. *Journal of agricultural education*, 49(4), 96-105.
- Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business Communication Quarterly*, 75(4), 453-465.
- Saunders, M., Lewis, P. & Thornhill, A. (2009). Research methods for business students. 5th Edition. London: Pearson Education Limited
- Singh, N. and Rangnekar, S. (2018), Workplace spirituality: a new imperative in Indian manufacturing sector, *Development and Learning in Organizations: An International Journal*, 32 (5), 11-14.
- Singh, N., Warriar, U. and Bharti, T. (2019), Emotional intelligence strategies to achieve subjective career success: implications for learning and development in knowledge industry. *Development and Learning in Organizations*, 34 (3), 23-26.
- Strom, P. S., Thompson, M., & Strom, R. D. (2013). Teamwork Evaluation by Middle Grade student in inclusive Classrooms. *Middle Grade Research Journal*, 8 (3), 83-97.
- Thomas, J. W. (2000). A review of research on project-based learning.
- Yasin, R. M., & Rahman, S. (2011). Problem oriented project based learning (POPBL) in promoting education for sustainable development. *Procedia-Social and Behavioral Sciences*, 15, 289-293.



Copyright © 2021 Authors. This is an open access article distributed under the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.