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Effect of Situated Learning on Students' Psycho-Productive Skills in Machine Woodworking in Technical Colleges in Rivers State

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A B S T R A C T

This research aims to examine the effect of situated learning on students' psycho-productive skills in machine woodworking in technical colleges in Rivers State. Two research questions were posed to conduct the study, while two null hypotheses were formulated for the study. The population comprised all 160 National Technical Certificate (NTC) II woodwork students of two Government Technical Colleges. The instrument had a 0.76 Reliability Index using the KR-20 formula. The study found that situated learning is superior to the demonstration method in imparting psycho-productive skills in drilling operations in machine woodworking. The study also found that the group taught grinding operations with situated learning in machine woodworking performed better than the group taught grinding operations with the demonstration method. Based on the findings of the study, the following recommendations were made: Situated learning should be adopted by curriculum developers and instructors as one of the participatory methods of machine woodworking teaching and learning in technical colleges in Rivers State.

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INTRODUCTION

The role of Technical and Vocational Education and Training (TVET) in the development of any nation is providing a valuable platform for preparing youth for work through education and training, that provides knowledge and skills for employment. Therefore, it produces the semi-skilled and practical workforce required to reconstruct, revitalise, stimulate, propel, and boost the country's economy while considerably reducing youth unemployment (Ogundola, Abiodun & Jonathan, 2010). The objectives of TVET are to (i) provide trained manpower in the Applied Sciences, Technology, and Business, particularly at Craft, Advanced Craft and Technical levels; (ii) provide the technical knowledge and vocational skills necessary for Agricultural, Commercial and Economic development; and (iii) give training and impart the necessary skills for individuals to become economically self-reliant (Federal Republic of Nigeria, 2014).

Training in the fields of Agriculture, Business, Computer Technology, Industry Technology (Automotive, Construction, Electrical/Electronics, Metalwork, and Woodwork), Home Economics, and Entrepreneurship are all fields of TVET. These training categories are further divided into several vocational trade areas comprising Block laying, Bricklaying and Concrete work; Painting and Decorating; Machine Woodworking; Carpentry and Joinery; Furniture Making; Upholstery; Catering Craft Work; Garment Making; Cosmetology; Photography; Data Processing; Store Keeping; Bookkeeping, Mobile Phones maintenance and repairs; and Marketing. They also include Auto Electrical Work; Auto Mechanical Work; Air Conditioning and Refrigeration; Electrical Installation and Maintenance Work; Radio, TV and Electronic Servicing; and Block Laying, Bricklaying and Concrete Work (Federal Republic of Nigeria, 2014). All these vocational trades are planned towards preparing the trainees for immediate entry into gainful employment.

Situated Learning is education through exercise and involvement that stresses that significant learning will only occur if it is entrenched in, or simulates, the social and physical circumstances where it will be applied. The application of situated learning theory enables students to learn the skills as well as accurately apply what they have learned. It also enables students to learn by doing so that they can be productive after graduation. This concept considers the act of teaching and learning as a complicated order of human activity, which changes the focus from the individual to the socio-cultural. In the situated learning concept, learning is implied as participation in a "community of practice", which when applied as the foundation for instructional delivery, brings about the establishment of spirited learning settings where students can undergo significant social changes. Consequently, this method of learning which has its roots in the traditional apprenticeship model is intended to acculturate students into real-world activities through activity and social connections (Brown, Collins & Duguid, 1989). An important feature of the "situated learning" concept is the apprentice observing the "community of practice". A group of individuals who share a trade or a profession to acquire expertise in that line of work is known as a "community

of practice". Initially, involvement in a "community of practice" can be done from the boundary or "legitimate peripheral participation" (Lave & Wenger, 1991, Vygotsky, 1978). As the learners' comprehension and contribution to the "community" grow, they progress from observers to fully functioning "community of practice" members. "Legitimate peripheral participation" allows the learners to gradually appreciate the group's culture and what it means to be bona fide "community members". According to Lave and Wenger, ibid., to be able to participate in a "legitimately peripheral" manner, newcomers to the "community" must be broadly exposed to the practices of established members. The "Zone of Proximal Development (ZPD)" is the gap between what a learner can do individually (proficiency stage) and what the learner can do with the help of a proficient adult or a more knowledgeable peer (coaching stage).

For instructional design, Herrington and Oliver (1995, cited in Özüdoğru and Özüdoğru, 2017) stated nine important properties of "situated learning" conditions as (i) Authentic Contexts, (ii) Authentic Activities, (iii) Access to expert performances and modelling processes, (iv) Multiple Roles and Perspectives, (v) Collaborations, (vi) Reflections, (vii) Diverse Opportunities, (viii) Coaching and Scaffolding, and (ix) Authentic Assessment. First, authentic contexts replicating the real environment in which the knowledge is to be applied, and authentic activities which have practical significance and require students' active participation, must be provided in the instruction designed according to the principles of situated learning. Özüdoğru and Özüdoğru (ibid.), stated that Authentic Contexts can be (i) an actual work setting (ii) a virtual depiction of the actual work environment, and (iii) anchoring contexts, such as a video or multimedia programme. However, there remain divergent views in the extant literature concerning the contexts and activities considered authentic. According to Özüdoğru and Özüdoğru (ibid.), the implementation of situated learning theory via electronic media undermines this theory since the learning aid replaces the authentic context as the learning environment. However, many other researchers (Brown, et al., 1995, Harley, 1993, Reeves, 1995, cited in Özüdoğru and Özüdoğru, ibid.) have disagreed by saying anchoring contexts, such as a video or multimedia programme can provide an alternative for the actual situation, without diminishing the authentic context. Indeed, technology used in Case Studies or Web-based simulations has lately become an indispensable tool in aiding situated learning, and there are many such illustrations of situated learning activities online.

However, these cannot substitute indispensable, actual life experiences. Examples of situated activities are as follows (i) Cooperative education and internships that permit students to be embedded and physically active in the workplace, (ii) Field trips where students practically come into contact with the workplace, (iii) Laboratory settings in which students dynamically partake in virtual events (iv) Musical and Sporting Activities, which simulate real-life activities. Situated learning occurs "in the situation", as these examples illustrate (Kurt, 2021).

Furthermore, these students should have access to collaborative activities which promote the development of knowledge and higher-order thinking abilities, as well as thinking practices that promote concepts and different scenarios to communicate, discuss, and support their knowledge (Herrington & Oliver, 2000, cited in Özüdoğru and Özüdoğru, ibid). Herrington, et al., (2006, cited in Özüdoğru and Özüdoğru, ibid.) also stated that an effective teaching-learning method specifies events that guide students to identify their issues and resolve them as joint interactive events. Furthermore, for effective learning, events should be planned to last over a period of days, weeks, or months, rather than short durations, and they should be incorporated into diverse subject areas to allow for teamwork, thinking, and various results (Lankard, 1995, cited in Özüdoğru and Özüdoğru, ibid.). Furthermore, to enable students to engender their knowledge in complicated situations, combine various assignments that make them efficient performers, and evaluate them in realistic environments and contexts, teachers must also provide coaching and scaffolding promptly.

Although theoretical literature is abundant on situated learning (Herrington & Oliver, 1999, Herrington & Oliver, 2000, Brown, Collins & Duguid, 1989, Oliver, et al., 1996, Kemp, 2010), there is relatively lesser, substantive empirical support for the situated learning method. The concept of Situated Learning has found application in language learning (Comas-Quinn, et al., 2009, Uz-Bilgin, 2016, Shih & Yang, 2008, Yang, 2011), distance education library research courses (Catalano, 2015), Educational Technology courses (Huang, et al., 2011), and pedagogics for students with special needs (Utley, 2006). Machine Woodworking has become an indispensable part of the woodworking industry. The inclusion of Machine Woodworking as one of the additional thirty-four trade/entrepreneurial subjects in the Senior Secondary School subjects by the Nigerian Educational Research and Development Council (NERDC) "to cater for the nation's drive towards technological advancement and self-reliance" demonstrates the subject's importance (Orji, 2013).

Through machine woodworking, students can acquire competence in timber conversion, seasoning and preservation; the operation of woodworking portable powered tools and machines; general wood machine safety; safety equipment and devices in the wood machine shop; efficient wood machine shop layout; setting up and managing wood machine shops. As entrepreneurs, they can also utilize business opportunities in drilling operations, grinding operations, chamfering operations, tenoning operations, mortising operations, thicknessing operations, mitring operations, moulding operations, planing operations, sanding operations, curve cutting operations, shaping operations, grooving operations, carving operations, spraying operations, turning operations, bevelling and tapering operations, shooting operations, ripping operations, etc. In addition to these, the students are expected to acquire soft skills such as the ability to source funds through personal savings, bank loans, cooperative associations, thrifts, etc., so that they can aspire to be entrepreneurs, and employers of labour later on (Adebisi & Oni, 2012).

Portable powered woodwork machines have been invaluable and time-saving in attractive, exquisite woodwork. These include drills for drilling operations; angle grinders for grinding operations; wood chamfering machines for chamfering operations; surface planers for thicknessing operations; mitre saw for mitring operations; tenoners for tenoning operations; mortisers for mortising operations; spindle moulders for moulding operations; lathes for turning operations, planers for planing operations; sanders for sanding operations; jigsaws for curve cutting operations; circular saws for shaping operations; routers for grooving operations; etc. Psycho-productive skills are manipulative or technical skills that must be learned through observation, training, and experience to effectively carry out specific tasks in any given occupation (Osinem & Nwoje, 2015). The ability to perform a task or work effectively can be referred to as a skill. An individual is said to have acquired a skill when that individual can complete a specific task at a specific time without making a mistake (Nwangwu & Obi, 2014).

THEORETICAL REVIEW

Statement of the Problem

Even though technical colleges are deemed to be the key vocational institutions in Nigeria, where students are taught practical skills, there continues to be a lack of correspondence between education and training, and what the labour market wants and needs. There is a discrepancy between theory and practice, as what is learned in the classroom cannot be applied to problems that arise in the real world. Therefore, there is a large and growing gap between the skills employers need, and the skills possessed by individuals. Several indications in the extant literature suggest that one of the major reasons for this skills gap/mismatch is the use of lecture/demonstration methods to teach skills-oriented technical courses. Such studies have shown that teaching strategies based on constructivism - to which situated learning belongs – are effective in boosting students' academic performance in technical courses (Oludipe & Oludipe, 2010, Eze, Ezenwafor, & Obi, 2015, Obed, 2015). It is in light of this that the researcher considers it necessary to determine the effect of situated learning on students' psycho-productive skills in machine woodworking in technical colleges in Rivers State.

Aim and Objectives of the Research

This research aims to investigate the effect of situated learning on students' psycho-productive skills in machine woodworking in technical colleges in Rivers State. Specifically, the objectives of this research are to:

1. Determine the effect of situated learning on students' psycho-productive skills in drilling operations in machine woodworking in technical colleges in Rivers State.
2. Determine the effect of situated learning on students' psycho-productive skills in grinding operations in machine woodworking in technical colleges in Rivers State.

Research Questions

The following research questions were posed to guide the research:

1. What is the effect of situated learning on students' psycho-productive skills in drilling operations in machine woodworking in technical colleges in Rivers State?
2. What is the effect of situated learning on students' psycho-productive skills in grinding operations in machine woodworking in technical colleges in Rivers State?

Research Hypotheses

The following null hypotheses guided the study and were tested at a 0.05 level of significance:

H_{01}: There is no significant difference between the psycho-productive skills of students taught drilling operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

H_{02}: There is no significant difference between the psycho-productive skills of students taught grinding operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

METHODOLOGY

Quasi-experimental design, which involved a pre-test, post-test, and non-equivalent control group design with two intact classes was adopted for the study. The population comprised all 160 National Technical Certificate (NTC) II woodwork students of two technical colleges in Rivers State. Rivers State was selected for the study because it has the necessary number of technical colleges and a sizeable student population for the sample size and sampling requirements. 160 National Technical Certificate (NTC) II woodwork students from the two technical colleges chosen for the study made up the population for the study. The study adopted a purposive sampling technique, with the subjects separated into two groups. All the students of Government Technical College, Port Harcourt were assigned to the experimental group (N=95), while the students of Government Technical College, Ahoada were assigned to the control group (N=65).

The Machine Woodwork Students' Psycho-Productive Skills Rating Scale (MWSPSRS), developed by the researcher to evaluate students' performance on psycho-productive skills, served as the instrument for data collection in this study. It is intended to gauge how well students have mastered the practical skills required for machine woodworking. Mean and standard deviation were used to analyse the data for the research questions, and analysis of covariance (ANCOVA) was used to test the hypotheses at a significance level of 0.05. A pre-test was used to reduce the error variance, control the initial group differences, and increase the precision caused by the auxiliary variables. The entire data analysis for this study was done using the Statistical Package for Social Sciences (SPSS).

In this study, situated learning environments were simulated to teach the drilling operations and grinding operations, in the schools' wood workshops. For the experimental group, the instructor and research assistants (professional

tool operators) taught the drilling operations using portable powered handheld drills and the grinding operations using portable powered handheld grinders. Each student received a piece of wood to use for drilling and grinding operations, which supported authentic activities. The teacher and expert tool operators also provided access to expert performances by coaching and scaffolding within the students' zones of proximal development and using YouTube videos to demonstrate proper tool handling. Initially, the students worked in groups of 5 - 10, but their assessments were done individually using project artefacts, following the criteria set out in the rating scale (MWSPSRS).
For the control group, the authentic contexts were provided by using charts showing photographs of the drills and grinders, and their parts. YouTube videos were also used to demonstrate proper tool handling and the drilling and grinding operations, in the schools' wood workshops.

RESULTS AND DISCUSSIONS

Research Question 1: What is the effect of situated learning on students' psycho-productive skills in drilling operations in machine woodworking in technical colleges in Rivers State?

Table 1. Displays the Average Results for Students' Psycho-Productive Abilities in Drilling Operations

METHOD	N	Pre-test		Post-test		Main Gain	Mean Difference
		Mean	SD	Mean	SD		
Experimental Group	65	15.34	10.72	58.62	7.32	43.28	
Control Group	95	15 .70	10.01	43.06	7.42	6.23	37.28

According to the data in Table 1 above, the experimental group's calculated pre-test mean and standard deviation scores were 15.34 and 10.72, respectively, while the control group's calculated pre-test mean and standard deviation scores were 15.70 and 10.01, respectively. This indicates that before the treatment, both groups' levels of achievement were at par. However, following the treatment, the experimental group's mean and standard deviation values were 58.62 and 7.32, respectively, while the control group's values were 43.06 and 7.42, respectively. This indicates that compared to the control group, the experimental group had a higher achievement mean score. Therefore, the experimental group that was taught drilling operations using situated learning outperformed the control group that was taught using the demonstration method, by a mean gain score of 37.28. Therefore, situated learning is preferable to the demonstration teaching method for teaching drilling operations.

Research Question 2: What is the effect of situated learning on students' psycho-productive skills in grinding operations in machine woodworking in technical colleges in Rivers State?

Table 2. The Psycho-Productive Scores of Students in Grinding Operations

		Pre-test		Post-test		Main Gain	Mean Difference
METHOD	**N**	**Mean**	**SD**	**Mean**	**SD**		
Experimental Group	65	15.34	10.72	68.53	9.59	53.19	
Control Group	95	15.70	10.01	22.37	10.95	6.87	46.32

According to Table 2 above, the experimental group's calculated pre-test mean and standard deviation scores were 15.34 and 10.72, respectively, while the control group's calculated pre-test mean and standard deviation scores were 15.70 and 10.01, respectively. This indicates that before the treatment, both groups' levels of achievement were at par. However, following the treatment, the experimental group's mean and standard deviation scores were 68.53 and 9.59, respectively, while the control group's mean and standard deviation scores were 22.37 and 10.95, respectively. This indicates that compared to the control group, the experimental group had a higher mean score. The table similarly demonstrates a 46.32 mean difference between the two groups' scores for grinding operations. Accordingly, the experimental group that was taught grinding operations using situated learning outperformed the control group that was taught grinding operations using the demonstration method.

Research Hypotheses

H_{01}: There is no significant difference between the psycho-productive skills of students taught drilling operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

Table 3: Analysis of Covariance (ANCOVA) of Drilling Operations Students' Psycho-Productive Skills

Tests of Between-Subjects Effects

Dependent Variable: Post-test

Source	Type III Sum of Squares	D_f	Mean Square	F	Sig.
Corrected Model	17153.424[a]	2	8576.712	157.545	.000
Intercept	226659.014	1	226659.014	4163.476	.000
Pre-test	3.441	1	3.441	.063	.802
Method	17153.278	1	17153.278	315.087	.000
Error	15460.917	158	54.440		
Total	800675.000	160			
Corrected Total	32614.341	159			

a. R Squared = .526 (Adjusted R Squared = .523)

The calculated value of F_{method} (315.087) with associated probability value (P= 0.000) is shown in Table 3 above. The associated probability value was less than the researcher's 0.05 level of significance (P0.05), so the null hypothesis was rejected in favour of the alternative hypothesis, which states that there is a significant difference between the psycho-productive skills of students taught drilling operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

H_{02}: There is no significant difference between the psycho-productive skills of students taught grinding operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

Table 4: Analysis of Covariance (ANCOVA) of Grinding Operations Students' Psycho-Productive Skills `

Tests of Between-Subjects Effects

Dependent Variable: retention

Source	Type III Sum of Squares	D_f	Mean Square	F	Sig.
Corrected Model	48454.669[a]	2	24227.335	231.586	.000
Intercept	275344.809	1	275344.809	2631.983	.000
Pre-test	20.859	1	20.859	.199	.656
Method	48385.327	1	48385.327	462.509	.000
Error	29710.648	158	104.615		
Total	1009033.000	160			
Corrected Total	78165.317	159			

a. R Squared = .620 (Adjusted R Squared = .617)

The calculated value of the F_{method} (462.509), along with the associated probability value (P=0.000), is displayed in Table 4 above. The associated probability value fell below the researcher's established 0.05 level of significance (P0.05), which led to the rejection of the null hypothesis in favour of the alternative hypothesis. Therefore, the psycho-productive skills of students taught grinding operations in machine woodworking using situated learning and those taught using demonstration methods differ significantly. According to the findings of the study, situated learning outperforms the demonstration method in psycho-productive skills in drilling operations. The study also displayed the calculated value of F_{method} (315.087) along with the associated probability value (P= 0.000). The associated probability value was less than the researcher's 0.05 level of significance (P0.05), so the null hypothesis was rejected in favour of the alternative hypothesis, which states that there is a significant difference between the psycho-productive skills of students taught drilling operations in machine woodworking using situated learning and those taught using the demonstration teaching method.

This finding is consistent with Catalano (2015), who reported that situated learning promoted pre-service math teachers' higher-order thinking skills, indicated its potential to facilitate transfer to real-world contexts, students demonstrated sophisticated problem-solving skills, exhibited meta-cognitive awareness, produced coherent artefacts, and high levels of motivation, and promoted long-term retention. According to the results of the study, the group that was taught grinding operations through situated learning outperformed the group that learned them through demonstration. Additionally, the calculated value of the F_{method} (462.509) and its associated probability value (P=0.000) were revealed by the findings of the study. The researcher's P0.05 level of significance was not met by the associated probability value, so the alternative hypothesis was accepted in place of the null hypothesis. This indicates that there is a significant difference in psycho-productive skills between students taught grinding operations in machine woodworking using the situated learning method and those taught using the demonstration teaching method.

According to Uz-Bilgin (2016), Obed and Deebom (2019), the findings of the study indicate that students were satisfied with the learning environment and perceived the learning environment as a factor that facilitated learning and enhanced their engagement and communication with the instructor. This finding is also consistent with the findings of Ünal (2015), who found that students' engagement increased in situated language learning environments. While students demonstrated emotional engagement by expressing their thoughts and opinions about the drama during e-meeting discussions, they demonstrated cognitive engagement by acquiring vocabulary knowledge and sentences with the assistance of scaffolding. Students also practised engagement in writing essays about the drama through asynchronous communication.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Compared to students who were taught machine woodworking using the demonstration method, situated learning students demonstrated higher psycho-productive skills in drilling and grinding operations. This suggests that the situated learning approach, as opposed to the demonstration approach, better develops students' psycho-productive skills. Based on the findings of the study, it was determined that situated learning is superior to the demonstration method for enhancing students' psycho-productive skills. Given the foregoing, the study suggests, among other things, that teachers use situated learning for instructing and learning at technical colleges in Rivers State because it fosters efficient exchanges and interactions between teachers and students, which subsequently enhances the students' psycho-productive skills.

Recommendations

Based on the findings of the study, the following recommendations were made:

i. Considering the relative effectiveness of situated learning over the demonstration teaching method in improving students' psycho-productive skills, it should be considered the preferred instruction method for teaching psycho-productive skills in technical colleges.
ii. There should be continuous professional development (CPD) training, and on-the-job training for technical teachers in form of workshops, seminars, and conferences on how to employ situated learning for a better impartation of psycho-productive skills in technical colleges.
iii. Situated learning cannot be effectively carried out in ill-equipped workshops and classrooms. Therefore, technical college workshops should be adequately equipped to simulate the social and physical context in which the skills would be applied.

FURTHER STUDY

Further studies can be carried out in these following areas

1. Effect of Situated Learning on Students' Cognitive Skills in Machine Woodworking
2. Effect of Situated Learning on Students' Psycho-Productive Skills in other mechanical areas

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