Perceived support and recall in statistics learning among undergraduates: The moderating effect of constructivist learning

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Abstract

The study examined whether the association between perceived support and recall in statistics learning was affected by the undergraduates' constructivist learning. Participants were 112 undergraduate students (56 males and 56 females, *Mean age* = 22.22, *SD* = 2.86 years), drawn using a stratified random sampling technique from a tertiary institution in South-Eastern Nigeria. Measures for data collection were the Perceived Social Support Scale and the obtained recall in statistics grade. The Hayes PROCESS Macro for SPSS which has a regression-based path-analytical framework for analysing the data was employed. Results showed that perceived support had a positive association with recall in statistics learning; constructivist learning had a negative significant association with recall in statistics learning. Constructivist learning moderated the association between perceived support and recall in statistics learning. The findings suggest that learning with the constructivist method contributes to a higher recall of students' statistics learning. The findings may help advance the recall in statistics learning of undergraduates in most institutions of higher learning.

***Keywords*:** perceived support, constructivist learning, statistics, undergraduates, moderation.

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Introduction

Students' academic performance is critically important to parents, guidance, and other significant figures. Social support has been identified as a key variable influencing students' academic performance (Abdelkarim et al., 2018). Academic failure and dropout are pervasive challenges at all levels of the education system in most countries (Organization de Coopérationet de Dévelopement Économiques (OCDE), 2013). The psychosocial needs of students play a critical role in their academic success. Several studies have demonstrated that social support has a positive effect on adolescents' health and wellbeing (Gini et al., 2009; Lindsey et al., 2010) and their academic success (Azmitia et al., 2009; Danielsen et al., 2010).

Nevertheless, constructivism works from the premise that constructing meaning and understanding are two sides of the same coin. We develop our understanding by creating and reflecting on constructs (Duffy & Jonassen, 2013). Recently, there has been a notable growth of interest in problem-based learning (constructivist learning and statistics learning) among undergraduates. This may be in part to the major shift in how we conceptualise knowledge of statistics and learning, shifting the focus from "what students learn", to "how students learn" (Ellis & Berry, 2005). Problem-based learning requires the students to solve problems in which the tasks or learning activities should be authentic or realistic. In turn, authenticity can be adapted from learning by doing. It is essential in helping students at a meta-cognitive level such as asking them further questions and elaborate answers given.

There is evidence of an existing problem in teaching statistics to students in higher institutions. This is largely due to a lack of social support and the constructivist learning method. It is a view of some studies (e.g., McCray, 2007) that students do not understand or retain succinct knowledge. Many researchers also host many discussions and writings about why some subjects like statistics are important and how they should be taught, which has caused further conflict among educators. Answers to these problems were yet to be found. However, a combination of social support and constructivist learning methods is expected to improve students' learning of statistics.

Perceived support and recall in statistics learning

Social support is a multidimensional construct comprising of the psychological and material resources available to individuals through their interpersonal relationships, and it enhances an individual's ability to cope with stressful life events and their general health and wellbeing by influencing cognitions, emotions, behaviours, and biological responses (Cohen et al., 2000; Uchino, 2006). Social support positively correlates with academic achievement in adolescents and emerging adults (Mishra, 2014). It is typically assumed that social support leads to increased academic achievement and most studies are designed with this theoretical assumption in mind (e.g., Lindsey et al., 2010).

In a study on how social support influences university students' academic achievement and emotional exhaustion: the mediating role of self-esteem, Li et al. (2018) observed that social support was positively related to academic achievement. However, when a student receives higher levels of social support from family, friends, teachers, and significant others, it can have a positive effect on their statistics learning and improve their grades in the course. Social support of students becomes very important, especially when they study technical courses such as Statistics.

Constructivism learning method and recall in statistics learning

Constructivism views learning as a process in which the learner actively constructs or builds new ideas on concepts based on current and past knowledge. In other words, "learning involves constructing one's knowledge from one's own experience. The constructivist learning

method means encouraging the students to ask questions, actively involving them in class activities, continuously reflecting on students' understanding, and evaluating their performances (Jennings et al., 2013). Constructivist also believes that learning is a journey of discovering meaningful information. They believe that constructivism can eliminate the struggles of learners with the assistance of teachers and knowledgeable others. The central idea of constructivism or 'constructivist learning theory is the belief that learning is an active process where new knowledge is 'constructed' by individuals (and groups) based on prior knowledge and experience (Duffy & Jonassen, 2013).

In the constructivist classroom, students interact with the environment and create their interpretation of the world instead of being mere recipients of information transmitted by the teacher (Jonassen et al., 1998). A previous study (e.g., Akinola, 2011) examined students' academic performances and how web-based teaching affected them. It was observed that this approach boosted their results, and a positive effect was observed when it came to developing democratic consciousness. Problem-solving skills, reflective inquiry, and decision-making skills were crucial areas for social studies, and these skills could assist in promoting active citizenship in a democratic world (Berson, 1996).

Again, Deslauriers et al. (2019) investigated actual learning versus the feeling of learning in response to being actively engaged in the classroom. They found that active learning strategies significantly improve student learning outcomes (like, recall in statistics) compared to traditional lectures. The study emphasised the importance of engaging students in learning processes to enhance retention and understanding (Deslauriers et al., 2019). Moreover, another study (Krishnan et al., 2017) investigated the effects of recall, reproduction, and restudy on word learning. The study found that active recall (such as testing oneself in statistics recall) led to better long-term retention than passive methods like restudy (Krishnan et al., 2017).

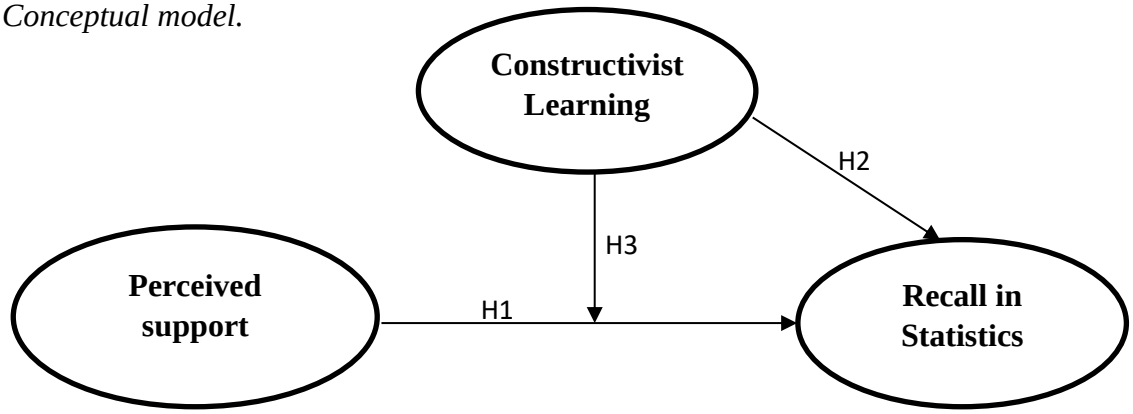
The current study

The ability to effectively learn and retain statistical concepts is crucial for undergraduates in many academic disciplines. However, many students struggle with statistics, which may impede their confidence and educational progress. Perceived support from instructors and peers is crucial in students' learning experiences and outcomes. Despite its importance, the influence of perceived support on recall and comprehension in statistics learning has not been extensively studied. Additionally, the potential moderating effects of constructivist learning approaches—which emphasise active learning, critical thinking, and real-world applications—remain underexplored, especially in the Nigerian context.

This study aims to fill this gap by investigating how perceived support impact students' recall abilities in statistics learning and whether constructivist learning approach can enhance this relationship. By examining these dynamics, the research aims to provide insights into effective teaching strategies that can improve statistical literacy and academic success among undergraduates. Understanding these relationships is essential for theory explanation, developing educational practices that foster supportive learning environments, and enhancing students' cognitive outcomes in challenging subjects like statistics. In this study, however, Social Cognitive Theory (Bandura, 1989) was employed as the foundational framework to elucidate these relationships. This theory underscores the importance of observational learning, social experiences, and reciprocal determinism in understanding behaviour and learning processes. It suggests that perceived support from teachers and peers can boost students' motivation and engagement, thus enhancing their learning outcomes, including recall. Therefore, it was hypothesised in this study that: Perceived support will significantly predict recall in statistics learning among undergraduates. Constructivist learning methods will significantly predict recall in statistics learning among undergraduates. Constructivist learning

methods will significantly moderate the link between perceived support and recall in statistics learning among undergraduates.

Figure 1.
Conceptual model.



Constructivist learning method as a moderator of the link between perceived support and recall in statistics learning

Method

Participants

Participants were 112 undergraduate students of a federal university in the South-eastern region of Nigeria. They comprised 56 males and 56 females, with an age range between 17 to 28 years (*Mean age* = 22.22, *SD* = 2.86). They were selected using a stratified random sampling technique from different departments that offer statistics.

Instruments

Perceived Social Support from Family and Friends Scales (PSS-FA & PSS-FR)

The 10-item versions of the Perceived Social Support from Family (PSS-FA) scale and the Perceived Social Support from Friends (PSS-FR) scale (Procidano & Heller, 1983) were used to assess perceived support from family and friends. Responses to the PSS-FA and PSS-FR were on a 5-point Likert scale ranging from 1 - strongly disagree to 5 - strongly agree where higher scores indicate more perceived social support. The PSS-FA and PSS-FR scales have items assessing whether participants' family and friends give them the moral support they need, enjoy hearing about what they think, are sensitive to their personal needs, and give them emotional support. Procidano and Heller (1983) reported $\alpha = 0.88$ and $\alpha = 0.90$ for the PSS-FA and PSS-FR respectively. Skinner, John, and Hampson (2000) reported PSS-FA $\alpha = 0.89$ and PSS-FR $\alpha = 0.86$, while the present study found $\alpha = 0.86$ and $\alpha = 0.83$ for PSS-FA and PSS-FR respectively among emerging adults.

Grade Center and Course Evaluation Survey (CES)

The data for the constructivism learning method in this study was derived from the Grade Center and Course Evaluation Survey (CES). The Grade Center is used by the lecturers to track students' performance. The Course Evaluation Survey (CES) is an instrument used by the University to collect valuable feedback from the students at the end of every semester and share it with the respective lecturer. Students also had options to provide narrative comments in the CES. The data on student motivation level is also taken from the survey analysis and qualitative comments provided by the students. To determine the effect of the constructivist

learning approach, the analysis of the data was carried out by considering the overall final scores of the students.

Procedure

The researchers administered a survey questionnaire to all the participants to assess each construct. The students were informed about the nature of the study and their consent was obtained. A demographic sheet was included so the participants' responses could be recorded when asked to rate themselves on the Social Support from Family and Friends Scales (PSS-FA & PSS-FR). Some individuals assisted in the administration and collection of the questionnaires. They were given instructions not to fill any of the instruments by themselves to avoid biases. We waited patiently for the participants to fill out each questionnaire which took them up to 25-30 minutes to fill. The ethical considerations were carefully addressed, ensuring that participation in the exercise was entirely voluntary. In conclusion, we thanked all the participants for their voluntary participation. The participants were measured on social support from family, friends, and significant others, and also on the constructivist learning method.

For the constructivist learning method, the researchers used the scores obtained from each participant as a criterion for eligibility and grouping (A & B), based on how high or low the perceived social support level of participants is through randomisation. Moving on, the researchers went on to randomly assign participants to two different classrooms. Group A accommodated participants who scored high and low on perceived social support and were taught a topic in statistics by the researchers for a while using the constructivist learning method, while Group B participants made use of the conventional learning method. This way, both groups will get social interaction and attachment as sources available to provide material, psychological, and overall support during times of need. The major source of the data of the study was participant observation and the obtained statistics grade. All the activities carried out in the classrooms were recorded. As a participant-observer, the researchers kept field notes of all activities, based on some of the items on the constructivist learning environmental survey (CLES).

Design/Statistics

This experimental study employed a randomised control group design. Participants were randomly assigned to the experimental group (n = 56), which was taught with the constructivist learning method, or the control group (n = 56), which was taught with the conventional learning method. Based on the design, Pearson moment correlation was used to test for association between the variables used in this study, and the Hayes PROCESS Macro for SPSS (Version 23) was used in a test of moderation hypotheses as used in previous studies (e.g., Edumudor & Ndukaihe, 2024; Ndukaihe et al., 2023). The Hayes PROCESS Macro is the best standard in tests of moderation hypotheses because, besides other advantages, it simultaneously tests direct and interaction effects (Hayes, 2018).

Results

Results of the descriptive statistics and correlation analysis which considered the level of significance and correlation among the study's variables are presented in Table 1, while the Hayes Process Macro regression results can be found in Table 2.

Table 1.
Mean, standard deviation, and inter-correlations among study variables (n = 112)

Variables	Mean	Std. Deviation	1	2	3	4	5
1 Age	22.22	2.86	1.00	-	-	-	-
2 Gender	-	-	-.07	1.00	-	-	-
3 PS	29.38	7.49	-.04	-.29**	1.00	-	-
4 LM	-	-	-.07	.00	-.21*	1.00	-
5 SL	6.28	2.94	.10	-.10	.31**	-.58**	1.00

Note: ** = p<.05; ** = p<.01; Gender was coded as: 1 = male. 2 = female; Learning Method (LM) was coded as: 1 = conventional learning, 2 = constructivist learning; PS-Perceived Support; SL-Statistics Learning.*

Results of correlational analyses showed that among the demographic variables tested; none was significantly associated with recall in statistics learning. The results of the correlational analysis indicate that perceived support was significantly and positively associated with recall in statistics learning (r = .31, p = .001); while, the learning method was significantly and negatively associated with recall in statistics learning (r = -.58, p = .000).

Table 2.
Hayes PROCESS Macro Regression results predicting recall in statistics learning by perceived support and learning method

Variables	*B*	*SE*	*t*	*P*	*95% CI*
Perceived Support (PS)	.07*	.03	2.25	.026	[.01; .13]
Learning Method (LM)	-3.16	.45	-7.03	.000	[-4.05; -2.27]
PS x LM	.14*	.06	2.21	.030	[.01; .25]

Note: * = p < .05; R^2 = .39; ΔR^2 = .03

In Table 2, it was found that perceived support positively predicted recall in statistics learning (B = .07; p = .026). However, the learning method negatively predicted recall in statistics learning (B = -3.16; p = .000). Again, the learning method moderated the association between perceived support and recall in statistics learning (B = .14; p = .030), given that the interaction effect between perceived and learning methods on recall in statistics learning was significant.

Figure 2.
Interaction effect of perceived support and learning methods on recall in statistics learning

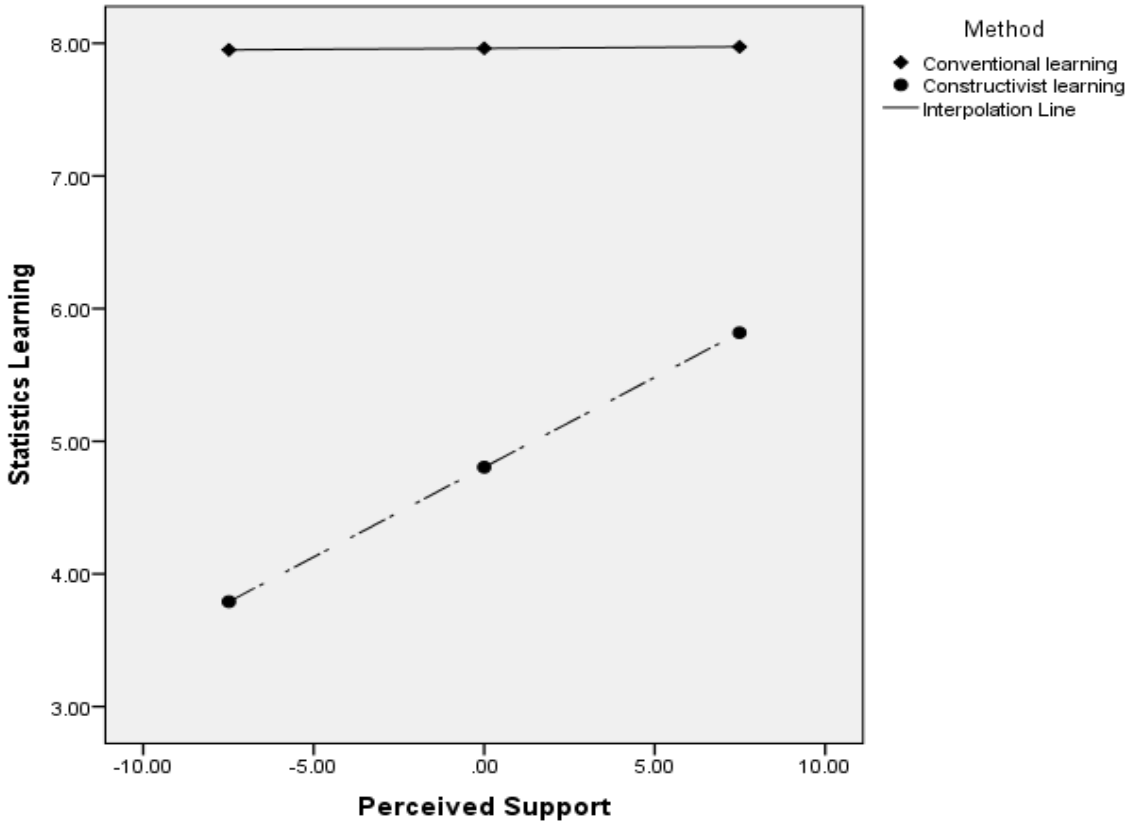


Table 3.
Conditional effects of constructivist learning method on recall in statistics learning

Variables	***B***	***SE***	***t***	***P***	***95% CI***
Conventional Method	.00	.05	.03	.974	[-.09; .09]
Constructivist Method	.14*	.04	3.37	.001	[.06; .22]

The slope of the conditional effect of perceived support and learning methods on recall in statistics learning (see *Fig*. 2) indicated that constructivist learning participants predicted increased recall in statistics learning {B = .14, t = 3.37, 95% CI = [.06, .22]. p = .001}, but conventional learning participants did not predict recall in statistics learning {B = .00, t = .03, 95% CI = [-.09, .09], p = .974). The predictor variables accounted for 39% of the variance in recall in statistics learning, F (3, 108) = 23.49, p < .001.

Discussion

The findings of the study indicate that perceived support predicted recall in statistics learning among undergraduate students. This finding is in tandem with the findings of (Glozah & Pevalin, 2015; Li et al., 2018). A possible explanation for this finding could be that

undergraduate student who perceives support from family, friends, and significant others would have the necessary motivation to excel in their chosen course.

Constructivist learning method also predicted increased recall in statistics learning, but conventional learning participants did not predict recall in statistics learning. This finding corroborates the findings of (Hijazi, 2009; Semerci & Batdi, 2015). However, constructivist learning moderated the association between perceived support and recall in statistics learning among undergraduate students. The findings lend further support to previous results that supportive social relationships enhanced recall in statistics learning among undergraduates (Duffy & Jonassen, 2013; Jennings et al., 2013). The joint effect of perceived support and constructivist learning may have resulted in motivating students to do well in statistics learning.

Implications of the Study

The result of the present study has implications for statistics learning, especially as regards the level of social support. Statistics as a course is very tactical and requires one to be emotionally stable to cope well in the course. Also, the level of social support determines the performance in the course. The results show improvements in students' academic performance along with their learning abilities.

The analysis of the findings shows students taught under the constructivist learning approach in Statistics have higher scores compared to the students who are taught under the non-constructivist teaching approach. The results also indicate that the students who received more support are motivated in learning Statistics when taught under the constructivist approach compared to other students who are not been supported. This is because students can overcome their shyness and interact more actively in class, make sense of the concepts learned, enjoy different learning techniques, and take ownership of their learning process.

Considering the negative effect that low social support has on statistics learning, both parents, friends, and teachers must join hands to give the students the much-needed support and encouragement necessary to cope well with such a tactical course. Constructivist learning methods should be added to the educational curriculum in tertiary institutions, and there is a need to give the students the necessary support and a sense of belonging. There is also a need for enlightenment on the vitality of timely intervention for parents who have poor relationships with their children as negligence could lead to poor academic performance.

Limitations and Suggestions for Further Studies

The present study had some challenges which might limit the generalisation of the results. One of the limitations is that data were collected from a relatively small sample size which may have negatively influenced the statistical power and may not be confidently generalisable to the populace.

Future research should take into consideration of a longitudinal study and large sample sizes that cut across different levels probably all the states in Nigeria to add strength to their result and increase generalisability. Future research should also examine this relationship with different measures of perceived social support, or factors that can mediate this relationship, as well as use more objective measures of statistics learning.

Conclusion

In conclusion, the constructivist approach presents an alternative view on education, where there are several other measurements and evaluation activities made possible. Social support and constructivist learning methods have been shown to predict recall in statistics learning among the undergraduate students of Alex Ekwueme Federal University Ndufu Alike, Nigeria. From the results and findings, the researchers have attempted to explain these phenomena, especially within the Nigerian context.

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