AN INVESTIGATION INTO SKILLS ACQUISITION AND ATTITUDE DEVELOPMENT IN SELF-STUDY AMONG STEAM TEACHERS

[1]AGORO Aminat Aderonke and [2]ADEOYE Ikeoluwa Folasade
Department of Integrated Science, Faculty of Science Education,
Emmanuel Alayande University of Education, Oyo. Oyo State, Nigeria.
ikeoluboye@yahoo.com, ikeoluwaadeoye@gmail.com
and adeoyeif@eauedoyo.edu.ng
[1]Orchid ID: 0000-0002-0348-726X [2]Orchid ID: 0009-0004-6350-0755

Abstract
The study investigated STEAM teachers' views on how gender, location, and years of teaching experience affect skills acquisition and attitude development in self-study. A survey design was employed to sample three hundred and ninety-five (395) STEAM teachers in Oyo State, Nigeria. A structured questionnaire of sixteen positive statements on the scale of strongly disagree, disagree, agree and strongly agree of time management, critical thinking, research skills and self-assessment as skills acquisition, self-motivation, discipline, curiosity and confidence as attitude development. The Self-Study for Skills and Attitude instrument had two parts: skills and attitude, was pilot tested with reliability coefficients of 0.78 for skills and 0.80 for attitude, as measured by Cronbach's Alpha. The data collected were analysed using an independent-samples t-test, Analysis of Variance (ANOVA and data visualisation to determine the effects of these variables on skills and attitudes in self-study. The findings show a significant main influence of teachers' location on teachers' attitude toward self-study, no significant main influence of teachers' gender and an interaction influence of teachers' gender and location on skills and attitudes. The results show that the teachers share comparable levels of competence and dispositions toward self-study. The study recommended equal accessibility of self-study resources for all teachers to support personal and professional development.

***Keywords*: S**elf-study, skills acquisition, attitude development, professional development, STEAM teachers

Introduction

Self-study is a personalised, driven learning process that an individual undertakes to understand concepts and principles in a particular domain of knowledge. Self-study is an approach that enables individuals to take initiative and ownership of acquiring knowledge without being instructed by a teacher, tutor or guidance. It allows individuals to explore the understanding of topic(s) at their own pace.

In teacher education, self-study is a systematic, reflective approach in which teachers critically examine their teaching practices for personal and professional development. Kitchen (2023) conceptualised self-study as a dynamic process in which the individual assumes an active, self-directed role in investigating their professional practice. Similarly, Martin and Russell (2020) viewed self-study as a deliberate engagement in professional contexts in which learning arises through reflection-in-action, serving as an alternative framework for personal and professional development.

Self-study is characterised by self-confidence, self-reflection and self-acceptance, leading to positive, self-

fulfilling, and successful outcomes. It is different from the traditional method, which involves structured lessons and a set pace for learning. In effective self-study, digital resources, relevant books, practical experience, and a conducive environment are crucial. An individual can self-study at home or in the library to improve knowledge in specific subjects (Truong, 2025). Other names ascribed to self-study include self-learning, independent study, autonomous learning, and self-directed learning. Berry and Kitchen (2023) described self-study as processes of knowing oneself, professional capabilities for understanding oneself, and practices for potential action.

Self-study involves questioning and analysing information to differentiate relevant from irrelevant details and to find solutions to problems, thereby promoting critical thinking and problem-solving skills. Self-study requires a schedule to plan study, set specific and measurable goals, prioritise activities, and allot time for studying without procrastination. These approaches enhance time management, creativity, self-reflection and organisation skills which aid in achieving success. Self-study helps students take ownership of learning rather than relying solely on teachers, who serve as facilitators. It promotes students' ability to believe in themselves, fosters a love for learning beyond the classroom, encourages eagerness to discover new ideas, and develops a willingness to keep trying until they understand concepts/topics in context, all while cultivating a positive attitude towards learning, which are good attitudes for lifelong learning and educational development.

Teachers can engage students in self-study by asking them to watch a short video on a concept, read and explain a passage, reflect on what they have learned, and complete homework on topics that are yet to be taught. These would promote students' self-reflection, self-motivation and curiosity to learn.

There are several studies on the practices and benefits of self-study. Barhoumi (2023) acknowledged teamwork, discussion, and flipped classes as practices in self-learning for the acquisition of soft skills. Knowledge is dynamic and rapidly growing, which is essential for vibrant industrial and economic development. Subject-matter knowledge, communication, leadership, teamwork, and lifelong learning are crucial for teachers and students. Diacopoulos et al. (2021) identified willingness to improve, reflect, collaborate, changes in practice, new identities, and sharing with others as paths to self-study in education and research.

Lim et al. (2025) found that self-study, when combined with discussion, increased students' scores in science education than the lecture-and-discussion method. The study also indicated no significant interaction among the teaching methods. Lim and Park (2023) also showed that self-study and discussion had a greater effect on improving students' learning outcomes than the traditional method. Omeliqwe and Kpangban (2023) examined the impact of self-learning and explicit teaching strategies on students' achievement in biology. They found a significant difference between students taught with self-learning and explicit instruction and those trained with the lecture method. The study found no significant difference in the achievement of male and female students and no significant interaction between students' gender and instructional strategies. Ofojebe and Anagbogu (2020) studied the effect of the self-instruction technique among secondary school mathematics students. The study found that self-instruction was effective in promoting student achievement, but it had a greater impact on female students' achievement in mathematics. Thuy (2020) identified motivation, learning methods,

time management, teaching methods, learning environment, support equipment, and resources as factors that influence self-learning.

However, there are no studies on self-study that specifically examine skills acquisition and attitude development in relation to gender, school location, and years of teaching experience among STEAM (science, technology, mathematics, and arts) teachers.

The Study Objectives

The objectives of the study are:

1. To determine the significant difference between STEAM teachers' skills acquired and attitudes developed in self-study by gender, school location and years of teaching experience.
2. To examine the significant interaction effects of STEAM teachers' skills acquired and attitudes developed in self-study on gender, school location and years of teaching experience.

The Study Hypotheses

The formulated null hypotheses at a 0.05 confidence level are:

H_o1: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by gender.

H_o2: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by school location.

H_o3: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by their years of teaching experience.

H_o4: There is no significant interaction influence of gender and school location on STEAM teachers' skills acquisition and attitude development in self-study.

H_o5: There is no significant interaction influence of gender and years of teaching experience on STEAM teachers' skills acquisition and attitude development in self-study.

H_o6: There is no significant interaction influence of school location and years of teaching experience on STEAM teachers' skills acquisition and attitude development in self-study.

H_o7: There is no significant interaction influence of school gender, location and years of teaching experience on STEAM teachers' skills acquisition and attitude development in self-study.

Theoretical Framework in Self-Study

The theories of self-directed learning, self-regulated learning, and the Decide, Act, Believe (DAB) model support self-study. The concept of self-directed learning theory is taking responsibility for one's own education by assessing needs, setting goals, finding resources, choosing suitable learning techniques and evaluating the learning process. The self-regulated learning theory (Zimmerman, 1989) emphasises how individuals manage learning through a three-phase cyclical model of setting goals and planning strategies (forethought), executing the learning activities, monitoring the progress and adjusting the plan as needed (performance) and evaluating the learning outcomes for future learning (reflection) while DAB model promotes self-study skills and attitudes by identifying one's strengths and weakness, interest and setting goals (decide), developing action plans and steps for their achievement (Act) and trusting one's ability to succeed through available support (Believe) by Millen et al. (2021)

Conceptual Framework

The study's conceptual framework was based on two dependent variables:

skills acquisition and attitude development in self-study. In contrast, the independent variables were teachers' gender (male and female), location in two zones (Ibadan and Saki), and years of experience at three levels (1-10 years, 11-20 years, and 21-30 years).

Methodology

Study Design, Population and Sample Technique

The study design was a survey type used to sample STEAM teachers in Upper Basic Schools and Lower Senior Secondary schools, who constituted the study population. The researchers targeted one thousand and six hundred (1600) STEAM teachers in Orogun, Ibadan and Saki Zones in Oyo State, Nigeria. This population of teachers was responsible for Basic Science and Technology, Mathematics, and English Studies at the educational levels. Four hundred questionnaires were produced for the two zones. However, three hundred and ninety-seven (397) STEAM teachers, randomly sampled and composed of two hundred (200) from Orogun, Ibadan Zone, and one hundred and ninety-nine (197) from Saki Zone, completed the questionnaires, forming the study's sample. The sample size of 397 exceeded the expected sample size of 310 for the finite population.

Instrument, Its Validation and Reliability

The instrument used for data was a Likert Scale, designed to measure STEAM teachers' levels of agreement with statements on the questionnaire. These statements assess perceptions of skills acquisition and attitude development in self-study, using a scale of strongly agree, agree, disagree, and strongly disagree. The responses, strongly agree, agree, disagree, and strongly disagree, were scored as 4, 3, 2, and 1, respectively. The instrument had sixteen (16) items grouped into section A for skills and section B for attitude. Each section contained eight positive statements. The statements were structured on time management, critical thinking, researching, and self-assessment for skills, and self-motivation, curiosity, discipline, and confidence for attitude, all cultivated through self-study. The instrument was given to four STEAM teachers at a university for construct and content validation and for rating. The validators' comments were incorporated into the final version of the instrument. The inter-rater value was 0.87 using Fleiss' Kappa statistical measure. The validated instrument was pilot tested on twenty STEAM teachers, and the reliability coefficient values 0.78 for skills acquisition and 0.80 for attitude using Cronbach's Alpha.

The validated and reliable instrument was administered to the STEAM teachers during the clustered training, held between July and August 2025. The researchers observed ethical considerations by seeking permission and consent from the centre coordinators and participants before administering the questionnaire, ensuring that no participant was coerced into completing it.

The data collected were analysed using mean, standard deviation and analysis of variance (ANOVA)

Results

Table 1. Mean, Standard Deviation Values of STEAM Teachers by Gender, Year of Experience, and Location

		Skills			
Gender	Year of Experience	Location	Mean	Std. Deviation	N
Male	1-10 years	Ibadan	3.2250	.44697	30
		Saki	3.1510	.56018	48
		Total	3.1795	.51778	78
	11-20 years	Ibadan	3.1771	.36330	12
		Saki	3.2431	.27611	18
		Total	3.2167	.30957	30
	21-30 years	Ibadan	3.2500	.45069	9
		Saki	3.3250	.40117	5
		Total	3.2768	.41942	14
	Total	Ibadan	3.2181	.42193	51
		Saki	3.1866	.49139	71
		Total	3.1998	.46206	122
Female	1-10 years	Ibadan	3.2644	.43253	78
		Saki	3.0579	.43077	54
		Total	3.1799	.44208	132
	11-20 years	Ibadan	3.1276	.37281	49
		Saki	3.1081	.44313	59
		Total	3.1169	.41096	108
	21-30 years	Ibadan	3.1034	.36147	29
		Saki	3.0313	.27717	4
		Total	3.0947	.34943	33
	Total	Ibadan	3.1915	.40621	156
		Saki	3.0823	.43088	117
		Total	3.1447	.41969	273
Total	1-10 years	Ibadan	3.2535	.43485	108
		Saki	3.1017	.49557	102
		Total	3.1798	.47039	210
	11-20 years	Ibadan	3.1373	.36849	61
		Saki	3.1396	.41258	77
		Total	3.1386	.39230	138
	21-30 years	Ibadan	3.1382	.38312	38
		Saki	3.1944	.36503	9
		Total	3.1489	.37648	47
	Total	Ibadan	3.1981	.40926	207
		Saki	3.1217	.45621	188
		Total	3.1617	.43338	395
Attitude					
Male	1-10 years	Ibadan	3.3375	.49366	30
		Saki	3.0885	.52082	48
		Total	3.1843	.52174	78
	11-20 years	Ibadan	3.2813	.31136	12
		Saki	3.2431	.41893	18
		Total	3.2583	.37418	30
	21-30 years	Ibadan	3.4028	.40878	9
		Saki	3.1500	.40889	5
		Total	3.3125	.41240	14
	Total	Ibadan	3.3358	.43696	51
		Saki	3.1320	.48866	71
		Total	3.2172	.47668	122
Female	1-10 years	Ibadan	3.3590	.41986	78
		Saki	3.0417	.40121	54
		Total	3.2292	.43962	132
	11-20 years	Ibadan	3.2806	.41656	49

		Saki	3.1144	.43257	59
		Total	3.1898	.43149	108
	21-30 years	Ibadan	3.2802	.39902	29
		Saki	3.0000	.44488	4
		Total	3.2462	.40803	33
	Total	Ibadan	3.3197	.41427	156
		Saki	3.0769	.41680	117
		Total	3.2157	.43171	273
Total	1-10 years	Ibadan	3.3530	.43932	108
		Saki	3.0637	.45961	102
		Total	3.2125	.47106	210
	11-20 years	Ibadan	3.2807	.39572	61
		Saki	3.1445	.43019	77
		Total	3.2047	.41935	138
	21-30 years	Ibadan	3.3092	.39926	38
		Saki	3.0833	.40505	9
		Total	3.2660	.40598	47
	Total	Ibadan	3.3237	.41895	207
		Saki	3.0977	.44482	188
		Total	3.2161	.44547	395

Table 2: Independent Samples T-test Values for Skills and Attitude by Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Skills Mean	Equal variances assumed	.020	.887	1.168	393	.243	.05511	.04717	-.03764	.14785
	Equal variances not assumed.			1.126	213.746	.261	.05511	.04894	-.04136	.15157
Attitude Mean	Equal variances assumed	.125	.724	.032	393	.974	.00155	.04857	-.09394	.09705
	Equal variances not assumed.			.031	213.218	.975	.00155	.05045	-.09789	.10100

t = 1.168, p = > .05 with .243 for skills equal variances and t = .032, p = >.05 with .974 for attitude for equal variances by gender.

Table 3: Independent Samples T-test Values for Skills and Attitude by Location

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Skills Mean	Equal variances assumed	.002	.960	1.754	393	.080	.07639	.04355	-.00922	.16201
	Equal variances not assumed.			1.745	377.291	.082	.07639	.04377	-.00968	.16246
Attitude Mean	Equal variances assumed	.379	.538	5.198	393	.000	.22593	.04347	.14047	.31139
	Equal variances not assumed.			5.183	383.645	.000	.22593	.04359	.14022	.31164

t = 1.754, p = > .05 with .080 for skills equal variances and t = 5.198, p = < .05 for attitude equal variances by location.

p > .05

Table 4: One-way ANOVA Values for Effect of STEAM Teachers' Year of Experience on Skills and Attitude

		Sum of Squares	Df	Mean Square	F	Sig.
Skills Mean	Between Groups	.150	2	.075	.398	.672
	Within Groups	73.849	392	.188		
	Total	73.999	394			
Attitude Mean	Between Groups	.137	2	.069	.345	.708
	Within Groups	78.050	392	.199		
	Total	78.188	394			

p > .05

Table 5: ANOVA Data of the Interaction Influence of Gender, Year of Experience and Location on Skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	2.250[a]	11	.205	1.092	.366
Intercept	1689.926	1	1689.926	9020.892	.000
GENDER	.537	1	.537	2.867	.091
YEAR OF EXPERIENCE	.008	2	.004	.021	.979
LOCATION	.062	1	.062	.333	.564
GENDER * YEAR OF EXPERIENCE	.246	2	.123	.657	.519
GENDER * LOCATION	.156	1	.156	.831	.363
YEAR OF EXPERIENCE * LOCATION	.456	2	.228	1.218	.297
GENDER* YEAR OF EXPERIENCE * LOCATION	.010	2	.005	.026	.974
Error	71.749	383	.187		
Total	4022.578	395			
Corrected Total	73.999	394			

a. R Squared = .030 (Adjusted R Squared = .003)

Table 6: Table 5: ANOVA Data of the Interaction Influence of Gender, Year of Experience and Location on Attitude

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.978[a]	11	.543	2.882	.001
Intercept	1735.981	1	1735.981	9207.614	.000
GENDER	.213	1	.213	1.130	.289
YEAR OF EXPERIENCE	.034	2	.017	.089	.915
LOCATION	1.982	1	1.982	10.513	.001
GENDER* YEAR OF EXPERIENCE	.111	2	.055	.294	.745
GENDER * LOCATION	.058	1	.058	.310	.578
YEAR OF EXPERIENCE * LOCATION	.511	2	.256	1.356	.259
GENDER* YEAR OF EXPERIENCE * LOCATION	.019	2	.010	.051	.950
Error	72.210	383	.189		
Total	4163.891	395			
Corrected Total	78.188	394			

a. R Squared = .076 (Adjusted R Squared = .050)

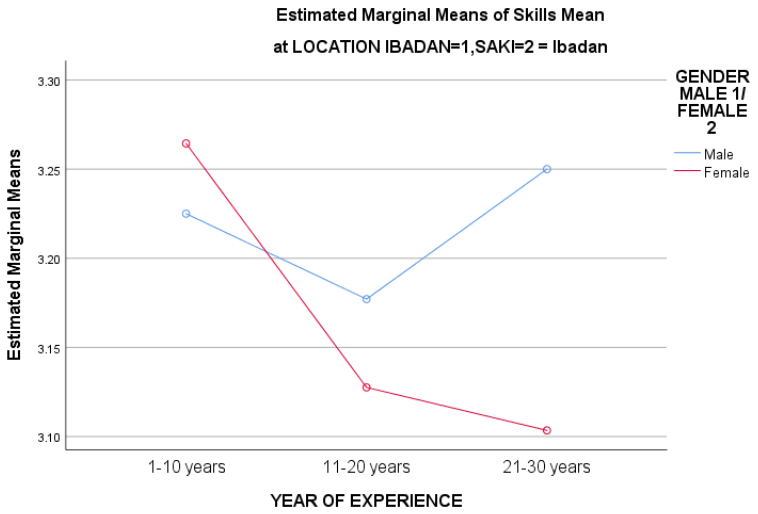


Figure 1: Interaction Influence of Gender, Location (Ibadan) and Experience on Skills

Among participants in Ibadan, females with 1-10 years of experience indicated a higher mean in skills acquisition than males. However, as years of experience increased, females' mean skill declined sharply, while males' mean skill remained relatively stable and later increased.

This indicated that the effect of experience on skill differs for male and female STEAM teachers. The lines cross between 1-10 years and 11-20 years show significant interaction of gender and years of experience in Figure 1. That is, gender influence on skills acquisition in Ibadan zone depends also on years of experience.

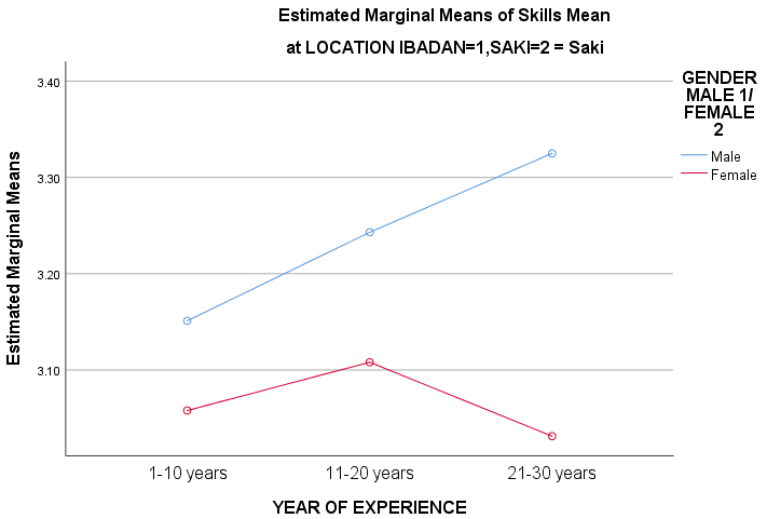


Figure 2: Interaction Influence of Gender, Location (Saki) and Experience on Skills

The lines are not parallel, indicating an interaction effect between gender and years of experience on skills acquisition. This suggests that the impact of gender and years of experience on skill development differs between male and female teachers. In other words, years of experience improve skills acquisition for males than females in the Saki Zone.

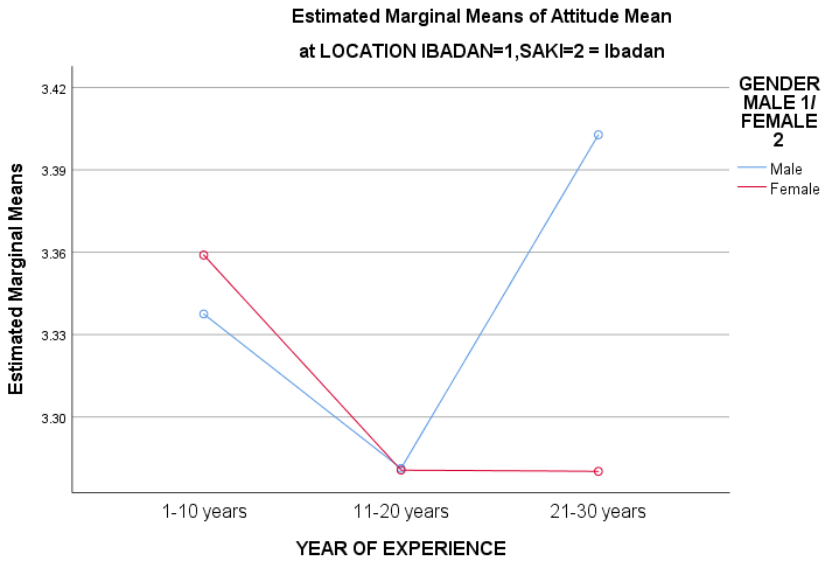


Figure 3: Figure 4: Interaction Influence of Gender, Location (Ibadan) and Experience on Attitude

The mean line graphs of attitude development for both male and female teachers decrease steadily to a point and diverge. Then, that of male teachers increases with years of experience, while the mean of female teachers remains constant in the Ibadan zone, as shown in Figure 3. The indication is that experience contributes more strongly to attitude development in self-study for male STEAM teachers in Ibadan than for female teachers. This pattern of divergence indicates an interaction effect between gender and years of experience.

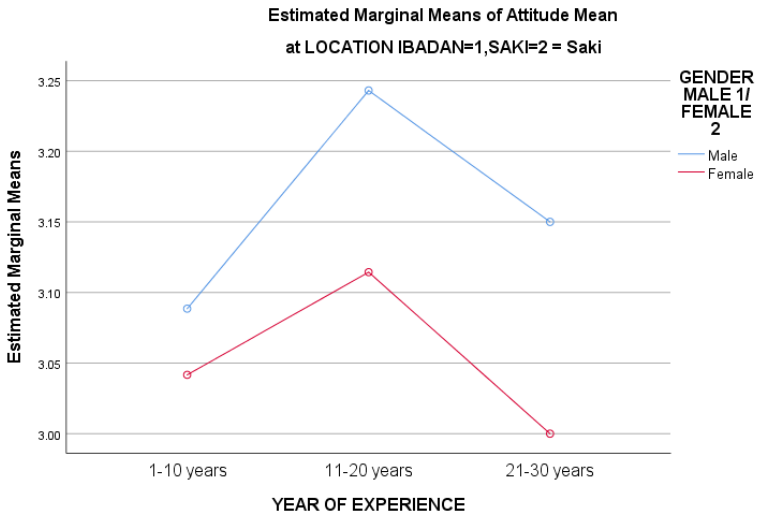


Figure 4: Interaction Influence of Gender, Location (Saki) and Experience on Attitude

The mean attitude lines for both male and female STEAM teachers increase steadily up to an experience level of 11-20 years, then decrease along the experience axis. However, the mean attitude among male teachers is higher than among female teachers, as indicated in Figure 4. The line pattern demonstrated in Figure 4 shows the interaction effect of gender and experience

on attitude in the Saki zone, since the lines were not parallel

Testing of Hypotheses

H_o1: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by gender.

The values of t = 1.168, p = > .05 with .243 for skills equal variances and t = .032, p = >.05 with .974 for attitude for equal variances by gender, as shown in Table 2, indicate no significant main influence of gender on either skills or attitude. Therefore, the hypothesis is accepted.

H_o2: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by school location.

The independent samples t-test to compare means indicated t (393) = 1.75, p = .960, for skills and t (393) = 5.19, p = .000 for attitude, as shown in Table 3, indicating no significant difference in the skills acquisition by location but a significant main influence for attitude. Hence, the null hypothesis, H_o2, was not rejected for skills acquisition but was rejected for attitude. Therefore, no significant main influence of school location on STEAM teachers' skills acquisition, but there was a significant main influence of location on attitude.

H_o3: There is no significant main influence of STEAM teachers' skills acquisition and attitude development in self-study by their years of teaching experience.

The one-way ANOVA results indicated on skills acquisition, F (2, 392) = .398, p = .672, and on attitude development, F (2, 392) = .345, p = .708, as shown on Table 4, indicated no significant main influence of years of teaching experience on STEAM teachers' skills acquisition and attitude. The null hypothesis, H_o3, was not rejected.

H_o4: There is no significant interaction influence of gender and school location on STEAM teachers' skills acquisition and attitude development in self-study

The UNIANOVA results in Table 5 show the interaction influence of gender and school location on skills acquisition, F (1, 393) = .831, p = .363. Also, no significant interaction influence of gender and school location on attitude development with F (1, 393) = .310, p = .578. Hence, the null hypothesis, Ho4, was not rejected.

H_o5: There is no significant interaction influence of gender and years of teaching experience on STEAM teachers' skills acquisition and attitude development in self-study.

The results of the UNIANOVA of gender and years of teaching experience on Table 5 for skills acquisition indicated F (2, 392) = .657, p = .519, indicating no significant interaction influence of gender and years of experience of the STEAM teachers on skills acquisition. The results from UNIANOVA on Table 6 for attitude also indicated no significant interaction influence of gender and teachers' years of experience, F(2, 392) = .294, p = .745. Hence, the null hypothesis, H_o5, was not rejected. H_o6: There is no significant interaction effect between school location and years of teaching experience on STEAM teachers' skills acquisition and attitude development in self-study.

The results of UNIANOVA, Table 5, on the interaction influence of school location and years of experience on skills acquisition indicated F(2, 392) = 1.218, p = .287, indicating no significant interaction influence. Table 6, UNIANOVA results on attitude showed no significant interaction influence of school and year of experience, F (2, 392) = 1.356, p = .259. Hence, the null hypothesis, H_o6 was not rejected.

H_o7: There is no significant interaction influence of school gender, location and years of teaching experience on STEAM

teachers' skills acquisition and attitude development in self-study. From Table 5, F (2, 392) = .026, p = .974, indicated no significant interaction influence of gender, school location, and years of teaching experience on STEAM teachers' self-study skills. Table 6 results of UNIANOVA, F (2, 392) = .051, p = .950, indicated no interaction influence of gender, school location, and years of teaching experience. The null hypothesis, H_o7, was not rejected.

Findings Discussion

Influence of Gender, Location and Years of Teaching Experience on Skills Acquisition

The findings of no main significant effects of gender, location on skills acquisition on self-study are indication perceived by the teachers irrespective of their demographic variables that self-study could enhance both students and teachers' competencies in plan and stick to schedule and efficient use of time to balance study and other task (time management), learn to analyse, compare and evaluate information, enhance decision making and reasoning abilities (critical thinking), becoming skilled at locating and synthesising information, learn how to validate sources and draw logical conclusion (research skills), and reflect on their own progress and identifying gaps for improvement and encouraging responsibility for correcting misunderstandings (self-assessment). These findings on skills acquisition in self-study confirm Barhoumi's (2023) observation that self-learning promotes skills acquisition.

The interaction of gender, location and experience was not established in skills acquisition. The 2-way and 3-way interaction effects were not statistically significant on skills acquisition by gender, location and experience, but there was a strong interaction effect of gender and experience in the Ibadan zone on data visualisation in Figure 1. This indicated that the effect of experience on skill differs for male and female teachers. The lines for 1-10 years and 11-20 years cross, indicating a significant interaction between gender and years of experience. That is, the influence of gender on skills acquisition in the Ibadan zone also depends on years of experience. In Figure 2, the male line moves upward, while the skills score increases steadily with more years of experience, whereas the female line increases slightly and then drops, indicating a different trend: not a steady increase. The lines are not parallel, indicating an interaction influence of gender and years of experience on skills acquisition. This indicates that the interaction between gender and years of experience in skills acquisition differs between male and female teachers. In other words, years of experience improve skills acquisition for males than for females in the Saki zone. The observed difference in the interaction effects of gender, location and experience is not statistically significant. In data visualisation, the observed interaction may be due to high variability within each gender/experience group, yielding very different scores, which weakens statistical significance. The differences observed in the lines graph may not be large enough for ANOVA to confirm as statistically significant, given the limited data.

Influence of Gender, Location and Years of Teaching Experience on Skills Development

There were no significant main effects of gender or experience on attitude development in self-study, but there was a significant main effect of location on attitude, with the Ibadan zone having a higher mean attitude perception than the Saki zone. The reason may be that the teachers in the zone had greater access to self-study resources that promote a positive attitude toward self-study.

The findings showed that the teachers had the views that self-study could

build the internal drive to purse knowledge independently, encourage enthusiasm for learning without external rewards (self-motivation), instil consistency in study habits and task completion and assist in staying on track despite distractions (discipline), spark the desire to explore and ask questions beyond the syllabus and encourage lifelong learning and intellectual growth (curiosity) and build belief in one's ability to understand and succeed, and encourage risk-taking and trying new methods of learning (confidence) regardless of gender, location and experience. These findings contrast with those of Ofojebe and Anagbogu (2020), who found that self-instruction had a greater impact on female students' achievement than on male students.

There were no significant interaction effects of the demographic variables on attitude development in self-study using ANOVA, while the lines in Figures 3 and 4 for the two locations, Ibadan and Saki, showed an interaction effect of gender and experience in the zones, as the lines were not parallel. The reasons for these differences in ANOVA results and those observed virtually may be that the pattern existed, but it was not strong or consistent enough to be considered statistically meaningful and probably, the graph may have virtually emphasised slight differences because of how the axis scale or range was set, what was large on the plotted lines might be numerically minor.

Therefore, the data visualisation provides descriptive insights into possible trends, and the inferential statistics indicate that the observed patterns in skills and attitude in self-study across the teachers' demographic variables were not significant. The results imply that gender and experience do not meaningfully interact to influence teachers' skill acquisition and attitudes toward self-study. Omeligwe and Kpangban (2023) found no significant interaction effect of method (self-learning and explicit instructional strategies) on achievement.

Summary

The findings of this study imply that self-study is a universal professional skill, not limited by who teachers are by gender, location or teaching experience, but by how they are supported and motivated within their working/learning environment.

Conclusion

The study examined the effects of gender, location, and years of teaching experience on teachers' skills and attitudes towards self-study. The findings revealed no significant main effects of gender or years of experience. Still, there was a significant main effect for location, and no interactive effects among these variables on the teachers' self-study skills and attitudes. This indicates that teachers generally possess similar skill levels and attitudes toward self-study, regardless of gender or length of teaching experience. This shows a culture that values continuous learning and reflection among teachers, which is essential for sustainable professional development and improvement in teaching effectiveness.

Recommendations

1. Teachers should have a positive mindset and devote time to self-study to acquire skills and develop an attitude associated with self-study
2. Educational authorities should promote equal opportunities for all teachers to access self-study materials and professional development programmes.
2. Self-study skills of time-management, reflection (self-assessment), researching and critical thinking should be integrated into teacher training to help teachers build strong independent learning habits.

3. School administrators should create an enabling environment for teachers that supports self-study, such as provision of internet access, mentorship, learning resources and time within the work schedule for self-development.
4. Collaborative self-study communities should be fostered among the teachers by encouraging peer learning and professional communities within learning institutions to share experiences and strategies for self-learning, promoting motivation, discipline, curiosity and confidence in learning regardless of teachers 'gender, location or experience.

Further Research

Future studies in self-study should:

- Include larger and more diverse samples to confirm the current findings of no significant main and interaction effects of gender, location and experience on skills and attitude in self-study.
- Explore other possible predicators, like access to technology, school culture, that may influence teachers' self-study skills and attitudes.
- Use mixed methods of research to gain deeper insights into teachers' perceptions of self-study.

Policy Development

Education policymakers should incorporate self-study and continuous professional learning as key components of teacher development frameworks, ensuring all teachers, regardless of background, receive consistent support for lifelong learning.

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Ethical Consideration

Ethical considerations were duly observed, ensuring that permission was sought from the centre's coordinators at the centres where the teachers were receiving training, and that none of the teachers was coerced into completing the questionnaires.

Conflict of Interest

The researchers have no conflict of interest to declare.