Analysis of Teaching and Assessment Methods used on the Acquisition of Soft Skills Among Mathematics Students in Enugu State, Nigeria

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ABSTRACT

This research studied the usage of teaching and assessment methods used by instructors on the acquisition of soft skills among mathematics learners in Enugu State, Nigeria. The research was guided by two research questions and two null hypotheses. It employed descriptive survey research design and all mathematics teachers and learners in senior sessions constituted the population. The researchers sampled two hundred (200) respondents (24 Teachers and 176 Students) using simple random sampling techniques. The adapted Measuring and Assessment of Soft Skills (MASS) questionnaire was used for the research. The instrument consisted of 25 structured items, 14 on teaching methods and 11 on assessment methods used by Mathematics teachers in the classroom. The instruments were validated by experts in area and subjected to trial testing yielding internal reliability coefficient of 0.81 using Cronbach alpha reliability coefficient. The collected data were analyzed, mean and standard deviation were used to answer the research questions, while independent t-test was used to test the hypotheses at 95% confidence interval. The results indicated that the mean rating scores of mathematics instructors and learners on the instructing and assessment methods used in enhancing soft skills development among students in Enugu state varies significantly. The findings recommend among others for Mathematics teachers to endeavor and use all appropriate instructing and assessment methods in enhancing the acquisition of soft skills among students

Keywords: Analysis, Assessment methods, Classroom instructions, Mathematics teaching, Secondary school students, soft skills acquisition, Teaching methods

INTRODUCTION

Over the years, secondary school graduates have deficiency on the technical and work force skills needed to succeed in their respective place of work or businesses or offices. This has been due to instructors' usage of various methods and assessment tools used in the mathematics classroom. This necessitated the need for the present study which aims to avail the instructing methods and assessment tools that help in the acquisition of soft skills needed among students. Soft skills are non-technical skills that show the way you work and mix with people to promote productivity at works place. Soft skill was described as the intra and inter personal abilities needed for progress and social involvement in the workplace (Quieng et al, 2015). It includes ones innate, encompassing ability to communicate using languages, and interpersonal abilities which was characterized by relating well with others (Devedzic et al., 2018). Abilities like working in a team, solving issues, adapting to a giving situation, thinking critically, management of time, leadership, effective communication, creativity and innovation are regarded as soft skills that are needful for school leavers in order to meet up with changing eras (Chu et al., 2016). Kechagias (2001) asserted that 'generalists and specifics' are the two schools of thought pertaining the teaching of soft skills. The generalists believed that soft skills can be taught differently from any discipline of learning. To the specifics, soft skills can't be taught differently from the field of study but rather within the discipline (Aworanti et al. 2015). This agrees with Aworanti (2012) who asserted that soft skills are innate in the individual. As a person, it is supposed that in your place of work you should relate well with people around you and solve various issues along the way. This relationship can be learnt based on the environment one finds oneself or with people that one relates with.

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Cultural and societal factors can significantly influence soft skills acquisition among secondary school students generally and among learners in Enugu State, Nigeria specifically. Among the societal factors that influences the acquisition of soft skills are family expectations, societal opinions, traditional gender roles. Also, cultural norms, parental influence, community values, school setting, teacher and school counselor support significantly influences soft skills acquisition among learners (Oderinde & Adesina, 2024). For example, Enugu-Ezike culture places a strong emphasis on respect for elders and authority, this has a strong impact on students' communication and teamwork skills. Also, may communities in Enugu State values hard work and diligence which might aid students, strong ethic and time management skills.

In consonance with the thought of soft skills being innate or learnt, group of twenty researchers from Europe described the teaching approaches in teaching soft skills to be "Autonomous Teaching" and or "Stand-Alone Approach" (Aworanti et al. 2015). The author opined that the researchers had fifteen item instruments for the assessment of soft skills in their continent. These skills are purely pertaining the progress of an individual in ones' work place. Busaka et al (2022) reviewed several literatures on the usage of soft skills in post primary schools in Africa and revealed scanty research pertaining the assessment of soft skills in mathematics. The authors include the readiness of mathematics teachers in integrating soft skills acquisition among learners. Moreover, different background may hamper the usability of these skills as Nigeria is a country with socio cultural background different from European countries. It has been asserted that only five items from the European researchers were teachable and assessable within Nigeria (Aworanti et al. 2015). The items are pertaining to how one is commited to his/her duty, how one attends to his/her responsibilities, how one adapts in work place environment, how one manages resources and how one is motivated in his work place. It is on this ground that the present study tries to explore how best to enhances these abilities in Mathematics classroom instruction by the teacher in Enugu state.

These skills should be developed in Mathematics classroom by a trained Mathematics instructor in the course of Mathematics instructions in secondary school. This is so, because Mathematics as a subject has been regarded as the mother of all subjects in secondary school (Ukwueze, Odugu & Idoko, 2024), thus as a mother who for see the progress of their wards, soft skills should be developed under her custody. Teachers' knowledge of essential soft skills are needed to ensure appropriate implementation of mathematics curriculum geared towards having a better student for career education. Hence, mathematics instructor ought to be sound in working as a good facilitator, a good organizer, a good problem solver, a good listener and a good adviser. This means that the development of these abilities in mathematics would help the learner in facing the challenges of work force and be able to compete globally, thus, this depends to a greater extent on how the mathematics teachers teach and assess their learners. The needfulness of these skills in ones' career for effective productivity of one's task has necessitated the advocacy for the integrating soft skills in post primary schools (Aworanti et al. 2015).

Hard skills refer to as the reverse of soft skills which are more cognitive, often instruct able, and easier to measure. Stewart (2017) has asserted that hard skills are specific, teachable skills that are easily measured. They are teachable to post primary school learners in order to prepare them for future career. It is of interest to note that, soft skills are not given the same order in schools (Balcar, 2016), despite the fact that world has come out from the era of "Industrial Age" to the era of "Information Age". This inspired people in having the needed awareness pertaining the development of extra abilities to function well in this era we are right now. Research has established that there was no fully integration of soft skills in African post primary schools. Blom et al (2017) have noted that post primary education in Zambia does not fully prepare learners with the soft skills needed in this globalized economy. Muzata (2018) revealed that, there is need to provide a better way of instructing and examining soft skills in secondary schools in Zambia. The author expresses the need to develop soft skills like interpersonal communication skills in the learners. Despite, these essential roles played by soft skills, its development has not been emphasized among secondary school students in Nigeria. All these reviewed studies were not done in Nigeria let alone in Enugu State, implying low studies in soft skills development among secondary school students. This necessitated this study.

Mathematics as a subject empowers learners to acquire both skills as it helps them to acquire needed skills of being critical and analytical in society, which witnesses' complexity each day that go by (Cox, 2018; Rohaeti, 2019). Also, the former asserted that the needed skills in any job are developed during mathematics instructions. Hence, the need for the present study which aimed at analyzing the instructing methods that enhances the acquisition of soft skills among senior post primary school mathematics learners in Enugu State Nigeria.

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The teaching methods are styles of teaching that any professional Mathematics teacher should employ in the course of mathematics instruction in order to attain the educational goals. Such instructing styles are role-play, problem-solving, projects based, case studies, flipped classroom, collaborative learning, gamification, problem-based learning, design thinking, thinking based learning, competency-based learning (Redaccion Real influencer, 2021; Ukwueze & Abugu, 2024). Any trained mathematics instructor is supposed to change from the role of know all to the role of a good facilitator who guides the learning process. Do mathematics instructors use these teaching methods as identified above in the course of their teaching.?

Moreover, they are equally expected to often examine the learners with various styles like the use of portfolios, use of classroom or field observation, use of projects, use of oral presentations, use of self-assessments, use of interviews, use of peer assessments, use of test, use of classwork, use of homework, use of sociometric technique, use of questionnaire report, use of checklist, use of rating scale etc (Obioma,2008). For soft skills to be enhanced in students, both the teaching and assessment styles employ by Mathematics teachers ought to be upgraded. With different styles of examinations, the learners have the advantages of having a clearer vision of what is expected to possess, be highly positive as a learner (Slattery, 2013). With this, they ought to show soft skills possessions in them. Davies (2013) opined three different sources in classroom assessment evidence, thus: observations of students being engaged in learning process, conversations with learners about their learnings, and reviewing their products (i.e. notebooks, tests work, class works, projects work, assignments and quizzes). According to the researchers, mathematics teacher ought to be an excellent teacher who inspires his/her learners (Ukwueze, et al. 2013). That is to say that the learner should be guided as they learn any concept in Mathematics independently.

It has been found that, only five soft skills are teachable in Nigeria post primary schools (Aworanti et al. 2015). Moreover, in Enugu state, the Post Primary School Management Board for sees the routine supervision and inception of teachers in the state, and have been up and doing with the current board Chairman. This implied in this study, that the regular supervision and inception of teachers in the state is culminating into the fact that teachers use various teaching and assessment styles as they have consistently been rated very high over the years. The performance of students over the past five years in WAEC and NECO is a pointer to this fact. It is on this ground that the present study tries to explore the teaching and assessment strategies used for the development of soft skills among senior post primary school learners in Enugu state from both the learners and teachers.

However, studies on soft skills acquisitions in post primary school mathematics in Nigeria is still scanty. This, necessitated the present study, hence, the study aimed at analyzing the teaching and assessment styles employed by Mathematics instructors for the acquisition of soft skills among senior post primary school Mathematics learners in Enugu State Nigeria.

Research Questions

The following questions were formulated to guide the study.

1. What are the mean and standard deviations rating scores of Mathematics teachers and students on the teaching methods that enhances soft skills among students?
2. What are the mean and standard deviations rating scores of Mathematics teachers and students on the assessment methods that enhances soft skills among students?

Hypotheses

The following research hypotheses were formulated to guide the study and were tested at .05 level of significant.

1. There is no significant difference on the mean rating scores of Mathematics teachers and students on the teaching methods that enhances soft skills among students.
2. There is no significant difference on the mean rating scores of Mathematics teachers and students on the assessment methods that enhances soft skills among students.

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METHOD

Ethical consideration Permission was received from the ethical committee of the school University of Nigeria, Nsukka, Enugu State to conduct this research. It employed a descriptive survey research design, with all the senior secondary school Mathematics teachers and senior secondary school students from Enugu State Nigeria making up the population. The sample of two hundred participants (200: Teacher=24, Student=176) using multi-stage sampling procedures were used in selecting the sample for the study. From six education zones that make up Enugu State, two education zones were randomly selected using purposive sampling techniques. From the selected education zones, four post primary schools were randomly selected using simple random sampling techniques of balloting without replacement. In each school 25 respondents participated from each selected school, 22 were students and 3 were teachers. Purposive sampling was used in selecting 22 students based on their performance in the previous term. The school principals were officially consulted and their consent granted before meeting with the mathematics teachers in the senior sections. Both the teacher and the students consented to participate before partaking in the research.

The study adapted Measuring and Assessment of Soft Skills (MASS) instrument from Aworanti, et al, (2015). It had two parts: Part A deals with biodata information of the respondents viz: school name, personality; teacher or student. Part B items deals on methods used in teaching and assessing of soft skills in the classroom. Its response options alongside the weightings were Very Appropriate (VA=4 points), Appropriate (A=3 points), Fairly Appropriate (FA=2 points) and Not Appropriate (NA=1 point). Criteria for decision was 1.0-1.95 poor in addressing soft skills, 2.0-2.45 fair in addressing soft skills, 2.5-3.45 good in addressing soft skills, while 3.5 and above means excellent in addressing soft skills.

The instrument was satisfactorily validated facially by experts in the Faculty of Education one from Measurement and Evaluation unit, one from Mathematics Education unit, and one from Educational Foundation all from University of Nigeria, Nsukka (UNN). The instrument yielded a reliability coefficient index of 0.81 gotten after subjecting the responses from the trial testing field work to Cronbach Alpha reliability coefficient test and was deemed reliable for the study. The choice of Cronbach Alpha was because the instrument was polythomously graded. The research team instructed the regular mathematics teachers in the staff room, handed them over their own copies of the instrument, after that they moved to classroom for administering the instruments to the selected respondents. It was collected on the spot check to avoid missing.

The generated data from the research were analyzed using SPSS version 20. Descriptive (mean and standard deviation) statistics was employed in answering the research questions and independent t test was employed in testing the null hypotheses at 0.05 significant levels.

RESULTS

The demographic variables of the research showed that 24 respondents were Mathematics teachers while 176 participants were students. Levene's test of equality of variance was used to test the homogeneity of variance with the coefficients F (198) =3.047; P=.162; and F (198) = 1.963; P=.293; for the two hypotheses respectively. The test showed that the p-value was greater than .05 level of significance indicating a violation of the equality assumption of variance. Due to this, independent sample t-test was reported using equal variance not assumed.

Research Question One: What are the mean and standard deviations rating scores of Mathematics teachers and students on the teaching methods that enhances soft skills among students?

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Table 1: SPSS Group for Descriptive Statistics

Mean and Standard Deviations rating scores from part B of the instrument.

Group	N	Mean Ratings	SD	Std. Error Mean
Mathematics Teachers	24	3.14	0.98	1.8147
Students	176	2.05	3.27	2.8617
Total	200			

The results display in the table 1 above indicated that Mathematics teacher had the mean rating scores of 3.14 and 0.98 as the standard deviation, also, the learners had the mean scores of 2.05 and the standard deviation of 3.27 and the standard error mean of 1.8147 and 2.8617 for teacher and learners respectively. This implied that teacher had higher mean rating scores with low standard deviation than

students on Measuring and Assessment of Soft Skills (MASS) questionnaire on teaching methods used in enhancing soft skills development among learners. With this, it implies that the variation in the learners' response was greater than the teachers.

Hypothesis One: There is no significant difference on the mean rating scores of Mathematics teachers and students on the teaching methods that enhances soft skills among students.

Table 2: Independent Sample t-test analysis for differences in the mean rating of Measuring and Assessment of Soft Skills (MASS) questionnaire on teaching methods

Group	N	X	SD	Df	t	p
Teachers	24	3.14	0.98			
				198	4.729	.007
Female	176	2.05	3.27			

The data in the table 2 above indicated that the difference in teacher and students with t (198) = 4.729=.007, P<.05. With this, it Implies that the null hypothesis was rejected, thus there was significance difference on the mean ratings scores of teachers and learners on the teaching methods used in enhancing soft skills development among students.

Research Question Two: What are the mean and standard deviations rating scores of Mathematics teachers and students on the assessment methods that enhances soft skills among students?

Table 3: SPSS Group for Descriptive Statistics

Mean and Standard Deviations rating scores from part B of the instrument.

Gender	N	Mean Ratings	SD	Std. Error Mean
Mathematics Teachers	24	3.22	1.13	.89926
Students	176	2.18	2.51	1.3692
Total	200			

The data display in the table 3 above showed that the mean and standard deviation of 3.22, 1.13 and 2.18, 2.51 for teachers and students respectively on the assessment methods used in enhancing soft skills development among students in Mathematics classroom. Implying that the students had lower mean rating scores and higher standard variation than their teachers' counterpart.

Hypothesis Two: There is no significant difference on the mean rating scores of Mathematics teachers and students on the assessment methods that enhances soft skills among students.

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Table 4: Independent Sample t-test analysis for differences in teachers and students' ratings on Measuring and Assessment of Soft Skills (MASS) questionnaire on assessment methods.

Group	N	Mean ($\bar{X}$)	SD	df	t	p
Teachers	24	3.22	1.13	198	5.946	0.002
Students	176	2.18	2.51			

The data in the table 4 above indicated that the value t (198) = 5.946 with the associated value of probability value of .002 (P<.05) implying rejecting of the null hypothesis, thus there was significant difference on the mean rating scores of Mathematics teachers and learners on the assessment methods used in enhancing the soft skills development among students.

DISCUSSION

The findings of the research indicated that teachers had a greater mean rating scores and lower standard deviation than their students' counterpart on Measuring and Assessment of Soft Skills (MASS) questionnaire on both teaching and assessment methods used in enhancing soft skills development among learners. With this, shows that the variation in the learners' response is higher than that of teachers. This shows that both instructors and learners agree on both the teaching and assessment methods used in teaching and assessing them with regards to soft skill acquisitions in different categories. Teachers rating coincided with the criteria of being good teachers while students' ratings coincided with teachers being fair with the method of teaching they used on them. Some students went further to assert that they don't know what some methods are all about like, flip classroom, design thinking in the course of their teaching thus, rated them as not seen.

This research finding showed that there was statistically significant difference in the mean ratings scores of teachers and learners on the teaching and assessment methods used in enhancing soft skills development among students with the high rating in favour of teachers. This indicates that in terms of examinations, no one will examine him/herself without getting a high grade and students normally criticize their teachers by denying of not been taught well. This behavior exhibit by students is normal as they intend using it to wave out asking them too many questions in the classroom or outside the classroom. Thus, the study adds to the empirical evidence that soft skills can be taught and examined in Nigerian secondary schools in Mathematics instructions. This result could be attributed to the fact that Enugu state government is up and doing in supervising and training of post primary school management board (PPSMB) staff on a regular basis for efficient delivery in the classroom.

The research finding is in harmony with the result of Aworanti et al (2015) which showed that soft skills such being committed to duty, being responsible, being adaptable, managing resources and being motivated can be taught and examined in Nigerian context. Also, their finding, indicated that the soft skills are instruct-able with the use of methods such as direct teaching, demonstration, discussing with the learners, simulation, self-discovery method, questioning, interviewing the learners, project-based learning, cooperative/collaborative based learning and reflection-based learning. Other methods including rote memorization, lecture method were inappropriate in teaching of the skills in Nigerian post primary schools. The above assertion coincided with this result as both students and teacher agrees that soft skills are teachable by rating the instruments from fairly appropriate to very appropriate. The finding from this study debunked the research study by Nsengimana et al. (2017) who asserted that the inappropriate impacting approaches employed by mathematics instructors could not adequately incorporate soft skills in Rwandan secondary schools. The authors revealed that mathematics instructors were not familiar with the teaching styles like using problem solving steps, using open- ended discussion, close- ended discussion, using problem tree, using the concept mapping style, backward teaching, teacher-directed instruction, discovery method, project-based learning, resource-based learning, brainstorming learning, and KWL (know, want and learn) chart methods (Nsengimana et al., 2017). Also, the findings of (Koskei & Chepchumba, 2020, Ondieki et al., 2019) indicated respectively that inappropriate teaching styles employed by mathematics instructors and the inability of young learners to work in groups (teams), utilizes and manage time, and to show ethics are the manifestations of non-integration of soft skills in post primary

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schools in Kenya. Finding from Sultanova, et al (2021) showed that mathematics teachers' possession and utilization level of soft skills such as sociability, creativity, empathy, corresponds to the medium level of possessions and utilization. This corroborate the students fair rating scores as found from this study as the number of mathematics teachers with a low level of sociability and empathy are greater than the number with a high level one.

This research result showed significant differences on the mean rating scores of Mathematics teachers and students on the assessment methods used in enhancing the soft skills development among students. This was in harmony with the result of Aworanti et al (2015) who showed that the identified soft skills can be assessed with the usage of objective tests, essay tests, practical tests, checklists, questionnaires, rating scales, observations and assignments by the teachers. The authors revealed that other methods such as the usage of speed tests, interviews and portfolios were not appropriate and suitable for the assessment of soft skills in Nigerian post primary schools. This study indicates students' denial of some assessment methods such as portfolios, questionnaires, rating scales, check list as they asserted not being aware of them, but they went on, in getting average of fairly appropriate from their collective rating scores.

Also, the finding of Chepkwony et al (2023) showed the agreement among students on their soft skills development processes facilitated by their teachers during the classroom instructions. The authors revealed that the manifestation of developing learners' soft skills in classroom occurs by observing/minding the tone when communicating, demonstrating ethics and professionalism of teacher during classroom interaction/instruction. Teachers equally organize learners in teams for discussion/deliberation and group works. From this, learners' skills such as leadership and teamwork were developed. Teams activities which are examined and awarded marks generally help young learners to develop soft skills such as understating that each learner has a role to play despite being in the group.

This study practically plays a greater role in helping students in learning skills needed in different workplaces in real life situation especially for those who might not get to higher institution. Societal factors such as family expectations, societal opinions, traditional gender roles, cultural norms, parental influence, community values, school setting, teacher and school counselor support significantly influences soft skills acquisition among learners in Enugu State, Nigeria. For example, many culture places a strong emphasis on respect for elders and authority which has a strong impact on students' communication and teamwork skills. The study unveiled that the skills are needed by students and could be helpful to the teachers as well. Theoretically, the findings of the study agree with the tenet of connectivism theory (Siemens, 2005) who advocates the usage of different methods in learning of various soft skills in Mathematics classroom. This research has some flaws which should be noted and as such the generalization of the findings should be done with caution since the research made use of only mathematics teachers and students of senior secondary school. Equally, the study sample only 200 participants which may be considered small and may have affected the study. Similarly, this study employed a quantitative measure (questionnaire) in collecting the data, however, the use qualitative measure could address personal opinions concerning soft skills acquisitions. A good review study considering these limitations is a needful area for another research. Specifically, the study suggests further researchers to explore the long-term impact of soft skills acquisition on students' outcomes and career success.

CONCLUSIONS

On the basis of this research findings, it was concluded that skills like commitment to once duty station, being responsible to once career, being adaptable to the work environment, managing resources and being motivated can be taught and examined in Nigerian post primary schools. This can be done while applying methods of instructions such as direct instruction, demonstration, discussion, simulation teaching, self-discovery, use of questioning, interviewing, use of project-based learning, cooperative learning and reflection by the mathematics instructors. In the same way the mathematics instructors should employ objective tests, essay tests, practical tests, use of checklists, use of questionnaires, use of rating scales, observations and assignments in examining the learners as it has been proved to enhanced students' acquisitions of soft skills. However, the use of other methods such as rote memorization, lecture method, speed tests, interviews and portfolios were inappropriate and should not be used as students can easily fake their responses in teaching and examining of soft skills in Enugu state post primary schools.

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RECOMMENDATIONS

On the basis of this research findings, recommendations were made as follows:

1. Learners should focus on all instructing and assessment styles that help in enhancing their soft skills as this was found to be of their benefit in real life applications
2. Mathematics teachers should embrace and employ all teaching and assessment methods in the learning of Mathematics as found in this research work in order to develop the soft skills acquisition among students
3. Curriculum planner and examination bodies should in cooperate soft skills as a separate subject to be taught and examined in secondary school.

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