PROGNOSTICATING SCIENTIFIC LITERACY OF PRESERVICE BIOLOGY TEACHERS: INFLUENCE OF LEARNING APPROACH AND MENTAL ABILITY

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Abstract
The study assessed how learning approaches used by the teachers and their mental abilities could impact developing scientific literacy with a focus on Biology. The study adopted correlational survey design. The population comprised all preservice Biology Teachers in Osun state. The researcher selected One hundred and fifty preservice teachers for the study using a simple random sampling technique. Three instruments called ASSIST approaches, Scientific literacy test(SLT), and Mental Ability Test with reliability coefficient of 0.76 for ASSIST using Cronbach Alpha, 0.72 for SLT using Kuder Richardson21 and 0.82 for MAT using Kuder Richardson 21 were used to collect data for the study. The study showed a low level of mental ability and scientific literacy of respondents (x = 6.24 from a maximum obtainable score of 24). The Deep Learning approach was predominated among the respondents, as shown by 60%. The deep learning approach and mental ability are the strongest predictors of scientific literacy. It then becomes essential preservice teachers employ deep learning approaches and improve mental abilities to enhance their scientific literacy. Educators should emphasize adopting a constructivist learning approach to the learner to improve the scientific literacy of preservice teachers.

Keywords: Scientific Literacy, Mental ability, Learning Approaches, Preservice teachers, Biology

Introduction

Education is a powerful instrument used by society to shape the future and mould the next generation. Education is critical in the development of an individual's life and career. Education as a discipline is germane and highly indispensable to human life both socially and personally as we cannot neglect its importance at any cost. Education is the only means to acquire knowledge, skills, and the right attitude for the all-around development and functional living of individuals. However, the dynamic nature of society demands that education and the educational system move with the trends and changes in the organization to solve pressing challenges in the community. Consequently, the knowledge of science and technology is required to keep abreast with the current needs and provide practical solutions to them as they occur.

Science education refers to applying educational theories to bring out knowledge which leads to the development of the cognitive, affective, and psychomotor domains via systematic procedures involving careful observation, deduction, and testing by empirical means serving as a viable tool for national advancements (Buseri 1995). This is because the application of scientific knowledge will enable its beneficiaries to solve emerging problems created by man's day-to-day activities. With science education, persons not traditionally considered members of the scientific community can share science material and processes. Nigerian science education focuses on teaching scientific principles, teaching methods, and dispelling misunderstandings students have about science concepts. According to Turiman (2012), science education is critical for any nation's growth. Every country should take it extremely seriously in all educational

institutions, as many developed nations have achieved so much in science and technology as a result of science education.

In Nigeria, Science education is taught at higher institution levels as Biology education, Chemistry education, Physics education, Mathematics education, among many others. Students learn various scientific concepts and skills required to function productively in society via effective teaching and learning of science concepts. Science education is the process whereby learners are equipped with knowledge and skills that ensure effective dissemination and inculcation of scientific ideas, culture, and thinking operations and activities through generally accepted pedagogical strategies based on learning and educational theories. Therefore, science education is more than the presentation or acquisition of scientific facts and skills. It embraces the development of new ways of thinking, reacting, and behaving. According to Okafor (2004, in the pedagogical literature, the primary purpose of science education is to promote scientific and technological literacy to help individuals. This will empower learners with the ability to use scientific knowledge creatively through familiarization with scientific processes that are used in making decisions and problem-solving. Science education will also enable individuals to understand scientific issues and utilize this knowledge to make both human and environmentally related decisions

Various science subjects are taught in secondary schools to enable learners to contribute to multiple parts of a scientifically developing society. This contribution to the scientific society is dependent on their level of literacy in the subject. Biology is one of the basic science subjects that teachers are trained to teach in senior secondary schools. Biology is a subject that provides scientific literacy required for national growth and development specific for life-related (plant and animal) issues. Ezeh (2006) attested that the levels to which a nation will develop depending on the level of scientific literacy of the citizens. Hence, for Biology, the level of life-related developments will rely on literacy in Biology. Biology explains body anatomy and physiology, health issues, understanding microorganisms around us, the effects of the microbes, how to control them. The importance of the Biology curriculum, as stated in the syllabus, is to help students with the knowledge of biological concepts, to promote their knowledge of the world around them, to develop broadly applicable skills such as problem solving, communication, critical thinking and objective reasoning ability to prepare students for work and self-sustainability in the global economy (Federal Ministry of Education (FME), 2004). This demonstrates that for Biology teaching and learning to be effective, the psychological construct of the learners towards becoming scientifically literate must be stressed. Scientific literacy is getting popularized daily due to global growth and development in science and technology(Vitric, 2022). Scientific literacy is a way of thinking and knowing nature and the physical World. According to Turiman et al. (2012), learners need to be equipped with 21st-century skills to overcome challenges in science and technology.

Scientific literacy provides understandable answers to so many questions that could be left unanswered through the knowledge acquired from non-science fields and traditional experiences. Scientific literacy could be assessed from the perspectives of content, context, method, and attitude(Vitric, 2022). Every person must base their decisions on scientific information to solve everyday difficulties and develop a sound scientific output whose origins can be traced back to scientific literacy. Scientific literacy, according to Dani (2009), includes knowledge and understanding of scientific concepts and scientific processes that are necessary for decision-making, cultural productivity, and economic productivity. Thus, everyone should have a basic understanding of scientific literacy, which includes scientific knowledge and the ability to conduct science.

Ruslowati, Nugroho, Susilowati, Mustika, Harfiyani & Prabowo (2018) explained that scientific literacy refers to knowledge and comprehension of concepts and science processes which is needed for decision making, social participation and culture and economic productivity. It would also include values related

to intellectual, attitudinal, societal as well as Inter disciplinary. (Holbrook and Rannikmae, 2009). Scientific literacy is believed to be divided into components which include body of knowledge, Way of knowledge, Way of thinking, interaction among science, technology, and society. (Ruslowati, et. al. 2018; Ogunmade, 2006; Turiman et. al. 2011). Another categorisation of scientific literacy is in terms of Nominal literacy, functional literacy, conceptual and multidimensional literacy. Nominal literacy will deal with recognition of concepts as related to science with misconceptions which would relate to body of knowledge, the functional literacy will deal with the ability to describe concepts but with limited understanding which would relate to the Way of knowledge, while conceptual literacy will involve developing adequate understanding of the major concepts and schemes of a discipline. Also, the relationship between concepts and schemes and general understanding of science explains the Way of thinking, the Multidimensional aspect of literacy would incorporate an understanding of science that goes beyond the concepts of scientific disciplines and procedures and steps of scientific investigation which will relate to interaction among science, technology, and society. It includes philosophical, historical, and social dimensions of science and technology. Students are able to relate what is learnt to their daily lives (Shwartz, Ben-Zyi and Hofstein, Holbrook & Rannikmae, 2008). The secondary school Biology seeks to prepare students to develop skills, attitude and reasoning abilities through effective teaching and learning. This would require that students are of adequate mental ability as this will be essential in learning and the end results of this learning is to develop the scientific literacy of the students. As such there is a demand that the approach used in learning is also appropriate for the students. Biology, like any science seeks to educate students to be scientifically literate by learning meaningfully so that they can apply what is learnt to their day to day living. Scientific literacy involves scientific inquiry and self-discovery with its application in the local context of an individual.

Talking about every individual, one pivotal component of learning and acquisition of scientific possessions is individual differences. Learners under the same learning conditions and environment do not basically perform the same way or produce similar learning outcomes. This shows that learning goes beyond the input of the teacher or instructor to factors associated with the learners. So, in expositing on developing learners' scientific literacy, building and teaching scientific literacy will not only be important but factors related to the learners themselves. Important aspects of these differences are mental ability and learning approaches of individual learners. Studies shows that tests of mental abilities differ in complexity based on thinking abilities and this shows a positive correlation with individual differences. Each individual is perceived to receive process and interpret information in er own unique Way; though these ways are always streamlined to few basic components. Faremi and Kehinde (2017) defined mental ability as human intelligence or individual ability to individually and intrinsically solve problems in a constructive manner. Mental ability is seen as individual cognitive abilities and how they are able to navigate different environmental challenges. These abilities are believed to be measured by conducting cognitive ability tests.

Mental ability is a reflection of an individual's cultural setting. Stern (1914) opined that mental ability is the general capacity of an individual to consciously adjust his thinking to new requirements. It is the general mental adaptability to new problems and conditions of life. This implies that the level, Way and manner in which an individual reasons or thinks is largely influenced by the experiences learnt from the community. In other words, different patterns of ability are learned in different cultural environment. The study of students' mental ability from different cultures revealed a significant difference among them. By implication students' cultural backgrounds influence their level of mental ability. As such, since scientific literacy could be unique to each environment or socio-cultural settings, it could be suggested that there could be correlation between mental ability and scientific literacy. Moreover, mental ability is also described as a person's capacity to acquire and recall information, recognize ideas and to relate the information to

their individual behavior when the need arises (Adesina, 2014). An individual's mental ability reveals how creative a person is, depends on how well he/ she can think and apply scientific concepts or skills learnt in new situation to bring about something novel. It has been observed from literature that mental ability has varying effect on learning outcomes. Akinlana (2013) submitted that mental capacity is the best predictive factor of students' academic performance when equated to educational academic optimism and motivation. This was also corroborated by Blessing (2014) who reported an impact of mental ability on academic achievement. Although this study seeks to see the impact and importance of mental ability beyond predicting academic performance but towards scientific literacy as authors seeks to argue that scientific outcomes should not be towards measuring academic performance in science but towards scientific literacy.

Faremi and Akinwarere (2017) explained that Wechsler came up with an Adult revised scale to measure individual mental ability. The instrument divided the mental ability of individuals into eleven subsets which consists of information, digit span, vocabulary, arithmetic, comprehension, similarities, picture completion, picture arrangement, block design, object assembly and digit symbol. Faremi and Akinwarere's study established that the mental ability of Junior secondary school students affected their academic performance. Bolaji, Ayanwole, Adesina, Oyeniran, Wahab (2016) pointed out in Onabanjo (2017) that mental ability is related to mental perception, ability to think in abstract terms, recognize, relate and align information to produce meaningful results. These abilities are believed to also impact on academic achievements. (Aremu &Tella, 2009, Sangodoin, 2011). Asides academic performance, research studies (Tracy, Sturman, Shao& Tews; 2010; Hunter & Hunter, 1984) also emphasized how general mental ability assist in the job performance of people in various occupational groups. These abilities could be inherent and could also be either learnt or acquired, in built and could easily be influenced by cultural background. These abilities according to Tracy et. al (2010) are essential pre requisite for learning which means that learning and acquisition of skills would not be meaningful or probably impossible without the adequate level of mental ability. Teachers could be pivotal in acquiring these skills. There is always an unconscious bias on the part of the teachers as teachers mostly teach based on how they learn personally. Students then have the potential to learn better when there is a synergy between the teaching and the learning approach. The approach individuals employ to learn could accentuate their skill performance and knowledge application.

Since there has been a paradigm change in education recently towards producing graduates who are talented and educated, educators are looking for methods that would enable meaningful learning towards people who have been given the mental preparation to address problems in real life. Since it is now obvious that memorization of concepts cannot sustain meaningful learning, attention has been focused on how learning strategies affect knowledge acquisition in relation to scientific literacy. Rigid memorization will produce a surface-level approach to learning and separate the knowledge from its application. This has an impact on scientific literacy. Marton and Säljö (1976) developed the concept of approach to learning. This then generated Students' Approaches to Learning (SAL) theory. Learning approaches deals with the mindset students have when they learn and how these mindset affects the production of learning outcomes. Three different approaches to learning have been validated by researches and these include; surface learners who learn by rote memorization and this is important for academic success, the other is the deep learners who goes beyond reproduction of course materials to understanding the purpose, meaning and significance of concepts and the strategic learners who focuses on achievements of certain requirement(Deiserito et. Al.,2022). Learning approaches affect the learners' motive to maximize performance and gain personal understanding using their individual organized style of study and effective study time management (Hasnor, Ahmad & Nordin, 2012, Gordon & Debus, 2002). Different findings by Hasnor et.al. (2017) showed that learning approaches could affect quantitative academic achievements but not qualitative achievements

and also not in the local use of content of what is learnt. A very good demonstration of the local use of content and qualitative achievement is the scientific literacy of learners. It then becomes important to assess how learning approaches affect scientific literacy. Oyetoro et. al. (2018) explained that there are limited studies on learning approaches adopted by secondary school students' *vis-a-vis* specific subjects where dwindling performance has been recognized. It then becomes imperative to have more researches focusing on learning approaches but as well focus should transcend academic performance to measurable, quantitative learning outcomes like scientific literacy. Works by Hazel, Prosser, and Trigwell (1996) cited in Gijbels et al. (2005), showed the correlation between students' learning approaches and academic achievement. The study showed that there was a relationship between low outcome measures, low scores on deep approaches and high scores on surface approaches in the first cluster. In contrast, the second cluster showed high outcome scores related to low surface approach scores and high deep approach scores. Bolaji, Ayanwole, Adesina, Oyeniran, Wahab (2016) explained that teacher's ability are important factors in influencing how students learn as teachers can only give what they have. Learning approaches and intelligence which is associated with mental abilities have a strong bearing on the academic achievements of students. (Canon, 2007). However, learning in present day does not emphasize performance but skill acquisition and practical application of knowledge. This makes the study and inquiry into scientific literacy important. It is important for preservice teachers to be influential factors in helping to build the scientific literacy of students. Their own learning approaches and mental abilities will have a significant hold on their student's abilities and literacy. It then becomes germane to assess and if possible, remediate the development and understanding of scientific literacy vis a vis the mental abilities and learning approaches of teachers in teacher training institutions in Nigeria.

Scientific literacy should be the hallmark of scientific teaching and learning. It allows for student to be able to apply what is learnt to their day-to-day activities and their workplace. The measure of scientific learning and activities is measured via how well students can perform on some measures of literacy as against academic achievements. Most literature have focused on learning outcomes in terms of performance as little has focused on scientific literacy. Individual factors are seen as factors that also affect learning the most. Mental ability and learning approaches are constructs that could impact on individual difference and learning and this could also have effect on learning outcome as scientific literacy is a vital component. It is important to assess how these factors that promote learning affect scientific literacy. Hence, this study.

Research Objectives

i Determine the level of scientific literacy of pre service Biology in southwestern Nigerian Universities

ii Assess the level of mental ability and learning approaches of pre service Biology teachers in Southwestern Nigerian Universities

iii Examine the influence of mental ability and learning approaches on scientific literacy of pre service teachers in southwestern Nigerian universities

Research Questions

i What is the level of scientific literacy of pre service Biology teachers in Southwestern Nigerian Universities?

ii What is the level of students learning approaches and mental ability of pre service Biology teachers in Southwestern Nigerian Universities

Research Hypothesis

There is no significant influence of mental ability and learning approaches on scientific literacy of pre service teachers in Southwestern Nigeria universities?

Methodology

The study adopts survey research design. The population comprised of all Pre service Biology teachers in Southwestern Nigerian Universities. The sample comprised of three Universities in three states in Southwestern Nigerian Universities. Fifty Pre service Biology teachers were selected from each of the three selected

Universities making a total of 150 pre service Biology teachers. Three instruments were used for the study. These include Preset Learning Approach Inventory adapted from Entwistle et al.'s (2000). ASSIST research instrument is also known as *Approaches and Study Skills Inventory for Students* and it was used to elicit information on Learning approaches of respondents. It consists of a five-point Likert scale of "*means agree", "agree somewhat", "unsure", "disagree somewhat", "disagree"*. Measuring 5, 4, 3, 2, and 1 respectively. It consists of 18 items with 6 items in each of the sections measuring deep, surface and strategic learning approaches. Cronbach Alpha values of 0.73. 0.84 and 0.64 were obtained for the deep approach, surface approach and strategic learning approaches respectively. PreSet Mental Ability Test (PMAT) adapted from National Talent Search & National Means-Cum Merit Scholarship Examination elicited information on mental ability of respondents. Students Mental Ability Test (SMAT) was adapted from OTIS-LENON (1967) which was used by Aina (2006). It contains 30 items multiple choice with 4 options, one correct option (stem) and three distracters for each item. The difficulty and discriminatory indices for the items that respectively ranged between 40%-60% and 25%-75% were retained. The Kuder-Richardson 20 coefficient yielded 0.78 as a test of internal consistency. Scientific literacy Test adapted from the framework of scientific assessment of PISA (2009) and Utah State University Scientific Literacy Test assessed scientific literacy of the respondents. Twenty-four items were adapted for the study Three items were adapted under the "*body of knowledge"*, nine items from "*way of knowledge"*, seven items were adapted for "*way of thinking*" and five items under the "*interaction of body of knowledge*". Data was be analyzed using descriptive statistics of frequency and percentages, mean and standard deviation and inferential statistics of discriminate functional analysis.

Results

Research Question One: What is the level of scientific literacy of pre service Biology teachers in Southwestern Nigerian Universities?

The test responses from the instruments were marked and scored 1 for right responses and 0 was scored for the wrong responses. Then, the total score for each segment of knowledge was determined and the subsequent analysis were presented in Table 1 below.

Table 1: Scientific Literacy of Pre Service Biology Teachers in Southwestern Nigeria

SL Component	Max. Score	Min.	Max.	Mean	Stand. Dev.	Adjusted Mean	Skewness	Kurtosis
BK	3	0.0	2.0	0.78	0.6	6.24	0.56	0.31
WK	9	0.0	4.0	2.03	1.2	5.41	-0.14	-1.01
WT	7	0.0	4.0	2.24	1.3	7.68	0.35	-1.10
IBK	5	0.0	4.0	1.40	1.3	6.72	0.49	-0.68
TSL	24	0.0	15.0	6.46	3.24		0.20	0.71

*BK- Body of Knowledge, WK-Way of Knowledge, WT-Way of Thinking, IBK-Interaction with Body of Knowledge, TSL- Total Scientific Creativity

$$\text{Adjusted Mean} = \frac{\text{(mean of classified SL x (Total max. Score obtainable from TSL)}}{\text{Max. Score obtainable in items of classified TSL}}$$

From Table 1, it was observed that the body of knowledge component had a mean score of 0.78 from a total possible score of 3, Way of knowledge had a mean score of 2.03 from a total possible score of 9, Way of thinking component had a mean score of 2.24 from a total possible score of 2.24 while the interaction between body of knowledge has a mean score of 1.40 from a total possible score of 5. The mean score lower than the mid-point score across all components of scientific literacy shows a low level of scientific literacy among the preservice Biology teachers in the study area.

Research Question Two: *What are students' learning approaches and mental ability of pre service Biology teachers in Southwestern Nigerian Universities?*
The mean and adjusted mean scores were used to analyse the learning approaches and mental ability of respondents in the study area. The components items on the ASSIST learning approaches inventory were categorized into deep, surface and strategic learning approaches. The mental ability which was also assessed via MAT and the result is presented in Table 2.

Table 2: Learning Approaches and Mental Ability of Pre-Service Biology Teachers

SL Component	Max. Score	Min.	Max.	Mean	Stand. Dev.	Rank	Skewness	Kurtosis
Mental Ability	30	0.0	17.0	8.41	3.32		0.20	0.71
Deep Learner	30	9.0	29.0	24.62	3.69	2	-0.96	1.67
Surface Learner	30	9.0	30.0	23.90	4.40	3	-.082	0.21
Strategic Learner	30	9.0	30.0	21.46	4.29	1	-1.01	0.94

The result showed a mean score for mental ability as 8.41. this mean score shows a low level of mental ability among respondents in the study area. It was also seen that the mean score for deep learners, surface and strategic learners was seen to be 24.62, 23.90 and 21.46 respectively. This shows that students use the deep approach more than the surface and strategic approaches. The respondents were further classified into groups based on dominance using Cluster analysis and the result is presented in Table 2b below.

Table 2b: Classification of Learning Approach

	Frequency	Mean
Deep Approach	90	60.0
Surface Approach	56	37.5
Strategic Approach	4	2.6

Table 2b showed that 60% of the preservice teachers utilize deep learning approach while 37.4% utilize surface approach as 2.6% of the respondents utilize a strategic approach. This shows that the deep approach was the predominant approach adopted by respondents in the study area.

Research Hypothesis
There is no significant influence of mental ability and learning approaches on the scientific literacy of pre-service teachers in Southwestern Nigeria universities?
To analyse the research hypothesis, discriminant function analysis was used to analyse the data on each of the variables (dependent= scientific literacy, independent = mental ability and learning approaches). The results are as presented in Table 3 below

Table 3: Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
DEEP LEARNERS	.994	.479	2	147	.620
SURFACE	.988	.908	2	147	.406
STRATEGIC	.888	9.277	2	147	.000
Mental Ability Test	.883	9.770	2	147	.000

The table above depicts that Surface learning ($F=9.277$, $p<0.05$) and Mental Ability ($F=9.770$, $p<0.05$) significantly differ from the learning abilities of respondents in the study area.

Table 4: Eigen value of discriminant function
Eigenvalues

Function	Eigenvalues	% of Variance	Cumulative %	Canonical Correlation
1	.252[a]	.252[a]	70.0	.449
2	.108[a]	.108[a]	100.0	.312

a. First 2 canonical discriminant functions were used in the analysis.

Table 4 depicts the Eigen value of 0.252. This indicates that the proportion of variance explained by the discriminant function analysis is small. The implication of this is that the function presented by the analysis is a weak one. This is also corroborated by the canonical correlation coefficients of 0.449 which is positive and weak. The combination of the factors (learning approaches and mental ability) presented by the discriminant function equation is 0.202 (about 20.2%, obtained by calculating the square of 0.449). This suggest that the model explains 20.2% of variations in the grouping variable, that is, scientific literacy.

Table 5: Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	.721	47.616	8	.000
2	.903	14.910	3	.002

Wilks' Lambda value as revealed by Table 5 is 0.721. This is the proportion of the total variance in the discriminant scores not explained by the differences among groups. This value is significant at 0.05 level of significance (p = 0.000). This function presented maximises the predictor variables of learning approaches and mental ability in the prediction of Scientific literacy. The standardised canonical discriminant function coefficients and structure matrix are presented in Table 6

Table 6: Standardized Canonical Discriminant Function Coefficients

	Function 1	2
DEEP LEARNERS	-.977	-.822
STRATEGIC	.591	.506
SURFACE	.056	1.115
Mental_Ability_Test	.950	.326

From Table 6, the standardized discriminant coefficient revealed the values of - 0.822, 0.51, 1.12 and 0.326 for deep approach, strategic approach, surface approach and Mental Ability respectively for the first discriminant score and -0.977 for deep approach learners, 0.591, -0.056, 0.950 for strategic approach, surface approach and mental ability respectively. The function that can be derived from the Table 6 and which can be used to calculate a score for each subject for the discriminant function is:

(1) DDA Score = 0.950 Mental ability -0.977 Deep Approaches+0.591 Strategic approaches-0.056 Surface approaches+ Descriptive Discriminant Scores

(2) DDA Score= 0.33 Mental ability-0.822 Deep approach+0.51 Strategic approach+1.12 Surface approach + Descriptive Discriminant Score.

The function could be interpreted that for every 1 standard deviation increase in mental ability scores their DDA score is predicted to increase by 0.95 if all other variables are held constant. The function reveals that for every one standard deviation increase in deep approach scores students' DDA score is predicted to decrease by 0.977 if all other variables are held constant. For every 1 standard deviation increase in Strategic approach scores DDA scores is predicted to

increase by 0.591 assuming also that all other variables are held constant while for every 1 standard deviation increase in surface approach scores, students' DDA score is predicted to decrease by 0.056. More substantively, because the discriminant function maximises the differences between the scientific literacy of the preservice teachers, it can be seen that mental ability contribute positively to group differences and also show more between-group variation. This is supported by the discriminant structure coefficients. The structure coefficient also suggested that the use of deep and surface approaches is inimical to students' scientific literacy as it takes away from the discriminant function rather than add to it. However, deep learning approach and mental ability are the strongest predictors of scientific literacy.

Table 7: Classification of Groups

Classified Group	Predicted Group membership			
	Low	Average	High	Total
Low	72	34	4	110
Average	10	24	4	38
High	0	0	2	2
Low	65.5%	30.9%	3.6%	100.0
Average	26.3%	63.2%	10.5%	100.0
High	0.0%	0.0%	100.0%	100.0

The table shows that 65.5% of the respondents who had low scientific literacy are correctly classified while 63.2% of the respondents who had average scientific literacy are correctly classified as all the respondents with a high level of scientific literacy are correctly classified.

Discussion And Conclusion

The study showed that building the teaching and learning of science around conceptual understanding of learners and focusing on improvement of scientific literacy. Teaching of science should correspond towards the achievement of scientific literacy in learners as against building understanding towards performance and achievement. Science cannot be taught with the aim of scientific achievement but towards understanding the nature of science to foster scientific literacy skills of learners. The Underlying factor for teaching science should be focused on achieving scientific literacy by the learners. It is impossible for teachers to teach and inculcate that which they do not understand, it is important that the aspects of teaching teachers to be teachers of science, the primary goal of science teacher education should inculcate with pedagogy and conceptual knowledge the teaching of concepts that would develop and improve scientific knowledge towards scientific literacy for everyday life. The study showed a low level of scientific literacy in the study area with "way of knowledge" being the highest form of scientific literacy and Way of thinking being the lowest form of scientific literacy in the study area. this shows that the component of scientific literacy most utilized have to do with having attributes that portrays understanding of scientific ideas. This could be attributed to the methodology adopted in the classroom as well as a focus on teaching and learning on concepts. The low level of Way of thinking as seen in the study portrays that even though the learners learn concepts and ideas as well as scientific terminologies, their ability to demonstrate understanding and a relationship between concept is low. This could as well impact on the understanding of nature of science. (Lederman (2013)The implication of this on preservice teachers is that they would not effective demonstrate understanding of scientific concepts to their own students. (Fives, Huebner, Birnbaum, & Nicoloch, 2014). Hence, institutions that trains preservice teachers would need to improve on training teachers to teach science from the baseline of explaining, inculcating and improving their scientific literacy so that learners can become science-oriented citizens.

The result showed a low level of mental ability among respondents in the study area. Majority of the learners used the deep approach to learning

and strategic approach to learning was the least utilized. Mental ability and deep approach were observed to be the strongest predictors of scientific literacy. Building science education would be important for learners to communicate and relate effectively in and with the society, Holbrook and Rannikmae (2009) explained that scientific literacy would help to improve understanding by providing science through education and education through science. This implies that the improvement of scientific literacy would improve the all-round development of teachers in terms of conceptual and pedagogical understanding in science. This will also help learners improve their understanding hence improving societal development.

Since deep learning approach and mental ability strongly impact on scientific literacy. Learning science through a cognitive-constructivist approach would then be important towards building scientific literacy. Preservice teachers' ability to think through concepts and ideas would facilitate their learning and scientific literacy. The focus on learning will emphasize an approach that is centered around inquiry-based form of learning for promoting understanding as learners' ability to think through concepts and ideas would help to promote understanding of scientific literacy. Once this is encouraged, preservice teachers would have better scientific literacy and would be able to impact learners constructively. Viera, Florentino de Melo, Avraamidou, Lobata (2017) explained that students' epistemological profiles are important towards reconceptualizing scientific literacy. It was explained that these profiles would allow the learners to construct models and new knowledge based on their understanding. Preservice teachers through their mental ability and learning approaches especially will an encouraged and improved used of deep learning approaches will be able to synthesize concepts and conceptualize abstract terms effectively. The teaching of scientific literacy goes beyond concept knowledge, it stems to societal relevance and personal applications of what is learnt. Practical skills and classroom activities which would directly and indirectly improve learners' mental ability would be important towards building scientific literacy can be encouraged by teachers and instructors of preservice teachers.

The low level of mental ability and scientific literacy seen in preservice teachers could explain the reason for poor performance of students in sciences in the study area a posited by literature. (Tella, 2008). Thus, emphasizing that no performance in science without a concrete improvement in factors that would improve literacy. If science is not put into practice, learners would find it difficult to understand the concepts and would ultimately not perform well in classroom subjects. Classroom should focus on building scientific literacy and science education curriculum could be the *protagonist* instruments towards pushing these improvements. Supporting Learning through the cognitive constructivist approach that encourages adequate and deliberate understanding of subject matter by teachers would facilitate meaningful learning and proper dissemination of relevant knowledge that would aid transfer of ideas and experience to learners via teachers' creativity and ingenuity. (Bolaji, 2016). A better level of scientific literacy would also assist the teachers to better understand and select the appropriate innovative strategies to use in teaching various components of science subjects, (in this case Biology) as the use of innovative strategies, being core to constructivist approach of learning will promote creativity and innovation among learners. This will allow biology students gain skills, abilities and competencies in Biology. It is therefore recommended that the teaching of science should focus on the inculcation of pedagogy and conceptual knowledge that would develop and improve scientific knowledge of learners towards scientific literacy for everyday life. Such pedagogy may include the use of constructivist paradigm which encourages the construction of knowledge by individual learners.

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