

Holistic Literacy by Emphasizing Values Integration across the Science and Mathematics Teaching and Learning

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Abstract: This quantitative-qualitative research study investigated the extent of integration of values in the science and mathematics education in the elementary and secondary level. It also determined what scientific values were mostly prevalent in the science and mathematics classrooms. Four hundred science and mathematics teachers both from elementary and secondary levels, from big and small schools, either from private or public schools were taken as the respondents of the study. A researcher-made questionnaire on values integration on science and mathematics teaching was used to gather the data. Results revealed that most of the science and mathematics teachers highly integrated values in their teaching. However, when they were categorized into certain variables, science teachers highly integrated values as compared to mathematics teachers. Moreover, teachers who were teaching 20 years and below dedicatedly integrated values in the classroom highly than those who were already more than 20 years in the service. The same results can be noted in terms of educational qualification, that those masters and doctorate degree holders highly integrated values than those bachelor's degree holders. When grouped into type of school and school level, all science and mathematics teachers highly integrate values in their teaching. In the interview conducted, the learners were described as digital learners, impatient and most of them were not intellectually honest. The teachers further attested that the learners be given the chance and opportunity to change their attitudes. During the focus-group discussion, the science and mathematics teachers emphasized that the integration of values among learners during the teaching-learning process was much affected by the behavior of the learners. Factors affecting the extent of integration depended largely on the quality of learners being enrolled, and the kind of attitude of learners. In such, it can be construed that the availability of materials in the classroom during the experiment can be a factor in the integration of values for patience and intellectual honesty were intervened. Thus, science and mathematics teachers were challenged to be more resourceful in handling science and mathematics subjects of attaining holistic literacy among learners

Keywords: holistic literacy, values, extent of integration, science and mathematics education

INTRODUCTION

Education can equip learners with agency and a sense of purpose, and the competencies they need, to shape their own lives and contribute to the lives of others. The quality of education that the learners should receive is very much dependent on the quality of teachers in terms of their knowledge, skills and attitudes.

Teachers are committed to helping every learner develop as a whole person, fulfil his or her potential and help shape a shared future built on the well-being of individuals, communities and the planet. Children entering school in 2018 will need to abandon the notion that resources are limitless and are there to be exploited; they will need to value common prosperity, sustainability and well-being. They will need to be responsible and empowered, placing collaboration above division, and sustainability above short-term gain.

In the face of an increasingly volatile, uncertain, complex and ambiguous world, education can make the difference as to whether people embrace

the challenges they are confronted with or whether they are defeated by them. And in an era characterized by a new explosion of scientific knowledge and a growing array of complex societal problems, it is inappropriate that curricula should continue to evolve, perhaps in radical ways.

As the present scenario of the Philippine educational system, science and mathematics education are found at the bottom part of the global assessment. This is alarming on the part of the Science and Mathematics teachers being considered the core subjects in the development of a holistic education (UNESCO, 2021).

In the modern knowledge economy, societies are demanding greater mathematical and scientific literacy and expertise from their citizens than ever before. At the heart of such demands is the need for greater engagement by students with school mathematics and science.

It posits that factors may not only be due to the knowledge and skills but the bigger problem lies on the values integration in the classroom. According to Chin, Leu, and Lin, (2018), the values portrayed by teachers in mathematics classrooms are linked to their pedagogical identities. Seah and Bishop, (2018) describe the values held by teachers as representing their 'cognization' of affective variables such as beliefs and attitudes, and the subsequent internalization of these values into their respective affective-cognitive personal system.

Even in science education the study of values in classrooms is not a major focus of research. Nevertheless, in mathematics and science education values are crucial components of classrooms' affective environments, and thus have a crucial influence on the ways students choose to engage (or not engage) with mathematics and science. Clearly the extent and direction of this influence will depend on the teachers' awareness of, respectively, values ascribed to the particular discipline, the values carried by their selection from the available pedagogical repertoire, and their consciousness or otherwise of imposing their own personal values (Pritchard & Buckland, 2016).

Aiming that learners be trained not only mentally and technically but also emotionally, this research study determined to primarily investigate the actual impact of integrating values in science and mathematics education. Regarding their similarities, both mathematics and science are taken as ways of understanding that are embedded in rational logic - focusing on universal knowledge statements. Both are seen by society in general as essential components of schooling, rivalled only by literacy.

Hence, teachers of each face substantial political and social pressures from outside the school (e.g., system-wide assessments of student performance, purposes for teaching seen as being directly related to technological development, etc.). In their teaching, both involve following routines, although not exclusively. Both involve modelling, albeit with different emphases. Similarly each is incorporated into the other's applications but in an asymmetrical relationship.

Yet mathematics plays a much more prominent role as a gatekeeper in society than does science. For example, it is often used as a selection device for entry to higher education or employment, even when the skills being tested are unrelated to the ultimate purpose.

METHODOLOGY

This quantitative research study investigated the extent of integration of values in the science and mathematics education in the elementary and secondary level. It also determined what scientific values were mostly prevalent in the science and mathematics classrooms. Four hundred science and mathematics teachers both from elementary and secondary levels, from big and small schools, either from private or public schools were taken as the respondents of the study. A researcher-made questionnaire on values integration on science and mathematics teaching was used to gather the data.

This research study sought to answer the following questions:

To what extent are values being integrated in the science and mathematics teaching when respondents are taken as a whole and when grouped according to (a) subject handled, (b) sex, (c) highest educational attainment, (d) school level, (e) years of teaching?

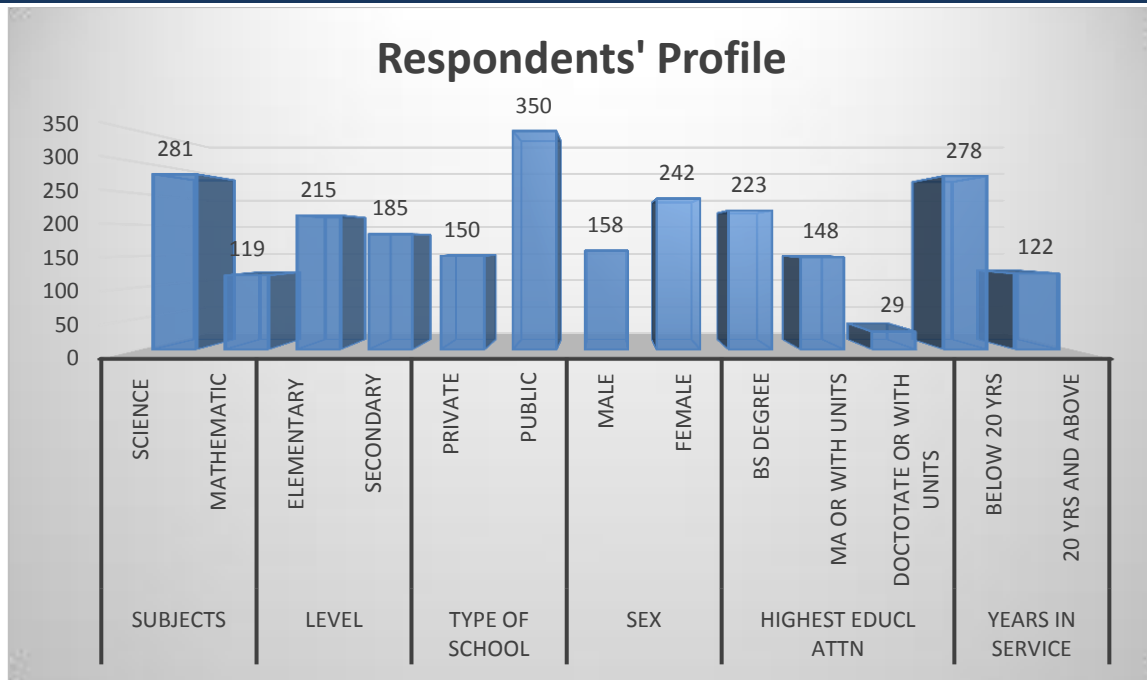
What scientific value/s is/are mostly prevalent in the science and mathematics teaching when respondents are taken as a whole and when grouped according to (a) subject handled, (b) sex, (c) highest educational attainment, (d) school level, (e) years of teaching?

How is holistic literacy being considered in the science and mathematics teaching? What can be done to improve science and mathematics education?

RESULTS

Profile of the Respondents

The 400 Science and Mathematics teachers as respondents of the study were further categorized into certain variables such as sex, school level, highest educational attainment, subjects handled, years of service and type of school.



Graph 1: presents the data

Extent of Integration of Values in the Science and Mathematics Teaching

Using the mean, the science and mathematics teachers had integrated the following values in science and mathematics teaching. As shown, in general the science and mathematics teachers,

Graph 2 presents the results.

mostly think up new ideas and creatively develop strategies towards their delivery of instruction. The least values being integrated in the science and mathematics teaching was the emphasis on the care of nature.



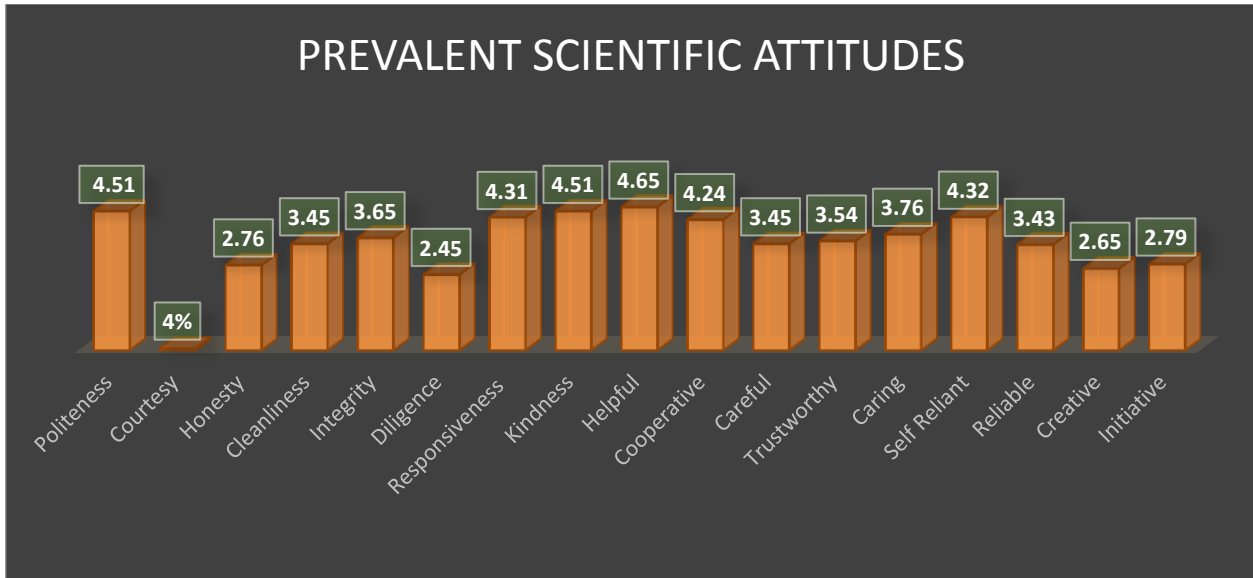
Graph 2: Extent of Values Integration in the Science and Mathematics Teaching

Prevalent Scientific Attitudes

In the science and mathematics teaching, the scientific attitude most prevalent was being

“helpful” and the least prevalent scientific attitude was courtesy.

Graph 3 presents the results.



Graph 3: Prevalent Scientific Attitudes in the Science and Mathematics Teaching

Extent of Values Integration in the Science and Mathematics Teaching when the Respondents were grouped into Certain Variables

As shown both, males and females science and mathematics teachers, highly integrated values in their teaching with a mean of 4.33 and 4.26

respectively. However, it can be noted, males integrate values more in the classroom as compared to the female teachers.

Table 1 presents the results.

According to Sex

Table 1: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Sex

Values	Male	Female
I am thinking up new ideas and being creative	3.56	4.25
I believe that every person in the world should be treated equally	4.32	4.21
It is important for me to show my abilities. I want other people to admire what I do	3.89	4.67
It is important for me to live in a safe and secure surrounding	4.51	4.78
I love surprises and always want to try something new.	4.21	4.12
I believe that I should obey rules even when no one is around	3.98	4.32
It is important for me to stay humble and	4.12	3.98
I believe in listening to people who are different from me and try to understand them	4.98	4.32
Having a good time is important to me. I like to ‘spoil’ myself at times.	4.98	4.32
I prefer to make my own decisions and do what feels right to me.	4.12	4.33
I like helping people around me.	3.33	4.56
Being successful is important to me	4.15	3.12
It is important for me to ensure that the government is taking care of my safety concerns.	4.32	3.56
I want to take up new adventures and want to live an exciting life.	4.65	4.78
It is important for me to behave properly at all times and not do anything that people consider wrong.	4.9	4.65
It is important for me to earn respect from others.	4.32	4.35
Being loyal to my friends is a priority in my life.	4.12	3.98
I try to follow my traditional values and customs that my family and society have endowed on me.	4.98	4.32
I strongly believe that we should care about nature	4.98	4.32
It is important for me to do things that give me pleasure	4.12	4.33
Average	4.33	4.26

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

According to Highest Educational Attainment

In terms of educational qualification, teachers with Bachelor's Degree integrated values in their teaching (M =4.16), Master's degree holders or those with MA units and Doctorate Degree holders

or with units, highly integrated values in their teachings (M = 4.22 and M =4.28 respectively).

Table 2 presents the results.

Table 2: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Educational Qualification

Values	BS	MA/Units	Doc/Units
I am thinking up new ideas and being creative	3.67	4.8	3.78
I believe that every person in the world should be treated equally	4.33	4.12	3.98
It is important for me to show my abilities. I want other people to admire what I do	4.87	4.98	4.32
It is important for me to live in a safe and secure surrounding	4.65	4.12	4.33
I love surprises and always want to try something new.	3.78	3.33	4.56
I believe that I should obey rules even when no one is around	3.89	3.87	4.15
It is important for me to stay humble and	4.1	4.11	4.98
I believe in listening to people who are different from me and try to understand them	4.12	3.98	4.12
Having a good time is important to me. I like to 'spoil' myself at times.	4.12	3.98	3.33
I prefer to make my own decisions and do what feels right to me.	4.12	4.1	4.15
I like helping people around me.	4.68	4.87	4.32
Being successful is important to me	3.87	4.13	4.65
It is important for me to ensure that the government is taking care of my safety concerns.	3.67	3.87	4.9
I want to take up new adventures and want to live an exciting life.	4.9	4.32	4.32
It is important for me to behave properly at all times and not do anything that people consider wrong.	3.4	4.9	4.12
It is important for me to earn respect from others.	4.65	4.67	4.98
Being loyal to my friends is a priority in my life.	4.1	4.11	4.98
I try to follow my traditional values and customs that my family and society have endowed on me.	4.12	3.98	4.12
I strongly believe that we should care about nature	4.12	3.98	3.33
It is important for me to do things that give me pleasure	4.12	4.1	4.15
Average	4.16	4.22	4.28

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

According to Type of School

The science and mathematics teachers both in the private and public schools integrated values in

their teaching with a mean of 4.16 and 4.19 respectively.

Table 3 presents the data.

Table 3: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Type of School

Values	Private	Public
I am thinking up new ideas and being creative	4.56	4.21
I believe that every person in the world should be treated equally	4.1	4.11
It is important for me to show my abilities. I want other people to admire what I do	4.12	3.98
It is important for me to live in a safe and secure surrounding	4.12	4.1
I love surprises and always want to try something new.	4.68	4.87
I believe that I should obey rules even when no one is around	3.33	4.56
It is important for me to stay humble and	4.32	4.12
I believe in listening to people who are different from me and try to understand them	4.33	4.12

Having a good time is important to me. I like to 'spoil' myself at times.	4.56	4.68
I prefer to make my own decisions and do what feels right to me.	3.12	3.87
I like helping people around me.	3.56	3.67
Being successful is important to me	4.78	4.9
It is important for me to ensure that the government is taking care of my safety concerns.	4.65	4.01
I want to take up new adventures and want to live an exciting life.	4.35	4.65
It is important for me to behave properly at all times and not do anything that people consider wrong.	3.98	4.1
It is important for me to earn respect from others.	4.32	4.12
Being loyal to my friends is a priority in my life.	4.32	3.89
I try to follow my traditional values and customs that my family and society have endowed on me.	4.33	4.12
I strongly believe that we should care about nature	4.56	3.9
It is important for me to do things that give me pleasure	3.12	3.87
Average	4.16	4.19

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

According to Level

Both science and mathematics teachers highly integrated values in their teachings with a mean of 4.32 and 4.30 respectively.

Table 4 presents the data.

Table 4: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Level

Values	Elementary	Secondary
I am thinking up new ideas and being creative	3.87	4.15
I believe that every person in the world should be treated equally	4.87	4.32
It is important for me to show my abilities. I want other people to admire what I do	3.45	4.65
It is important for me to live in a safe and secure surrounding	4.45	4.9
I love surprises and always want to try something new.	4.89	4.32
I believe that I should obey rules even when no one is around	4.68	4.12
It is important for me to stay humble and	3.98	4.98
I believe in listening to people who are different from me and try to understand them	4.1	4.98
Having a good time is important to me. I like to 'spoil' myself at times.	4.87	4.12
I prefer to make my own decisions and do what feels right to me.	4.13	3.33
I like helping people around me.	3.87	4.15
Being successful is important to me	4.32	4.32
It is important for me to ensure that the government is taking care of my safety concerns.	4.9	4.65
I want to take up new adventures and want to live an exciting life.	4.67	4.9
It is important for me to behave properly at all times and not do anything that people consider wrong.	4.11	4.33
It is important for me to earn respect from others.	3.98	4.56
Being loyal to my friends is a priority in my life.	3.98	3.12
I try to follow my traditional values and customs that my family and society have endowed on me.	4.1	4.33
I strongly believe that we should care about nature	4.32	4.56
It is important for me to do things that give me pleasure	4.9	3.12
Average	4.32	4.30

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

According to Subjects Handled

Mathematics teachers moderately integrated values in their teaching (M=3.36) while the Science teachers highly integrated values in their teaching.

Table 5: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Subject Handled

Values	Math	Sci
I am thinking up new ideas and being creative	3.12	3.87
I believe that every person in the world should be treated equally	3.56	3.67
It is important for me to show my abilities. I want other people to admire what I do	3.12	4.9
It is important for me to live in a safe and secure surrounding	3.12	4.98
I love surprises and always want to try something new.	3.21	4.65
I believe that I should obey rules even when no one is around	3.98	4.1
It is important for me to stay humble and	3.4	4.12
I believe in listening to people who are different from me and try to understand them	3.8	4.12
Having a good time is important to me. I like to 'spoil' myself at times.	3.5	4.12
I prefer to make my own decisions and do what feels right to me.	3.21	4.68
I like helping people around me.	3.12	3.87
Being successful is important to me	3.56	3.67
It is important for me to ensure that the government is taking care of my safety concerns.	3.4	4.9
I want to take up new adventures and want to live an exciting life.	3.19	4.98
It is important for me to behave properly at all times and not do anything that people consider wrong.	2.33	4.1
It is important for me to earn respect from others.	3.45	4.87
Being loyal to my friends is a priority in my life.	3.87	4.13
I try to follow my traditional values and customs that my family and society have endowed on me.	3.21	4.1
I strongly believe that we should care about nature	3.21	4.87
It is important for me to do things that give me pleasure	3.87	4.13
Average	3.36	4.34

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

According to Years in Service

Teachers who were in the field for 20 years and below, highly integrated values in their science and mathematics teaching (M=4.30) while those who were almost more than 20 years in service,

moderately integrated values in their teaching (M=12).

Table 6 presents the data.

Table 6: Extent of Integration of Values of Science and Mathematics Teachers when Grouped into Years in Service

Values	20 & below	Above 20yrs
I am thinking up new ideas and being creative	4.13	4.12
I believe that every person in the world should be treated equally	3.87	3.78
It is important for me to show my abilities. I want other people to admire what I do	4.32	3.56
It is important for me to live in a safe and secure surrounding	4.9	4.21
I love surprises and always want to try something new.	4.67	4.89
I believe that I should obey rules even when no one is around	4.11	3.89
It is important for me to stay humble and	3.98	3.12
I believe in listening to people who are different from me and try to understand them	3.98	3.56
Having a good time is important to me. I like to 'spoil' myself at times.	4.1	4.5

I prefer to make my own decisions and do what feels right to me.	4.87	4.65
I like helping people around me.	4.13	4.35
Being successful is important to me	3.87	4.12
It is important for me to ensure that the government is taking care of my safety concerns.	4.32	4.12
I want to take up new adventures and want to live an exciting life.	4.9	3.65
It is important for me to behave properly at all times and not do anything that people consider wrong.	4.13	3.87
It is important for me to earn respect from others.	3.87	4.87
Being loyal to my friends is a priority in my life.	4.32	4.13
I try to follow my traditional values and customs that my family and society have endowed on me.	4.9	4.1
I strongly believe that we should care about nature	4.68	4.87
It is important for me to do things that give me pleasure	3.87	4.13
Average	4.30	4.12

Scale: 1.00 – 1.80 not integrated at all; 1.81-2.60 less integrated; 2.61-3.40 moderately integrated; 3.41-4.20 integrated; 4.21-5.00 highly integrated

Scientific Values Prevalent in the Science and Mathematics Teaching

Qualitative Analysis

Using Focus Group Discussion (FGD) or in-depth interview, the respondents answered the following:

Question 1: How do you describe the kind of learners in today's generation?

The learners of today were described as digital learners. Some of the respondents described the learners as techi-learners. The science and mathematics teachers described the learners as less patient, feel bored of lecture classes and most of them were considered as kinesthetic learners.

Question No. 2: How can you compare the learners before than the learners in the 21st century?

The learners before are book-dependent learners while the learners of today were described as computer dependent learners, The learners of today preferred using multi-media devices to assist them in their studies. However, the learners before used textbook in their daily school classes.

Question No. 3: Do you think there is a need to integrate values in the class?

Most of the respondents duly answered that, today's learners be given time to realize the importance of values in their lessons as part of the growth of their lives as a professional. Learners of today, as agreed by the respondents were more mentally excellent but they were emotionally a failure. Basic values were left behind for learners were not given the opportunity to show cases the right values expected of them.

Question No. 4: What major problems on values have you encountered in your life as a Science/Math Teacher?

As most of the science and mathematics teachers, said that learners failed to display intellectually honesty and patience. These two values were the most identified values needed by the learners.

Question No. 5: Is it possible to change the values of the learners of today?

Most respondents said that nothing is impossible in terms of change. Every person has the right and capacity to change. Hence, most of the respondents agreed that these learners if given the chance, may be able to change their values with the support of the teachers and parents.

Analysis

Based on the above results, most of the science and mathematics teachers highly integrated values in their teaching. However, when they were categorized into certain variables, science teachers highly integrated values as compared to mathematics teachers. Moreover, teachers who were teaching 20 years and below dedicatedly integrated values in the classroom highly than those who were already more than 20 years in the service. The same results can be noted in terms of educational qualification, that those masters and doctorate degree holders highly integrated values than those bachelor's degree holders. When grouped into type of school and school level, all science and mathematics teachers highly integrate values in their teaching.

In the interview conducted, the learners were described as digital learners, impatient and most of them were not intellectually honest. The teachers further attested that the learners be given the

chance and opportunity to change their attitudes. During the focus-group discussion, the science and mathematics teachers emphasized that the integration of values among learners during the teaching-learning process was much affected by the behavior of the learners. Factors affecting the extent of integration depended largely on the quality of learners being enrolled, and the kind of attitude of learners. In such, it can be construed that the availability of materials in the classroom during the experiment can be a factor in the integration of values for patience and intellectual honesty were intervened. Thus, science and mathematics teachers were challenged to be more resourceful in handling science and mathematics subjects of attaining holistic literacy among learners.

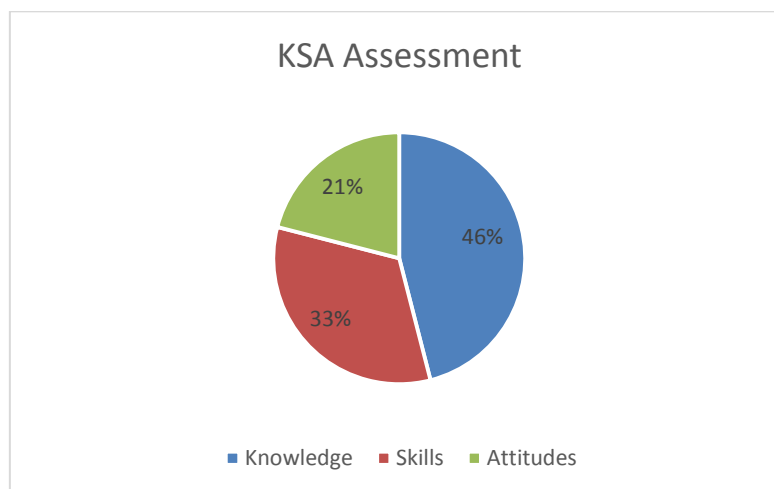
DISCUSSION AND CONCLUSION

Values are an inherent part of the educational process at all levels, from the systemic, institutional macro-level, through the meso-level of curriculum development and management, level of classroom interactions (Le Métails, 2017) where they play a major role in establishing sense of personal and social identity for the student. However the

notion of studying values in mathematics education is a relatively recent phenomenon (Bishop, 2019).

Even in science education the study of values in classrooms is not a major focus of research. Nevertheless, in mathematics and science education values are crucial components of classrooms' affective environments, and thus have a crucial influence on the ways students choose to engage (or not engage) with mathematics and science. Clearly the extent and direction of this influence will depend on the teachers' awareness of, respectively, values ascribed to the particular discipline, the values carried by their selection from the available pedagogical repertoire, and their consciousness or otherwise of imposing their own personal values (Pritchard & Buckland, 2016).

As determined during the survey, it was barely noted that values are the less concern of the teachers in the classroom. Most of the teachers in the field focus on developing the mental and technical skills of the learners. As presented in the graph below values are not fully emphasized in the science and mathematics teaching.



Therefore, it can be strongly recommended that the Department of Education may also look into the real scenario of what is really the focus of basic education. To add up it can also be encouraged that teachers in the field be fully aware of the impact of values in the teaching-learning process to attain holistic literacy in the basic education process.

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