Student-Teachers' Knowledge and Skills in Contemporary Quantitative Methods in Action Research Reporting

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Abstract: *The study explored the knowledge and skills of undergraduate student-teachers in utilizing contemporary quantitative techniques to present their action research reports. The study purposely sampled 165 student-teachers who pursued Bachelor of Education in Basic Education degree in the University of Education, Winneba in Ghana, and adopted an exploratory mixed design in exploring the student-teachers' demographic information, academic qualifications, and knowledge and skills to cover many and varied characteristics of the student-teachers. Particularly, their knowledge and skills were centred on data collection instruments, data representing skills, and data analysis methods. Their views were sought on the main areas to help diagnose and improve their knowledge and skills. The findings revealed that student-teachers implored inadequate quantitative methods to support the statistical significances of their reports to confidently disseminate to influence educational policies and national discourse.*
Keywords*: action research; contemporary quantitative methods; knowledge and skills*

I. Introduction

Best and Kahn (2014), Spratt, Walker and Robinson (2004), and Gay and, Airasian (2003) contend that modern contemporary research in education has not paid much attention to action research design to uncover effective ways of dealing with problems in the real world and classroom through the application of scientific methods to improve upon school, teaching and professional spirit. The results are not generalizable to any other setting and not meant to contribute to knowledge. They emphasize that action research methods are divided into quantitative and qualitative designs. The quantitative methods are the descriptive, evaluation and assessment outcomes. These answer questions related to *how much, by how far, to what extent, how significant, how different and how related*. The qualitative research methods are subdivided into ethnography, phenomenology, narrative research and case study. They answer questions concerning *what, where, when, how, and by what means*. However, it appears student-teachers fail to fully explore these laid down procedures and bring varied of analyses on the findings of action research reports. This study therefore, explored both quantitative and qualitative methods of analyzing action research findings in order to improve upon the knowledge and skills of student-teachers in the quantitative methods.

Philosophy of Quantitative Methods in Action Research

Action research designs are systematic procedures done by teachers (or other individuals in an educational setting) to gather information about, and subsequently improve, the ways their particular educational setting operates, their teaching, and their student learning. Educators aim to improve the practice of education by studying issues or problems they face. Educators reflect about these problems, collect and analyze data, and implement changes based on their findings. In some cases, researchers address a local and practical problem, such as a classroom issue. In other situations, researchers seek to empower, transform, and emancipate individuals from situations that constrain their self-development and self-determination (Creswell, 2015; Best & Kahn, 2014; Dampson & Mensah, 2014; Creswell, 2012).

The philosophy of action research rests on mixed research methodologies. A mixed methods research design is a procedure for collecting, analyzing, and combining both quantitative and qualitative methods in a single study to fully and vividly understand a research problem (Creswell & Plano Clark, 2011). The basic assumption is the combination provides a better understanding of the research problem and question than either method. Creswell (2012) contends that mixed methods research has its philosophical worldview from pragmatism. Pragmatism is the philosophical belief that a research problem emanates in many diverse ways and that many varied methods are required to fully understand that research problem. Creswell (2012) also supports the dialectical position that recommends that researchers report the multiple worldviews they hold on a research problem and this requires the combination of employing both quantitative and qualitative data. Mertens (2009) argues in favour of the transformative research perspectives that advance the need for addressing issues of social justice for marginalized and underrepresented groups.

Creswell (2012), and Creswell and Plano Clark (2011) outline the commonest mixed methods designs as the convergent parallel design, the explanatory sequential design, the exploratory sequential design, the embedded design, the transformative design and the multiphase design. The researchers used the explanatory sequential mixed design model to undertake the study.
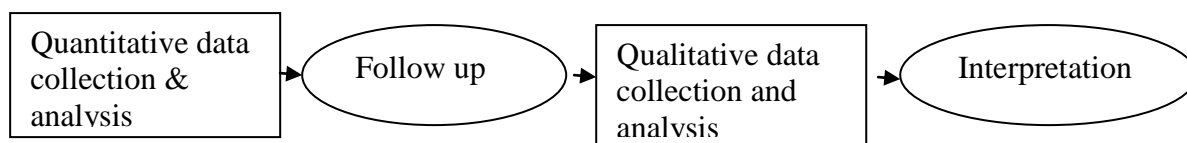
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│ Quantitative   │     │           │     │ Qualitative    │     │               │
│ data           │ ──▶ │ Follow up │ ──▶ │ data           │ ──▶ │ Interpretation│
│ collection &   │     │           │     │ collection and │     │               │
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Figure 1: The Explanatory Sequential Mixed Design
(**Source:** Creswell, 2012)

Figure 1 shows the model the researchers adopted to collect quantitative and qualitative data sequentially in two phases, with the qualitative data collection following and informing the quantitative one. The researchers first collected quantitative data and then followed up with qualitative data to help explain, elaborate and confirm the statistical significance of the quantitative results. While the quantitative data and results provided us a general picture of the research problem, the qualitative specifically refined, extended, or explained the general picture of student-teachers' knowledge and skills in contemporary quantitative methods in action research.

This model depicts our priority on exploring the student-teachers' knowledge and skills in quantitative data, and explains why we collected the quantitative data first in the sequence and then followed it up with the qualitative data collection to refine the results from the quantitative data through probing. This process enabled us to identify key outliers or extreme cases, differentiate the quantitative and qualitative parts, capture the best of both data and refine the findings through an in-depth qualitative exploration phase (Creswell & Plano Clark, 2011; Ivankova & Stick, 2007).

Action research typically composes of the practical action research and the participatory action research. Here, the teachers seek to research problems in their own classrooms to improve upon their students' learning and their own professional performance. Teams can also engage in action research to address common issues to enhance the practice of education through the systematic study of a local problem (Creswell, 2012; Mills, 2011).

Participatory action research on the other hand, rather than focus on individual teachers solving immediate classroom problems or schools addressing internal issues, has a social and community orientation and emphasizes on research that contributes to emancipation and change in our society. This approach is an action-oriented advocacy means of inquiry that involves both qualitative and quantitative data collection (Kemmis & McTaggart, 2005). The purpose of participatory action research is to improve the quality of organizations, communities, and family live through emancipation, empowerment and improving systems in schools, entire education, and communities. The distinct ideological foundations shape and address topical issues of social, economic, political, and class problems in our society. These sensitive issues are normally tests that stereotype some students, texts that omit groups, assessments that confirm students' failure and classroom interactions that silence or quiet the voices of minority students (Stringer, 2007). The cardinal features in all these issues involve the social process in which the researchers deliberately explored the relationships to examine student-teachers' knowledge, understandings, skills and values to practically and collaboratively address the constraints in order to better facilitate student' learning in basic educational research in the school or classrooms.

Pundits view this type of design as highly advanced, time-consuming, require extensive data, and require direct participate in a research team (Creswell & Plano Clark, 2011; Ivankova and Stick, 2007). There are also worries expressed in merging, integrating, linking, and/or embedding the two phases in a mixed methods study. However, proponents believe that utilizing mixed explanatory sequential design encourages change in the schools, fosters democratic approaches to education, empowers individuals through collaboration on projects, positions teachers and other educators as learners who seek to narrow the gap between practice and their vision of education, encourages educators to reflect on their practices, and promotes a process of testing new ideas (Creswell, 2015; Best & Kahn, 2014; Dampson & Mensah, 2014; Creswell, 2012).

Quantitative Methods in Action Research Data

The major analyses in quantative data are descriptive and inferential. The descriptive analysis can be grphical or numerical. If it is graphical, then one needs to determine whether to use continous line graphs or discrete charts. If it is numerical, then one needs to determine whether the data is nominal or continous to make decisions on the type of central tenndency, the variability, the peakness and the hypothesis test to implore. Best

and Kahn (2014), McClave and Sincich (2009), Kuwulich(2008), and Gay and Airasian (2003) opine that descriptive data are not only suitably analyzed with categories, themes and word transcriptions but can also be coded, transformed and presented on charts. In particular, the simple bar charts are useful for making comparisons of two or more categorical variables, and Pareto and pie charts are useful for comparing different sub-groups to the whole group. However, if the responses are purely quantitative, then line graphs, stem-and-leaf displays, histograms and probability plots are usually useful in establishing shape and long time trend.

In numerical data analysis, Wang (2012), McClave et al, (2011), McClave and Sincich (2011), McClave and Sincich (2009), and Cohen, Manion and Morrison (2000) contend that the most frequently used numerical tools are the measures of central tendency (mode, mean and median), the variabilities (standard deviation, skewness, and kurtosis) and relative standings (quartiles, deciles, and percentiles). Here, the mode measures the maximum number of times a construct recurs, the mean indicates the average value of all variables and the median describes the number of constructs above and below 50% of the entire sample. It must be distinguished clearly that while the mode and median are most suitable and applicable in qualitative data, the mean and standard deviation are useful in quantitative data analysis (Wang, 2012; McClave, et. al, 2011).

In inferential tools of data analysis or hypothesis testing, McClave and Sincich (2011), McClave and Sincich (2009), and Gay and Airasian (2003) subdivide them into parametric (distribution-bound) and non-parametric (distribution-free) tools. Statistical Analysis Software (SAS) Institute (2003) divides the parametric into tests of group differences and tests of group associations. The test of group differences examines whether two populations differ with respect to their means while that of the test of association examines whether there is a relationship between two or more variables within this population. In action research, teachers usually compare performance of their students within the same class or school and between other classes or schools. Therefore, student-teachers knowledge and skills in parametric and non-parametric tests can enhance quality and effective research that address critical issues to improve upon classroom instructional strategies.

In hypothesis testing, student-teachers' sound knowledge and skills of null (H_0) and alternative (H_a) hypotheses, one or two tails, level of significance, critical values and p-values indeed improve data analysis and effective dissemination of research findings. A hypothesis is a statement temporarily accepted as true about a phenomenon and employed as a basis in search of a new truth which should emanate from H_0 and H_a (McClave & Sincich, 2009; DeCoster, 2006; Gay % Airasian, 2003). The H_0 usually makes a specific claim about the parameters (like saying that the average score is 60%) while the H_a proposes that H_0 is false. Sometimes, H_a simply proposes that H_0 is wrong (e.g. the average population score is *not* 60%). Other times, H_a suggests that H_0 is wrong in a particular way (e.g. the average population score is less or more than 60%). If the statistical manipulations support H_0, we simply infer that there are significant differences or relationships in the variables, and if otherwise we conclude in favour of H_a that there are either no significant differences or no relationships in the variables.

In two-tailed and one-tailed tests, Wang (2012), Arthur (2011) and, Gay and Airasian (2003) explain that two-tailed test is the rejection of H_0 if the sample mean is significantly higher or lower than the population mean, and one-tailed test rejects the H_0 if the sample mean is entirely either lower than or higher than some population mean.

In utilizing the level of significance or alpha-level (α-level), Wang (2012), Arthur (2011), and Gay and Airasian (2003) explain it as a percentage of allowable error (usually 15%, 10%, 5%, 1% or 0.1%) usually chosen before hand with great care, thought and reason to carry out the hypothesis test. It is the breakpoint at which the researcher decides as to whether to accept or reject H_0. Creswell (2012) advises that 5% α-level is suitable for research work in education and other social sciences. For instance, choosing a 5% α-level means that the researcher is willing to take 5% risk of rejecting the H_0 even when it happens to be true.

Another essential quantitative statistic is the critical value. Critical values are the normal or standard normal statistics (Z-values) based on the H_0. The Z-values corresponding to α-level of 15%, 10%, 5%, or 1% are 1.44, 1.64, 1.96 or 2.58 respectively. Researchers use Z-values to decide whether to accept H_0 or reject H_0. We reject H_0 when the Z-value is so large or outside the α-level (Arthur, 2011; McClave & Sincich, 2011; McClave & Sincich, 2009; Gay & Airasian, 2003).

Even though the Z-statistic is popular, student-teachers and many basic research works in education utilize the t-test statistic especially when the population parameters are unknown. DeCoster (2006) explains that the t-distribution is actually a family of curves which are determined by its degrees of freedom (df). The df represent the number of scores that are free to vary in calculating the t-statistic. In a single sample of size n, the n-1 scores are allowed to vary while only one variable is fixed. McClave and Sincich (2011), and Pagano (2007) contend that the t-test is mainly useful for comparing the mean scores of two groups on a single test, testing the equality of means of two groups with equal variance, and/or testing the F-ratio in analysis of variance to comparing the mean scores of many different groups. Pagano (2007) however, bemoans the most difficult challenge of deciding on whether samples are independent or dependent. The independent samples are usually two randomly or purposely selected groups which are unrelated to each other (boys and girls, private and public

schools, urban and rural, and religious and secular schools). On the other hand, the dependent samples are either two groups matched (paired sample) on a variable or the same variable is being tested several times (repeated measures). The study therefore explored the knowledge and skills of student-teachers in utilizing these contemporary quantitative techniques to present their action research reports.

In utilizing the probability or p-value, Best and Kahn (2014), Arthur (2011), and Gay and Airasian (2003) opine it is the probability that one would obtain the present results if the H_0 were true. If the p-value is smaller than a test statistic, we reject H_0, and fail to reject H_0 if the p-value is larger. Without reference to test statistics as usually computed by most statistical software, DeCoster (2006) opines we also reject H_0 when the p-value is smaller than the α-level and implore the following techniques:

- We report exact p-values like p=0.03 instead of confidence levels like p<0.03.
- If the p-value is greater than or equal to 0.10, we report two significant digits like p = 0.12,
- If the p-value is less than 0.10, we report one significant digit like p = 0.003.
- We should never report that a p-value is equal to 0 because there is always some probability that the results are due to chance alone.

We should always report that the p-value is less than 0.001 even if it is 0.000 in statistical software. However, the p-value does not really provide the probability that H_0 is true but rather suggests that the researcher may obtain the same results if the H_0 is true. That is why rejecting H_0 does not mean that it is due to the very cause and effect relationship in the hypothesis, and accepting the H_0 does not also constitute the proof that H_0 is true. The latter just means that there is no statistical evidence to reject H_0 (Arthur, 2011; Gay & Airasian, 2003).

Purpose of Study

The purpose of this study was to explore the student-teachers' knowledge and skills in utilizing contemporary quantitative methods to present action research reports confidently and coherently to influence policy and professional practice.

Research question/Hypothesis Test

1. What difference would gender, academic level, years pursuing programme, and knowledge and skills in quantitative methods make in action research reports?
2. H_0: There were no associations among the independent variables and their constructs.
   H_a: There were associations among the variables and their proportions (Turner, 2014).
3. H_0: there are no statistically significant relationships in student-teachers knowledge and skills in quantitative data methodology.
   Ha: there are statistically significant relationships in student-teachers knowledge and skills in quantitative data methodology.

II. Materials and Methods

Research Design

The study first examined factors that contribute to student-students' persistence disinterest in quantitative methods in the analysis of action research reports and implored the quasi-experimental mixed explanatory sequential design (Ivankova & Stick, 2007). With this approach, one-time single test items were administered to 165 final-year student-teachers and then followed the test up with one open qualitative item to explore their challenges in analyzing quantitative data into detail.

Participants and Sampling Technique

The data on the student-teachers were collected from the office of the Department of Basic Education, University of Education, Winneba in Ghana and satisfied all the ethical issues of permission, approval and assurance of confidentiality. Purposive sampling was adopted because the student-teachers started writing action research projects and had prerequisite knowledge and skills in undertaking action research study. According to Creswell (2013), purposeful sampling allows the researchers to select participants and sites for an action research because they purposefully get informed of the research problem and central phenomenon in the study. We illustrated rigorous quantitative methods in the purposive sampling technique to the group as well as persuasive qualitative open interview to support the quantitative items.

Data Collection and Analysis Procedures

We utilized a simple model for mixed action research methods (Creswell, 2012) to conceptualize the procedures involved from the quantitative to the qualitative phases, and described how the data was collected and analyzed in order to gain greater insights into the essential phenomena of utilizing contemporary quantitative methods. We conceptualized the independent variables to be the student-teachers' genders, number

of years spent on programme, and level before completing the programme. With simple questionnaire items distributed to 195 student-teachers, about 165 (85%) was retrieved and used for the analysis. In the analysis, pie and Pareto charts were utilized for the descriptive statistics while Chi-square and t-paired samples were used to test for the hypotheses (Best & Kahn, 2014; Dampson & Mensah, 2014; Arthur, 2011; Gay & Airasian, 2003).

Validity and Reliability

Cohen, Manion and Morrison (2000) opine that threats to validity and reliability can never be erased completely but the effects of these threats can be attenuated by attention to validity and reliability throughout a piece of research. Validity is explained as the degree to which results from a study are likely to be true and free from bias if done repeatedly and separately by another study. Mixed explanatory sequential designs respect the two world views of constructivism and positivism when dealing with validity.

That is why we took care of the constructivist principles of natural setting source of data, context-boundedness descriptions, socially situated and socio-culturally saturated, self involvement and double hermeneutic interpretation. These were addressed through the honesty, depth, richness and scope of the data we concentrated on. Therefore, we made the items simple, unambiguous, varied, and straight to the points to achieve our aim, and to ensure that the relevant information as well as the quality of the data was explicit and detailed (Creswell, 2015; Best & Kahn, 2014; Dampson & Mensah, 2014; Cohen, Manion & Morrison, 2000).

We also addressed the positivist principles of controllability, replicability, predictability, derivation of laws, context-freedom, fragmentation and atomization of research, randomization of samples and observability. In quantitative data, validity might be improved through careful sampling, appropriate instrumentation and appropriate statistical treatments of the data. These explain why we adopted the purposive sampling technique, obtained the required information within the shortest period, and set the same conditions for all groups of student-teachers to minimize the inherent errors associated with quantitative data collection (Creswell, 2015; Best & Kahn, 2014; Dampson & Mensah, 2014; Cohen, Manion & Morrison, 2000).

Reliability in qualitative research is synonymy to the credibility, neutrality, confirmability, dependability, consistency, applicability, trustworthiness and transferability of the responses. We achieved the qualitative reliability by establishing trust, maintaining informality, pitching the questions at the right levels, and keeping to the point. On the other hand, reliability in quantitative research is essentially the dependability, consistency and replicability over time, over instruments and over groups of respondents. Here, precision and accuracy of the measurement variables was very essential. That is why we addressed the quantitative threats by spacing the tests periods appropriately, engaging respondents in meaningful learning, and directing the questionnaire to student-teachers who were actually undertaking action research in the university to achieve Cronbach's reliability coefficient of 0.718 (Creswell, 2015; Best & Kahn, 2014; Dampson & Mensah, 2014; Cohen, Manion & Morrison, 2000).
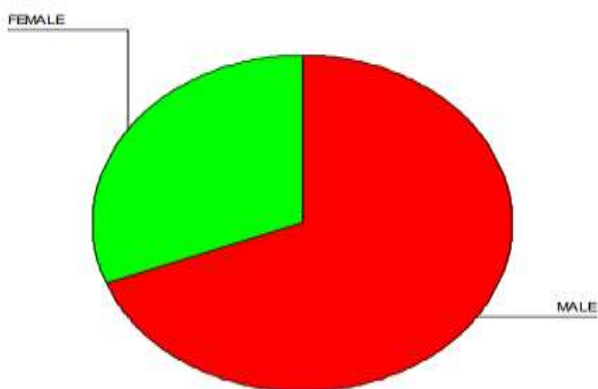
III. Results and Analysis

Figure 2: Pie Chart Showing the Gender Composition of Students

The chart in figure 2 shows the composition of gender groups in the study. Even though males formed the majority, we sampled a sizeable number of female student-teachers to be included in this quantitative action research study. The findings showed most student-teachers previously completed senior high schools before entering into the University and fulfilled the basic entry requirements into any University. A few others enrolled with teachers' certificates to spend two or three years of professional development for the awards of post diploma degree. This means that most student-teachers had acquired basic statistical methods from their previous schools and should be able to carry out quantitative action research.
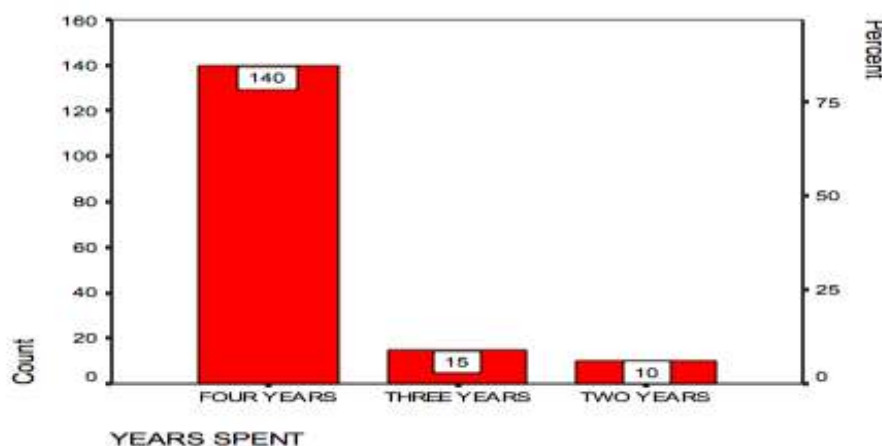
Figure 3: Pareto Diagram Showing Number of Years Students Spent

The Pareto chart in figure 3 displays the number of years the student-teachers spent in the University prior to writing their action research projects. It was clearly shown that more than three-quarters of them spent four years to study the bachelor degree programme. Apart from indirect research action research works student-teachers undertake in the various courses, they offer Research Methods, Educational Measurement and Statistics which provide student-teachers opportunities to study and analyze quantitative data.

The findings also revealed that majority of the student-teachers used psychological test instruments to assess and diagnose teaching and learning during peer teaching and out-of-school internship programmes that equally quantitative data. Particularly, it was encouraging to discover that many student-teachers assessed their knowledge and skills in quantitative data with very good and excellent. Therefore, student-teachers have the perquisite knowledge and competencies to undertake studies that demand for the analysis of quantitative research designs.

Table 1: Chi-Square Test of Knowledge and Skills in Quantitative Data

Statistic	Type of Data	Chapters	Data Collection	Data Analysis	Representation
Chi-Square	179.315	442.242	148.121	362.303	42.606
df	3	4	4	4	4
Asymp. Sig.	0.000	0.000	0.000	0.000	0.000

Table 1 shows a Chi-Square test for student-teachers' knowledge and skills in quantitative action research design. In Chi-square test, a statistically significant relationship is observed when the sample is unlikely to occur if really there is no relationship in the larger population, p-value for the chi-square statistic is the probability that the chi-square value would be larger if really there were no relationship in the population, the observed relationship is statistically significant when the *p*-value for a chi-square test is less than α-level, and we reject the null hypothesis if there is generalized relationship in the population (PennState, 2016). Since the Chi-square statistics were all higher than the p-values, we rejected the null hypothesis and concluded that the knowledge and skills of student-teachers in quantitative data were statistically significant.

Table 2: Paired-Samples T-Test Statistics of Assessments

Pairs with Self Assessment	Paired Differences and 95% Confidence Intervals					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95%				
				Lower	Upper			
Genders - Self Assessment	-2.467	1.091	0.085	-2.634	-2.299	-29.052	164	0.000
Levels - Self Assessment	-1.061	1.618	0.126	-1.309	-0.812	-8.420	164	0.000
Years - Self Assessment	0.012	1.071	0.083	-0.152	0.177	0.145	164	0.885

Table 2 shows the paired t-test for three variable and their self assessment of their knowledge and skills in quantitative data. The tests presented the mean, standard deviation, standard, and 95% confidence intervals. The others statistics are the *t*-values degrees of freedom (df), and the statistical significances (2-tailed *p*-value) of the paired t-test of 0.0000 and 0.885. Genders and levels of student-teachers were statistically significant (i.e., $p < .05$) while that of number of years were not statistically significant. In other words, the differences among the genders and levels of student-teachers with respect to assessing their challenges in quantitative data were not equal to zero but number of years was zero.

This means that while there was 1 in 5000 chances that the observed differences in the average group scores of genders and levels were due to random chance, there was no chance that the observed differences in

the number of years a student-teacher stayed in the university was due to chance. This means we cannot use number of years spent in the university to generalize for all student-teachers' knowledge and skills. We therefore, followed these analyses up with qualitative explanations.

Qualitative Discussions of Student-Teachers Challenges
     The challenges in reporting quantitative findings were revealed as presentation, interpretation, labelling, computation and discussion as displayed below. The following are some of the statement transcribed by the researchers:
1. I know that action research has challenges and I don't deal with areas that will give me challenge.
2. When I am doing action research, my challenges are how to calculate numbers but the calculator does the work for me. But I don't always know what to say about the number.
3. Every researcher has challenge in research. So my challenges are calculating and knowing all the meanings of the numbers.
4. *I don't know all the parts of the quantitative action research. That is why I don't want to do research in that area.*

Figure 3: Qualitative Assessment of Student-Teachers' Challenges

Challenges	Frequency	Percent	Valid Percent
Presentation	19	10.8	11.5
Interpretation	59	33.5	35.8
Labelling	15	8.5	9.1
Computation	54	30.7	32.7
Discussion	18	10.2	10.9
Total	165	93.8	100.0

     Figure 3 shows the challenges the student-teachers faced in having to report quantitative findings in their action research reports. We discovered statistical interpretations (59%) and computations (54%) were their topmost challenges. The rests were presentation (19%), discussion (18%) and labelling (15%). In statistical measures, errors of more than 10% are highly significant that ultimately affect the generality and conclusions of findings, and must seriously be discussed into details (Creswell, 2012; DeCoster, 2006).

Knowledge and Skills in Presentation
     Knowledge and skills of research presentation is a critical ingredient when reporting quantitative action research results that could change the formal learning of student-teachers. The researcher's role is to generate interest in the action research process by informing stakeholders on the successes of teaching and learning. The researcher should present findings during staff meetings, team meetings, seminars, symposia and conferences on what students need to learn in the classroom, impacts of new instructional practices, and instructional practices that need further investigation prior to implementation. It is therefore, important that student-teachers develop deep understanding of the numbers and numerical attributes in the action research to communicate and explain thoroughly the impacts of these numbers on classroom teaching and learning (Hewitt & Little, 2005).

Knowledge and Skills in Interpretation
     Knowledge and skills in quantitative interpretation of action research reports address critical issues that might have not been quantified, predicted and proven. It is always inadequate and widely open to judge that a particular instructional strategy works well. If the strategy is objectively presented for numerical scrutiny, the validity and reliability of the action research findings could stand the test of time. The cardinal strand of action research is to bring into focus new and varied learning methodologies in a multitude of ways. If teachers fail to grasp the numbers, the reports may as well encounter implementation challenges and cannot address the potential barriers to new teaching and learning styles.

Knowledge and Skills in Labelling
     The purpose of conducting action research is to provide feedback as a result of instructional successes and/or challenges. The researcher can facilitate effective communication and dissemination of findings by labelling the findings as succinctly as possible. If tables, charts or graphs are involved, they must be labelled, captioned and described so well that the reader sees no need to undertake deep reading before being communicated to (Hewitt & Little, 2005).

Knowledge and Skills in Computation
     To conduct action research successfully, the researcher must subject himself/herself to rigorous and inductive tuition of mathematical and statistical philosophies and concepts. A researcher who has flare and

natural affinity for central tendencies must fully understand the procedures for computing them so as to talk about them in the reports. This will allay ambiguities and multiple interpretations of statistical figures being described. While the mean is a holistic statistic, the median and the mode are partial ones and cannot be used as basis to make statistical generalizations and replications. There is therefore the need to develop, implement and sustain student-teachers mathematical knowledge and skills to provide with opportunities to report action research findings.

Knowledge and Skills in Discussion

Student-teachers learn not only by themselves but also by working with other teachers, students and experts in their areas of specialization and interest. Student-teachers need to discuss their reports of the instructional practices and techniques worthy of recommendation for implementation, new innovations integrated into the one ones, and basic research discoveries they have made during the action process. Effective discussions must utilize the goals of the curriculum standards, the kinds of instructional practices and techniques their research brings to bear, and the criteria for assessing students' learning achievements. The discussion must constantly make references to the topic, the research problem, the research question and the methodology to give way for plausible and coherent conclusions. This is the only way the findings can effect policy and improve learning (Hewitt & Little, 2005).

IV. Conclusion and Recommendations

The findings revealed that most student-teachers usually collected both qualitative and quantitative data to analyze their action research project reports. However, majority of them resorted to only the qualitative descriptive methods to the neglect of the quantitative methods. The reason behind this behaviour is attributed to the seemingly inadequate knowledge and skills in quantitative processes. There is therefore, the need to explore ways integrating student-teachers' knowledge and skills in the quantitative procedures alongside the complementary qualitative ones to bring variety and appeal of the findings to policy-makers and research community.

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