IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

AN ANALYSIS OF TEACHER'S CONFIDENCE IN TEACHING MATHEMATICS AND STATISTICS

Name of 1st Author-Meena Sahu, Name of 2nd author – Nigama prasan sahoo,
Designation of 1st author – Student, Designation of 2nd author- Asst.professor
Department –Msc Mathematics
Kalinga university Naya Raipur, Chhattisgarh ,India

ABSTRACT

Teacher's confidence and beliefs about the subject they teach play an important role in their teaching practices. This paper reports results for profiling a group of 75 mathematics teachers, from Grade 4 upwards, from different school of Raipur, Chhattisgarh in India. The research investigated confidence levels of teachers regarding the teaching of various mathematics and statistics topics. It also investigated teachers' beliefs in their ability to use the mathematics and statistics required to meet the general demands of everyday life as well as their beliefs in their ability about mathematics and statistics in the teaching and learning process.

A survey instrument was constructed and subsequent feedback revealed that teachers displayed high confidence in teaching some of the content topics such as fractions, decimals, percentages, histograms and pie charts, patterns and measurements. The teachers also expressed lower confidence about engaging in critical debate about mathematical and statistical statements in social media. In relation to their beliefs.

Key words: Teacher's confidence, beliefs, confidence-building factors, mathematics and statistics topics.

INTRODUCTION

Over the years, many studies have identified the need for a relevant statistics education curriculum that can help students develop the type of statistical thinking needed to cope with the demands of the real world. The study of statistics forms part of the mainstream mathematics curriculum in schools and has traditionally been an under-represented strand in schools. Many statistics education researchers have pointed out differences between the two disciplines.

The purpose of this study is to explore mathematics teachers' expressions of confidence in teaching mathematics and statistics concepts from various perspectives. Firstly, we are interested in whether teachers' confidence in teaching statistics and mathematics topics can be conceived as a single one-dimensional construct or whether these are conceived as different dimensions. We also identify concepts for which teachers were more confident in teaching than others. Finally, we investigate whether some demographic teacher factors are associated with different levels of confidence. The corresponding research questions are listed below:

1. Can mathematics teachers' confidence in teaching different mathematics and statistics concepts be considered as a unidimensional or multidimensional construct?
2. Which mathematics and statistics concepts are teachers most (least) confident about teaching?
3. Are there any differences with respect to teachers' confidence in teaching mathematics and statistics concepts according to gender, teaching experience, teaching phase and whether they received additional professional teaching certification?

This study will add to knowledge about teachers' confidence in teaching mathematics and statistics in school by providing insights about differences in confidence in terms of concepts as well as differences in confidence in terms of demographic factors.

REVIEW OF LITERATURE

With the introduction of democratic reforms in Raipur school chattishgarh , the education system was identified as requiring a complete overall. Hence, numerous reforms were carried out to define the new national education system. many of which used different curricula, i.e., there was no uniform standard for school . A first step to bringing about uniformity was to institute a common curriculum, called the Interim Core Syllabus. For mathematics, this initial common curriculum consisted of a list of common topics to be covered in each year of schooling. It is noteworthy that there were no statistics or probability concepts that were assessed in the Grade 12 mathematics examinations at that time.

The next set of curriculum revisions resulted in the *Curriculum 2005* (C2005) policy, which was introduced in 1998. little was known about teaching and learning statistics at school level in new Raipur.

The curriculum was understated, however, and did not include details of specific content and the depth to which these should be covered. It was only in the next set of curriculum revisions, the Revised National Curriculum Statements (RNCS) for the General Education and Training (GET) band, that is, Kindergarten to Grade 9, that Data Handling was stipulated as one of four outcomes of the curriculum.

Another development with respect to statistics, in the RNCS, was for the Further Education and Training (FET) band, that is, Grades 10 to 12, in which there was an increased emphasis on statistics (Data Handling was one of the strands that was to be assessed in the Grade 12 core mathematics examinations). It must be noted, however, that this was only implemented in the classroom in 2006 and culminated in being part of the final Grade 12 examination in 2008. It can thus be seen that statistics is a relatively new addition to the mathematics curriculum in South Africa and only formed part of the Grade 12 core mathematics assessment from 2008 onwards. It was only in the next set of curriculum revisions.

There have been many calls for a shift in the mathematics curriculum to reflect a focus on developing statistical literacy skills in learners and the changes in the mathematics curriculum in South Africa are indicative of a global movement towards an increasing emphasis on statistical literacy.

Regardless of the discipline, curriculum reform is a complex process, and its success is dependent on many factors . Developing the policy that underpins new curricula is just one part of the curriculum change process. we note that the implementation of new curriculum policy does not follow the "predictable path of formulation—adoption—implementation—reformulation but is recontextualized through multiple processes and mechanisms" .

Much of the research on curriculum reform agrees that teachers need sustained classroom support, over and above training workshops, as they try to negotiate changes in teaching to what they have been accustomed to doing in the past. Changes in the curriculum must accordingly be accompanied by intensive teacher support as the teachers try to implement the new curriculam.

Some studies focusing on teachers' confidence levels in the teaching of statistics found that teachers' confidence in teaching statistical ideas was not uniform across concepts.we conducted a study with 5 middle school mathematics teachers about their confidence in relation to the mathematics topics they teach. Their findings revealed the teachers were most confident about teaching Measurement and Space, and least confident about Pattern and Algebra. Many teachers indicated a lack of confidence in teaching topics related to proportional reasoning. we found that the extent of the teachers' confidence was related to their degree of familiarity with the concepts in the curriculum. The teachers lacked confidence in probability for example, which was a new concept in the curriculum.

We examined teachers content knowledge for teaching elementary mathematics. Using factor analysis, their findings revealed that teachers' knowledge for teaching elementary mathematics was multidimensional and included knowledge of various mathematical concepts and domains. The authors explained that the "multidimensionality" emerged because the factors describing statistical content knowledge (SCK), content knowledge (CK) of patterns, functions and algebra accounted for between 21% and 45% of the commonality in items written to represent these areas, while the SCK factor explained 12–23% of the commonality of items written to represent knowledge of content in number and operations.

METHODOLOGY

This study was conducted with 75 mathematics teachers who were part of a group of teachers who attended a series of five teacher professional development workshops focused on improving their knowledge and skills in statistics. Those teachers, who taught from Grade 4 upwards in schools, were selected purposively by the provincial educational department, according to the schools that were in most need of assistance of training in mathematics . Details of the participants are provided in Table 1.

Table .1 Details of participants

Factors	Categories	Frequency
Gender	Male Female	38 37
Teaching Experience	≤ 10 years 11-20 years >20 years	45 19 11
Phases	GET FET	30 45
Received additional professional certification	Yes No	57 18

The authors of this paper extended the questionnaire to include items related to the teaching of statistics. Printed questionnaires were distributed to the mathematics teachers, who were asked to rate their level of confidence in teaching 17 mathematics and statistics concepts on a 5-point with response options from very low to very high. Table 2 presents the results in terms of percentage per category with 0 being the least confident and 4 being most confident. There were no missing data.

Table 2. Confidence items: Category response percentages (N = 75)

	Very Low	Low	Moderate	High	Very High
Fractions	1.3	6.7	24.0	29.3	38.7
Decimals	1.3	8.0	24.0	33.3	33.3
Percentages	1.3	9.3	20.0	24.0	45.3
Ratio and proportion	4.0	13.3	33.3	21.3	28.0
Measurement	1.3	12.0	29.3	30.7	26.7
Pie graphs and histograms	2.7	16.0	20.0	28.0	33.3
Simple probabilities	4.0	13.3	30.7	29.3	22.7
Range and variation	4.0	22.7	34.7	17.3	21.3

Ideas of samplings and data collection	2.7	18.7	34.7	29.3	14.7
Using statistics in out of the classroom situations	5.3	20.0	36.0	21.3	17.3

For the Rasch analysis, there are tests of fit, which give information about the difference between the observed and the expected response . Items with fit residuals outside of the range –2.5 and +2.5 are considered as misfitting. The Person-Separation-Index (PSI) is an indicator of the internal consistency reliability of the scale . The PSI provides an indication of the power of the measure to distinguish amongst respondents with different levels of the trait being measured. In Rasch analysis, if the PSI is high (> 0.8), it suggests the instrument has been able to discriminate well between the persons' measures of the trait. The properties of Rasch measurement apply only to the extent to which the data will fit the model's demanding requirement.

When the data do not fit well with the model, Rasch models are useful in trying to understand the data by helping diagnose where the data are different from what was expected advise that when performance on an instrument can be interpreted in multidimensional way, these dimensions should be modelled separately first before the measure can be properly constructed. We used factor and a subtest analysis (Rasch analysis) to investigate the dimensionality. Principal components analysis, a factor analysis technique for identifying clusters of variables, was used in this study to extract factors. There are two categories of rotation techniques: orthogonal rotation and oblique rotation. Orthogonal rotation (e.g., Varimax and Quartimax) involves uncorrelated factors whereas oblique rotation involves correlated factors.

We used a logistic regression to look for answers to the third research question about the relationship between teachers' levels of confidence and demographic factors of phase in which they taught, whether additional professional courses were taken, gender and teaching experience. Logistic regression is a predictive analysis which is effective for describing a dataset where there are one or more independent variables that determine an outcome of a dependent or response variable that is measured as a dichotomous variable (two possible outcomes). In this study the binary response variable was teacher confidence (high or low confidence), and the independent variables were phase of teaching, gender, teaching experience and whether or not additional professional courses were completed.

RESULTS

In this section, we first present the finding concerning the levels of confidence expressed by the teachers about teaching various mathematics and statistics topic. Then, we report their beliefs regarding their own use of mathematics and statistics in everyday life as well as in teaching and learning. Thereafter, we discuss factors that contributed to their confidence development and finally we present an overall image of the relationship between their confidence and their eliefs.

Teachers' confidence about facilitating the content of the topics

The results of questions related to confidence of teachers about their teaching are expressed by the mean scores for each item, as given in Table . As discussed, a high mean value indicates a high level of confidence in teaching the related topic and a low mean value indicates a low level of confidence in teaching that particular mathematics or statistics topic. Results from Table must be read in relation to the fact that the higher the score, the more confident the teacher. t can be noted from Table that the teachers' confidence in their teaching varied according to the various topics being taught such as percentages (mean score = 4.0000, std = 1.0801), fractions (mean score = 3.9452, std = 1.0123), decimals (mean = 3.8630, std = 1.0044), and pie graphs and histograms (mean score = 3.6956, std = 1.1629). Table 2 also shows that the means scores of teachers' confidence in teaching mathematics topics are higher (highest mean = 4.000, std = 1.0801 for teaching percentages) than the means scores of teachers' confidence in teaching statistics topics (highest mean score=3.6986, std= 1.1629, for teaching pie graphs and histograms). These findings inform us that the teachers' confidence in their ability was not the same. This was confirmed by the results of non-parametric test, displayed in Table , which confirms that there is a statistically significant difference between group mean scores generated by the teachers' confidence in their ability to teach different topics. Table also shows that mean scores of teachers' confidence in teaching mathematics are higher than mean scores of teachers' confidence in teaching statistics.

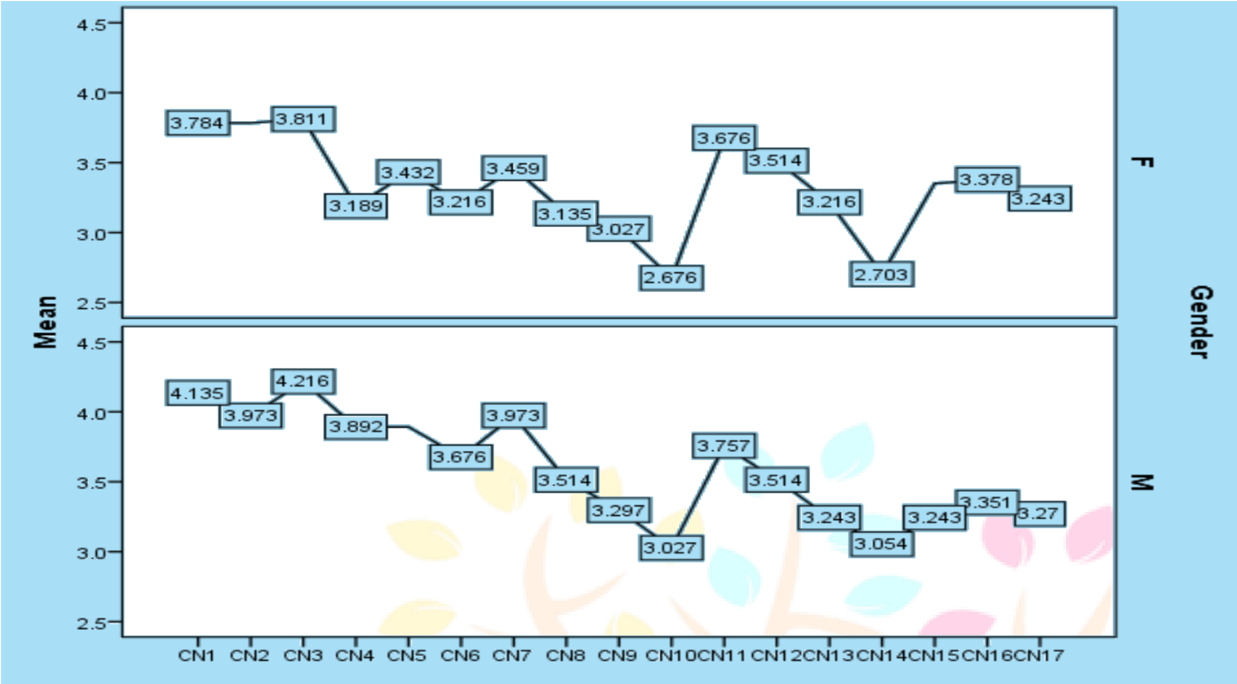
Topics Mean	(N=75)	Std (N=75	P-value[2]
Fractions	3.9452	1.0123	0.000
Decimals	3.8630	1.0123	0.000
Percentages	4.0000	1.0801	0.000
Pie graphs and histograms	3.6986	1.1629	0.000
Pattern and algebra	3.6849	1.1040	0.000
Measurement	3.6575	1.0304	0.000
Ratios and proportions	3.5205	1.1439	0.000
Simple probabilities	3.4932	1.0945	0.001
Range and variations	3.2466	1.1399	0.002
Using statistics outside of the classroom situation	3.2055	1.1050	0.002

Factors contributing to confidence development

Given that teachers' confidence was the central focus of this study, we investigated whether there appear to be some factors that contribute to a positive influence on the development of teachers' confidence in teaching statistics and mathematics topics. We investigated teachers' onfidence by gender, professional learning (those who attended workshops and who did not), use of technology, as well as the level of study. The factors which were found to contribute to confidence building are attending workshops in mathematics and in statistics, level of study, and using technology in teaching and learning mathematics and statistics.

Using multivariate analysis at significant level alpha = 0.05, we found that teachers' confidence n their ability was significantly different by gender (F = 1.488; p-value = 0.000). This could be seen clearly in certain topics where male teachers were found to be more confident in teaching decimals than female teachers (mean score = 4.216 for males versus 3.811 for females), percentages (mean score = 4.135 for males versus 3.784 for females) and ratio and proportions (mean scores = 3.973 versus 3.459) (see Figure 1). We also found a statistically significant difference between teachers' confidence ability and their age (F = 1.534; p-value = 0.000), where using the same plot we found that the teachers aged from 41 to 50 years old and 51 to 60 years old were more confident than young teachers. A statistically significant difference was further found between teachers' confidence in their ability and their use of the National Curriculum Statement (NCS) (F = 1.46; p-value = 0.001), where the teachers who were trained on the NCS and used it expressed high confidence in teaching fractions, decimals, percentages and measurements than teachers who did not use it. Furthermore, we found a statistically significant difference between teachers who attended workshops in mathematics' confidence in their ability and those who did not attend such workshops (F = 1.213; p-value = 0.038). We found that the teachers who attended workshops expressed a higher confidence than those who did not attend them. The teachers who attended workshops expressed a high confidence in teaching the topics of decimals, percentages and pattern and algebra, which are also topics that have been in the school curriculum for many years. Hence these are topics with which the teachers are more familiar. A statistically significant difference was further found to exist between the teachers' confidence in their ability and using technology in teaching (F =1.222; p-value = 0.034), where the teachers who used technology in teaching mathematics and statistics were more confident than those who do not use it.

Figure 1. Means plot of teachers' confidence by gender

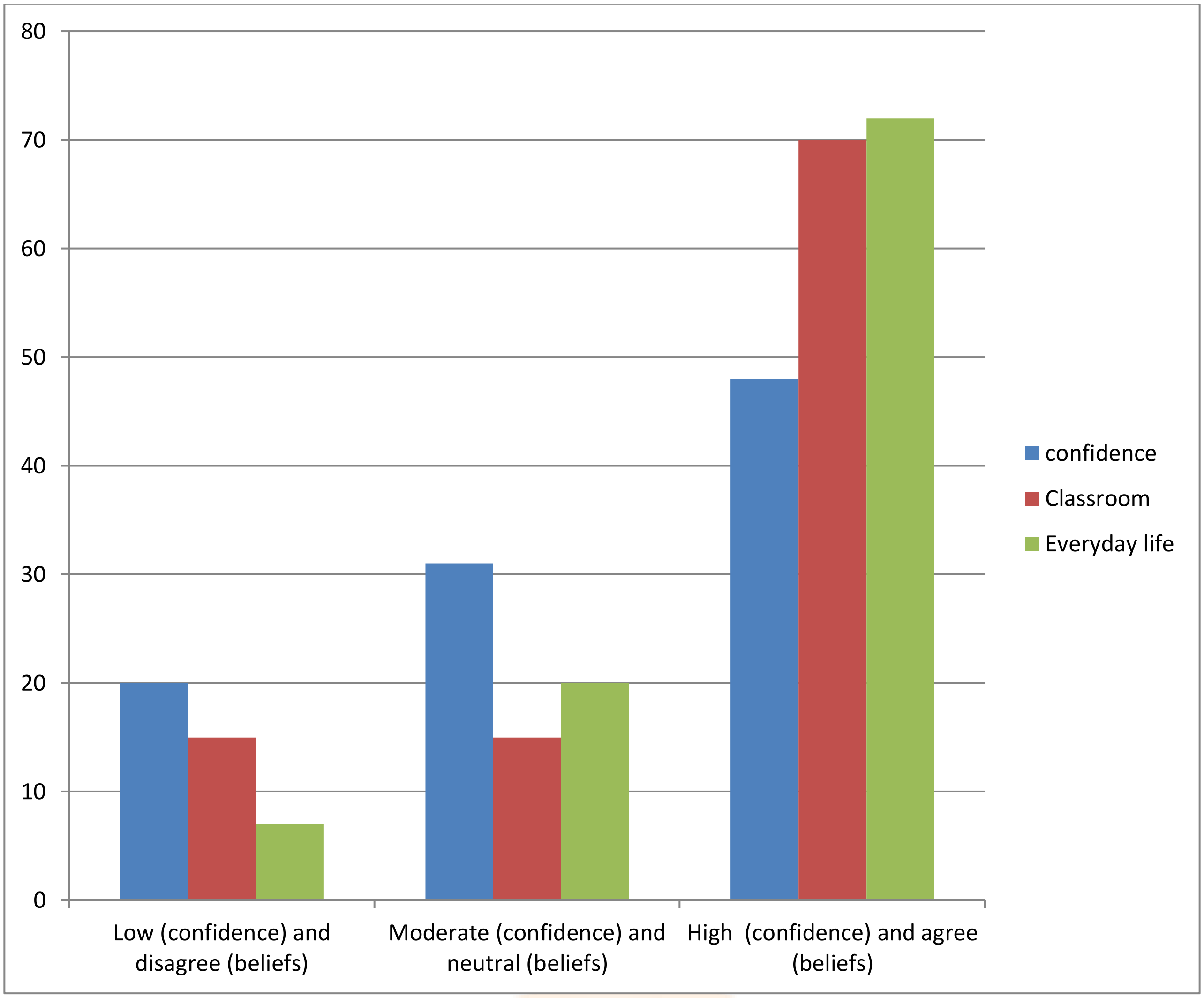


Overall findings regarding teachers' confidence and beliefs

In this section we present an overall picture of the teachers' confidence and beliefs about teaching and using mathematics and statistics. Tables 2, 3 and 4 show the individual mean scores and standard deviations to identify the topics about which the teachers are most confident. We next present the total image regarding their level of confidence and beliefs globally. Figure 2 indicates that 48% of the teachers expressed high confidence in teaching mathematics and statistics topics, while 31% of the teachers expressed moderate confidence and 20% of teachers expressed low confidence.

Figure 2 also indicates that 72% of the teachers expressed a high level of agreement that mathematics and statistics play an important role in our everyday life, whereas 20% of teachers stayed ambivalent and 7% expressed a negative belief. Figure 2 further indicates that 70% of teachers expressed positive belief that it is important to teach and learn mathematics and tatistics, whereas 15% did not say anything and 15% disagreed about the importance of teaching and learning mathematics and statistics

Figure 2. Overall representation of teachers' confidence and beliefs towards mathematics and statistics



We now consider in more detail the ordering of the items according to the teachers' endorsement. The application of a Rasch model allows one to represent the items hierarchically in order of difficulty, since with the analysis, the constituent items are hierarchically ordered in terms of difficulty level (Cavanagh & Waugh, 2011; Choi, 2014). As noted earlier, in this study the item location is interpreted in terms of whether teachers were confident in teaching the concept in the items. Since a lower location 10 in the Rasch analysis represents an easier item, the interpretation for confidence items is that low difficulty means high confidence. That is, if an item A is located at a lower location than an item B it indicates that teachers were more confident about teaching item A than they were about item B.

Figure 3 and Figure 4 present the Wright person-item map representing our data on teachers' confidence in teaching concepts in mathematics and statistics. A Wright map is a commonly used Rasch figure for simultaneously plotting both the item and person estimates on the logit scale. The thresholds are the points of equal probability of adjacent categories, while item difficulty D_i of item *i*, is the point where the top and bottom categories are equally probable, that is the "balance point at which the highest and lowest categories are equally probable" (Bond & Fox, 2013, p. 120). There are multiple thresholds for each item (because the items are polytomous), so we use a summary location (the overall item location) instead of multiple thresholds for each item, in the Wright maps of Figure 3 and Figure 4. The plot is divided down the center by a line, with the left side displaying a horizontal histogram of the person estimates and the right side displaying the items according to locations arranged from lowest to highest. The left-hand column locates the person measures of confidence along the variable. The shape of the distributions indicates variability among the mathematics teachers in terms of their level of confidence to teach mathematics and statistics concepts.

Figure 3. Item map for confidence in teaching mathematics concepts

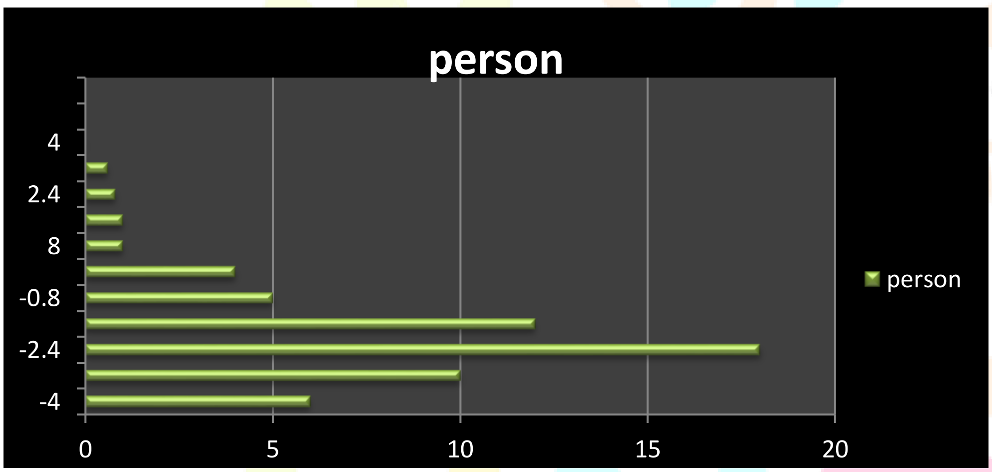
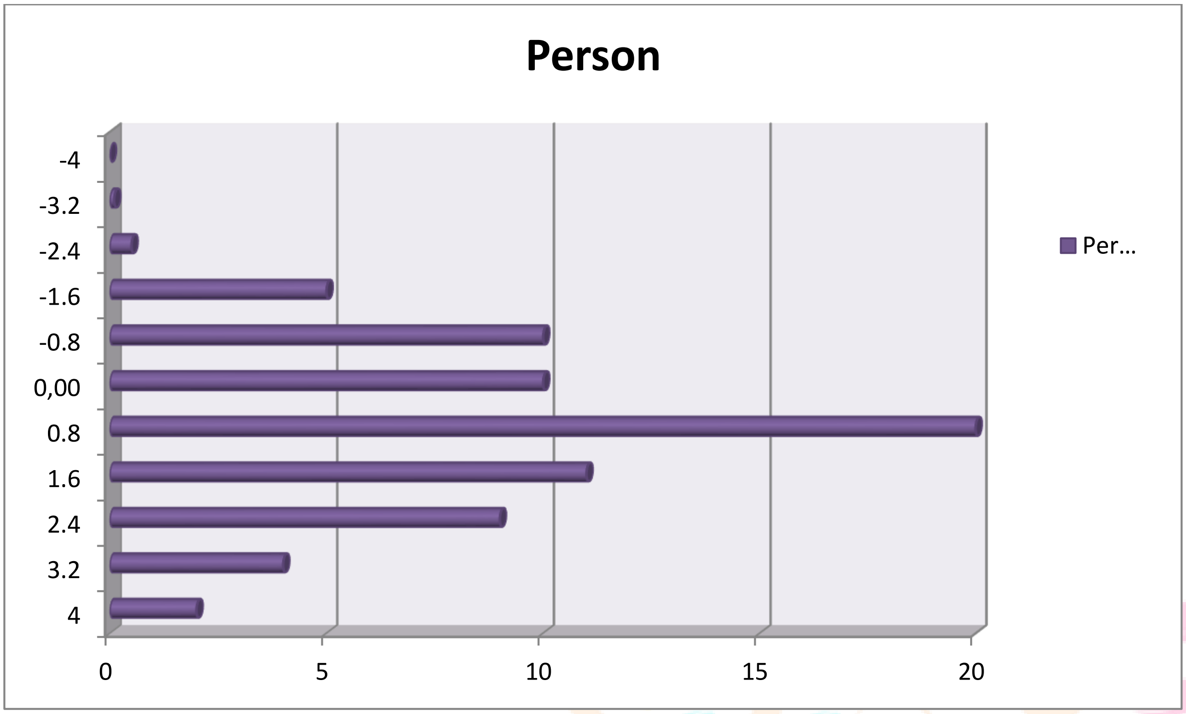


Figure 4. Item map for confidence in teaching statistics concepts and those which require connections



CONCLUSION

This paper reported on a study on teachers'confidence in their ability to teach most mathematics and statistics topics, their beliefs about their own use of numeracy and literacy skills in everydaylife, and their beliefs about teaching and learning mathematics and statistics in general with regard to confidence in teaching mathematics and statistics topics. The findings revealed that 8% of the teachers expressed high confidence, while 31% of the teachers indicated moderate confidence and 20% of the teachers expressed low confidence in teaching mathematics and statistics topics.Teachers who have a positive attitude about their role as teachers will help inspire their learners to develop confidence in mathematics and statistics.

REFERENCES

1.Beswick, K. (2007). Teachers' beliefs that matter in secondary mathematics classrooms. Educational studies in Mathematics
2. Xu, L. (2012). The Role of Teachers' Beliefs in the Language Teaching-learning Process. Theory and Practice in Language Studied
3..umsey, D. J. (2002). Statistical literacy as a goal for introductory statistics courses. Journal of Statistics Education, Schmidt,
4.Ben-Zvi, D., & Garfield, J. (2004). The Challenge of Developing Statistical Literacy, Reasoning and Thinking.Dordrecht Kluwer Academic.
5 www.stat.auckland.ac.nz/~iase/publications
6.http://www.creativewisdom.com/teaching/WBI/parametric_test.shtml.
7. http://publications.aare.edu.au/99pap/beg99082.html
8. https://commons.erau.edu/publication/1083

AKNOWLEDGMENTS:-

The autors whole heartedly acknowledge and thank all the authours and publishers whose content has been referred and cited in this research paper.