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Analyze The Problems That Learners And Teachers Encounter At The Early Levels Of Set Learning And Understanding Function

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ABSTRACT

Set learning and functions at early stages always pose a problem to the students while teaching as well the teachers to teach these mathematical expressions. The present study is an attempt to investigate and analyze the problem under discussion. For this purpose a sample of 40 students were taken from Swat district of KP, Pakistan. Questionnaire was utilized to collect the required data. The tool was first validated and reliability test was conducted which concluded that the tool is suitable for data collection purposes. Findings of the study show that students' majority face problem in the learning of set and understanding of function. Recommendations of the study are that teachers should use interesting teaching techniques for teaching of sets. They should teach types of sets in the early stages of students' learning.

Keywords: set, functions, geometry, conceptual foundation.

INTRODUCTION

Middle school is a bridge between concrete basic education and formal high school. Mathematical topics include matrices and determinants, real and complex numbers, logarithms, trigonometry, set and functions, ratio and proportion, and geometry.

The National Curriculum for Mathematics Grade I–XII (2006) covers these topics.

The programme helps students develop a firm conceptual foundation in mathematics to

apply their skills and succeed in subsequent studies.
The curriculum emphasises geometrical concepts and graphics to help students visualise and interpret mathematical expressions rather than blindly manipulate them. The curriculum recognises the advantages of contemporary technology for maths learning. Thus, it incorporates relevant technology to improve learning in an information-rich society.(2006 National Curriculum for Mathematics Grade I-XII)
Mathematics instruction emphasises knowledge and abilities, application and problem-solving, and environmental appreciation.
Students learn maths to prepare for life. They need information, abilities, and critical thinking. Mathematicians should encourage curiosity and problem-solving. Maths should inspire curiosity, confidence, and fun.

Knowledge and skills:
a) This is math subject knowledge. Students should master numbers and utilise them confidently.
b) A comprehension of spatial items related to size, area, or position linkages between forms, places, and ideas.
c) Measurement knowledge and capacity to estimate and measure.
d) Data collection, representation, and analysis.
e) Mathematical manipulation.

Application and problem-solving:
According to the Cockroft Report (1982:73), “Mathematics is problem-solving.” It adds that “the concept of investigation is fundamental both to the study of mathematics itself and also to an understanding of the ways in which mathematics can be used to extend knowledge solve problems in very many fields.”
Thus, students should be encouraged to use mathematical skills and investigative tactics to solve issues in maths, other subjects, and daily life.

Appreciation of the environment:
This means teaching maths in a way that encourages positive attitudes. Students should appreciate socio-cultural mathematical trends. They should use maths to solve local problems.
In today technologically advanced culture, math skills are vital.Our stores, businesses, industries, and sports employ mathematics.
Psychologists consider mathematics a "especially concentrated and powerful example of the functioning Human intelligence" (Harre & Lamb 1986:154).

OBJECTIVES OF THE STUDY
The study examined how Grade 10 instructors and students comprehend functions. The research examined Grade 10 instructors' and students' teaching and learning issues.

Objectives achieved this goal:

i. Understanding function requires previous information, ideas, and sub-concepts.

i. To assess student grasp of the aforementioned ideas;
ii. Function understanding assessment.
iii. To evaluate instructors' views of students, comprehending issues.
iv. Function-related content knowledge of instructors.
v. To determine whether instructors' subject knowledge affects students' function comprehension.

LITERATURE REVIEW

Function solving for many students. Verifying function questions needs numerous additional inset manipulation abilities. This section examines middle school learning set. Grade 10 students need subject knowledge and abilities. A detailed debate of how mathematical ideas are built in the knowledge that every student builds and what implications this has on the teaching of mathematics is looked into. Traditional methods of teaching and solving functions are evaluated and compared with a problem centered on constructivism. The author's experiences as a mathematics teacher and grade 10 yearly examination examiner informed the information above.

ALEGBRA

Algebra is "derived from the difficulties of Al-Jabr (literally, adding or multiplying both sides of an equation by the same thing in order to eliminate negative/fractional terms), which were paralleled by difficulties of Al-Muqabala (subtracting the same thing from or dividing the same thing into both sides)", according to Mason (1996:73).

This shows that algebra's definition was confined to question-solving. It's true that algebra has evolved from a technique to an object. In an attempt to define algebra, “Wheeler (1996:319) explains algebra as a pertaining to symbol system (its presence is identified by symbols), a calculus its use in computing numerical solutions to difficulties, and also as a representational system (it plays a major role in the mathematics of situations and experiences)”.

UNDERSTANDING SET AND FUNCTION

“A collection of well-defined distinct object is called a set,” whereas “function is a relation between output and input or function is a relation between domain and range” in mathematics.

Well-defined sets should explain which members are in them and which are not. The "cardinality" of a set is its number of elements. English capital letters signify sets. English alphabet little letters signify set members. Comma-separated set elements are curly bracketed.

Three ways to write a set are

1) Descriptive method

2) Tabular method
3) Set builder method

A set is described by a statement that clarifies each component. Set members write in braces in tabular style. Set builder uses symbols to define a set by specifying a characteristics attribute that identifies all its components.

Conceptual knowledge

Davis cited by Wessels (1990: 382) defines a mathematical notion as a set of meanings associated with a mathematical phrase. Cangelosi (1996:80) defines a notion as "a category people mentally construct by creating a class of specifics possessing a common set of characteristics".

Abstraction involves internalising some aspects of actual things or occurrences while ignoring others. Thus, an idea is a mental representation of anything.

Idea development entails building and reconstructing knowledge about the idea from instances and non-examples. "One important condition for the formation of a concept is that the individual must have a series of experiences that are in one or more respects similar; the constellation of'respects' in which they are similar constitutes the 'concept' that underlies them."

Number sense and Operations on Sets

“According to the Curriculum and Evaluation Standards of the NCTM (1989: 41), understanding of the basic operations, addition, subtraction, multiplication and division is central to knowing mathematics.”

Understanding operations here means being aware of their properties, including the order in which they should be used, being able to recognise relationships between operations, and understanding how operations affect numbers. Good operation sense allows learners to use operations meaningfully and flexibly and make intelligent judgments regarding results.

Symbols of sets and members of sets

Symbolic mathematics links mathematical knowledge. This language utilises letters, symbols, and sets.

Austin and Howson (1979) state that "mathematical symbolism in its now internationally accepted form is shorthand, the bulk of which has been devised by speakers of a few related language the use of this symbolism can accordingly cause considerable problems to those whose mother tongue has different structures" (Austin and Howson 1979-176) In order to use this formal mathematical language, learners must have a clear understanding of the related mathematical

RESEARCH DESIGN AND METHODOLOGY

Population of the Study

Since Grade 10 students in Swat study the subject, they were the target demographic. Functions are normally studied towards the conclusion of the school year or at the start of the next year. Ten District Swat high schools were studied. The researcher picked the schools because of their accessibility and solid relationships. Five of the schools are in Swat city, while the other five are outside the city but along the major road, making them conveniently accessible. The five sets of schools have similar physical and personnel resources, despite their diverse locations. Nearly all chosen schools have maths instructors. All 10 schools and all district high schools teach in English.

Sampling Technique and Sample of the Study

"In a survey research, the researcher must first identify the research population, after which data collection methods may then be used to gather information," says De Vos (2002:145).This research includes Swat district Grade 10 students. It was crucial to use a sample of this massive population. The target population is sampled. This group is trusted to deliver meaningful data as if it were the target population. Studying 10 schools. Random sampling selected 40 students from each school for the research. A random number table was employed. De Vos (2002:202) recommends a sample of 10% of each school's population. It was crucial to get data from Grade 10 maths instructors as the research investigated function understanding issues. The research included fifteen instructors, one to two from each school. Ten District Swat high schools were studied.

Questionnaire

Teachers and students had separate surveys. These were designed to assess instructors' and students' views on mathematics education, with a focus on pre-set ideas and function solving. The questionnaire assesses instructors' and students' Function content knowledge. Lickert scale responses. Each questionnaire concluded with an open-ended question for respondents to share their word problem-solving experiences.

Personal and General Information Rural and urban Areas

N = 400

Table 3.1

Parts	**Number**	**%**
Urban	210	52.0
Rural	190	48.0

52% of respondents were urban, 48% rural.

Age of respondents

N= 400

Table 3.2

Age	Number respondents	%
14 Years	50	**12.5**
15 Years	155	38.8
Over 15 Years	195	48.7

12.5%, 38.8%, and 48.7% of respondents were 15 or older.

SECTION A: Formulating sets.

Table 4.5 shows the distribution of answers on works in section A.

Table 4.5

ITEM\ OPTION	A	B	C	D	BLANK
1	5(1.3 %)	15(3.8%)	335(83.8%)	45(11.3%)	0 (0%)
2	10(2.5 %)	355 (88.8%)	30 (7.5%)	5(1.3%)	0 (0%)
3	200(50%)	105(26.3%)	55(13.8%)	35(8.8%)	5(1.3%)
4	20(5%)	25 (6.3%)	40 (10.0 %)	305(76.3%)	10(2.5%)
5	145(36.3%)	25 (6.3%)	65(16.3%)	155(38.8%)	10 (2.5%)

The highlighted digits show the right answers.

Most respondents were able to create correct statements in all five tests that tested learners' ability to develop set for written mathematical expressions. Questions 1, 2, and 4 had over 75% accurate responses, whereas questions 3 and 5 had 50% and 38.8% correct responses. The final two challenges featured intersection, and the student was unsure when to know singleton and infinite set. This is particularly obvious because options A and D, which both included components, are quite close. It's unexpected that B (26.3%) is the second most common answer to question 3. According to the literature research, students struggle to comprehend aspects.

SECTION B: Mathematical Language for expressions

Table 4.6 displays section B task answers. The activities assessed learners' understanding of mathematical terminology utilised in real-life function-solving issues.

Table 4.6

ITEM\ OPTION	A	B	C	D	BLANK
1	105 (26.3%)	15(3.8%)	260(65.0%)	15 (3.8%)	5(1.3%)
2	380 (95%)	0 (0%)	10(2.5%)	0(0%)	10 (2.5%)
3	50 (12.5%)	190 (47.5%)	130(32.5%)	10 (2.5)	20 (5.0%)
4	30 (7.5%)	80 (20%)	130 (32.5%)	155(36.3%)	5 (1.3%)
5	40 (10.0%)	175(43.8%)	180(45%)	5 (1.3%)	0 (0%)

Correct numbers are indicated.

This appears harder than portion A. 65% and 95% of reactants got questions 6 and 7 correctly, whereas fewer than 50% answered questions 8, 9, and 10. Correct and next-most-popular percentages are close.

Question 6's other A answer was 26.3% after the right choices C (65.0%). Parsing difficulty may explain this option. This hurdle makes students view union as collection instead of same or common. Alternative B (47.5%) outperformed the right alternative C (32.5%) for item 8. Most respondent's mistaken difference for components. Option A (12.5%) was chosen above option D (2.5%). Item 8 had the most blanks (5.0%). Answers to question 8 demonstrated that for some learners, "" stands for "and," while others work for greater because roughly the same amount of respondents chose others A and B, where B is the proper choice.

SECTION C: Operation on Sets

Tasks in this section were designed to test learners' ability to manipulate set expressions correctly.

Table 4.7 shows the distribution of subjects' responses to the tasks.

ITEM\OPTION	**A**	**B**	**C**	**D**	**BLANK**
11	155(38.8%)	10(2.5%)	60(15%)	**160 (40.0%)**	15(3.8%)
12	**190 (47.5%)**	65 (16.3%)	130(32.5%)	15 (3.8%)	0(0%)
13	155 (38.8%)	35 (8.8%)	**195(48.8%)**	10 (2.5%)	5 (1.3%)
14	35 (8.8%)	**185 (46.3%)**	125 (31.3%)	50 (12.5%)	5 (1.3%)
15	105 (26.3%)	**135 (33.8%)**	85 (21.3%)	70 (17.5%)	5(1.3%)

Correct answers are highlighted.

Respondents struggled with set operation. The responders got the right answers at a lower rate than in section A. 40% got item 11 right. D (40%) was the right answer,

followed by A (36.3%), the next most popular but erroneous choice. One responder demonstrated AUB's operation: AUB= {2, 4} Even though this worked well, it shows several union solution assumptions. The identical respondent identified A/ as a find expression for A/, whereas 38.8% of respondents chose {1, 2}. 'Cancelling' {3,4} yields option A, {1, 2}, for the same work. As said, element operations help learners grasp established procedures. 47.5% of respondents answered question 12 with A. Alternative C (32.5%). One respondent's work:

A= {1, 2, 3} B= {1, 2}

A∩B= {1, 2}

SECTION D: Solving Set and Function

This segment tested learners' abilities to answer real-life set and function word problems using easily available functions. Chapter 3's rubric determined each respondent's score. Task scores were shown in Table 4.8.

Table 4.8

ITEM\SCORE	0	1	2	3	4	5
16	**210 (52.5%)**	0 (0%)	5 (1.3%)	5 (1.3%)	20(550)	160(40%)
17	**375 (93.8%)**	0 (0%)	20 (5.0%)	0 (0%)	5 (1.3%)	0 (0%)
18	30 (7.5%)	**150(37.5%)**	40 (10.0%)	40(10%)	40(10%)	100(25%)
19	90 (22.5%)	55 (13.8%)	25 (6.3%)	35(8.8%)	30(7.5%)	**165(41.3%)**
20	75 (18.8%)	125(31.3%)	20 (5.0%)	0 (0%)	10(2.5%)	**170(42.55)**
21	35(8.8%)	10 (2.5%)	30 (7.5%)	0 (0%)	10(2.5%)	**315(78.8%)**

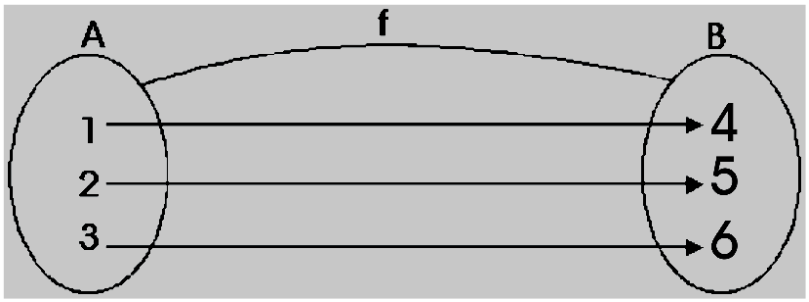
52.5% and 93.8% of respondents scored zero on real-life difficulties 16 and 17. 40% of respondents received 5 points on item 16, whereas none scored 5 on question 17. The 5% who received 2 points for item 17 did so as "benefit of doubt" (BOD) marks. Item 17 was the worst, maybe more complicated than item 16. The literature analysis showed that learners struggle with set operations. Students' most frequent incorrect attempt 16 question was {2, 3, 4}.Learners had to describe and rewrite real-life situations before they could solve them. Answers to these two questions show that this is hard work. The following questions 18, 19, 20, and 21 required subjects to solve the function. Zero-scoring responses declined dramatically here. Even respondents who received zeros on questions 16 and 17 earned 5 on some of the following items (18, 19, 20 and 21). Most responders earned 5 points on the later tasks.

Although items 18 and 21 have in function, question 18 needs knowledge about to discover function. Thus, respondent fared worse on question 18 than item 21. Only 25% of respondents received a 5-mark on question 18.

Item 21 responses were fascinating. According to the literature research, the learner does not appear to understand domain co domain and range in functions. Answers like:

A=
A function A to B was also found.
Some responders skipped unit A and B and performed inverse operations instead: AUB= {1, 2, 3, 4, 5, 6, 7}

Figure 4.7



Respondents utilised the learned union approach and mechanically solved the issue without understanding it.
Answers like
: AUB = {1, 3, 4, 5, 6, 7}
R_1= {(1, 4) (2, 5) (3, 6)}
R_1 is function.
Also revealed that the responder did not care to grasp the statement, merely applied the procedure carelessly and did not check whether the result made the original question true. This may indicate that learners cannot understand function statements. They don't grasp problem relations.
Items 19 and 20 include Cartesian products and binary relations on both sides of the equal sign. Item 19 had 22.5% zero scores, compared to 18.8% for item 20. It's odd that question 19, which 'seems' easier, was harder for responders. 50% of respondents scored up to 1 on this question, whereas 36.5% scored more than 1 on item 19. The creating function from binary relation from set A to set B was the most misunderstood. This produced:
A= {a, b} B= {1, 2, 3}
A×B ={(1,a)(1,b)(2,a)(2,b)(3,a)(3,b)}
f_1= {(1, a)(1,b)}
This shown that the verifying function has no significance. Again after a series of wrong operations, one respondent worked to AUB ={1,2} {1,2,3} and in attempt to make difference to the other side the new question was {1,2,3} but the next step the final answer AUB ={1,2,3} which would not perhaps be consistent with his interpretation

difference process {4,5,6,7} and not A to B difference process.

Synthesis

Learners' task replies show:

1. Identifying set is the hardest component of solving mathematical problems, as shown by respondents' performance on questions 16 and 17.
2. Students struggle to build set expressions using union and intersection.
3. Most students struggle with mathematical jargon, such as set conformation.
4. Set manipulations challenge students.
5. Students apply operations on sets they don't understand and receive erroneous answers.
6. Operations with constant numbers—especially negative numbers—are another source of learning in set.
7. Learners struggle with set builder form operations.

❖ Cancelling versus signs is tricky.

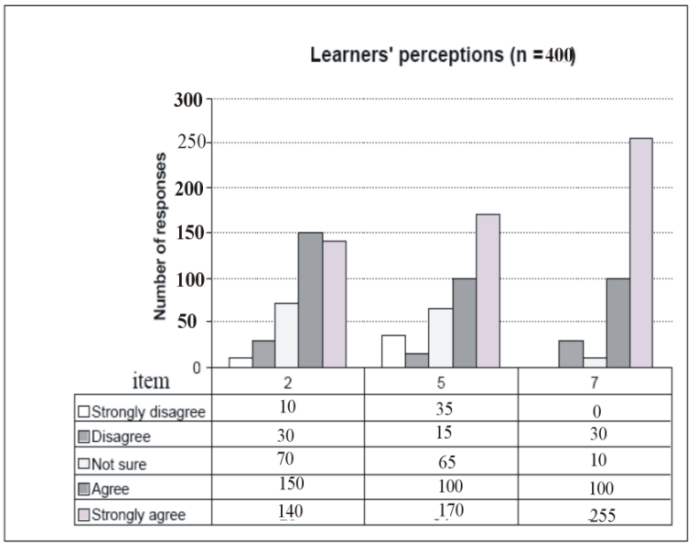
❖ Builder notation change signs are confusing.

Learners' Perceptions about Mathematics and its Teaching and Learning.

Statements that were intended to assess learners' perceptions on the nature of mathematics and what learning mathematics involves are:

2. All life activities involve mathematics
5. Mathematics is remembering data, laws, and methods
7. I enjoy solving mathematics if the teacher first demonstrates how to do it.

Graph 4.2



item	2	5	7
Strongly disagree	10	35	0
Disagree	30	15	30
Not sure	70	65	10
Agree	150	100	100
Strongly agree	140	170	255

Graph 4.2 shows how statements were answered.

72.5% of respondents recognised that all activities in our daily lives require mathematics, while 67.5% thought mathematics is about retaining facts, rules, procedures, and applying them to mathematical problems. If the instructor shows how to solve a problem, many (63.8%) like maths. The respondents' maths education may have shaped their views. Math teachers often provide a problem to students and demonstrate how to solve it. Then, trainees practise the skill on similar challenges. Respondents like maths. They solve maths by using the rules and procedures. This approach to maths education must be replaced with one that promotes comprehension. Math is best taught by letting students find the desired mathematical topic and acquire appropriate mathematical understanding.

Learners' Responses to the Open-Ended Question

The learners' questionnaire's last open-ended question allowed respondents to write on function-solving issues. Many views were offered here, though most focused on the prior inquiry.

Most respondents had trouble converting descriptive form to tabular form. Sometimes they don't comprehend what the query wants. Language is very complicated. "Changing descriptive form into builder form is difficult," stated one reply. Translating words to symbols is difficult. "When I am given a problem always experience problems in changing it into a builder form," one person said. If I could edit it appropriately, I could solve such a Venn diagram set." These responses merely corroborate the literature research.

Respondents' interpretation of elements and idioms is a recurring issue. One person said, "I find it difficult where I change tabular form to descriptive and [I] get stressed." At this level, some learners don't understand symbols and phrases. Another responder said he had trouble "giving answers mixed with letters and members," confirming that learners at this point should not answer in expressions.

As previously said, most of this questionnaire's results reiterate previous statements. Function solution requires cardinality and connection. Another issue is collecting similar items. One responder feels transferring element to another side of the issue causes complications since "It goes with its symbol." The multiple ways utilised to solve function questions make the procedure harder to grasp, according to the same responder. These imply that some learners see function solution as manipulating members and elements using meaningless rules and approaches. When learners receive components, rule of set, and procedures without meaning, this vision frequently arises.

The way a maths instructor teaches impacts student performance. Some respondents say their maths instructors care about their students' achievement, while others say they've developed a bad view of the subject due to how they're depicted, particularly when they don't comprehend. Some students monitored Polya's problem-solving tactics, which was intriguing. "I see the question to understand then verify the problem," wrote one function problem solver. I check my response. I recalculate whether the query is wrong."

Teachers' Responses to the Open-Ended Question.

In this portion of the questionnaire, participants were asked whether their students can easily answer function word problems that generate function. Following their initial response, participants were invited to examine the linkages between the difficulties and suggest ways to assist students develop problem-solving skills. Most (86.7%) respondents said learners struggle with function questions. 13.3% claimed their pupil could overcome such problems. Respondents said learners struggled to recognise ordered pairs, Cartesian products, and binary relations to solve functions. They say students may misunderstand the issue statement. They miss set-function linkages. However, respondents feel:

1. Solving function questions in every course may develop problem-solving abilities.
2. issue-solving skills should be taught to assist learners solve and analyse the issue before fixing it. Help students verify their answers.
3. Students will be better at answering function issues if they are exposed to them early in mathematics.
4. Class challenges should reflect students' daily lives. If so, students would comprehend the problem's tales and enjoy solving them.
5. Learning ordered pairs, Cartesian product, and binary relations helps students grasp function.
6. Students should work alone and in groups. They'll learn more by collaborating in groups. They might utilise reasoning to explain their solutions to peers.

Synthesis

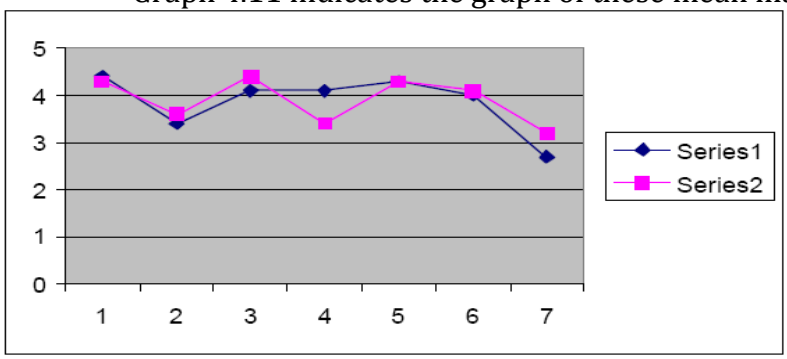
The instructors' questionnaire just repeated what was found in the learners' works and questionnaire. Teachers' questionnaire results: Participants typically behaved well while teaching maths despite learners' various difficulties. Some responders considered teaching set and function boring. Teachers are overworked because students struggle to understand set and function. Most defendants believed that teachers should teach students how to calculate function, but some believed that students should be allowed to use their own methods to solve mathematical problems and that discussing their methods would help them understand their strengths and weaknesses. Without enough abilities and ideas, function questions will always be difficult to grasp. Fundamentals include: Set number and fraction operations. This requires comprehension of the mathematical phrase operation order law. Mathematical brackets and set elements Mathematical set property understanding. Set notion and representation. Correct set symbols. Luck of comprehending building notation and symbol usage may also make set challenging for learners. Symbols include,,,, and. In a problem-based learning environment, students may guess, criticise, analyse broad circumstances, and apply logical reasoning to support and appraise their conclusions. Word difficulties from learners' everyday lives might help here. Teachers' content mastery of function question

ideas and sub-concepts is high. Teachers' understandings of ideas impact students' comprehension. Professional workshops are crucial for mathematics instructors and masters to share information, skills, and teaching experiences.

Comparison of the Responses from Teachers and learners

The judgment of the answers from the participating Teachers and learners was done using the mean scores of the answers.

Graph 4.11 indicates the graph of these mean marks.



key:
series 1: Teachers 'mean scores
series 2: learners mean scores

The graphic shows that the two graphs overlap, indicating that instructors and students have similar perspectives. Teacher response against.

FINDINGS

Test in this section were made to examine learners ability to identify the methods of representing a set.

1. There were 83.8% correct responses for item 1 which was about set builder notation form. It was easiest item and so the learners showed good position in this item. It was about background knowledge and concepts and sub-concepts about sets.
2. In item 2 were the easiest item which was about descriptive form of a set and learners were able to get 88.8% correct responses.
3. Item 3 and item 4 which were about null set and singleton set. In item 3 learner will able to marks 50% correctly and item 4 the learners were able to mark 76.3% right statements.
4. In item 5 test results showed that 38.8% students were able to understand the

concept of finite and infinite set.

5. In item 6 was less easy as compared to other items and only 65% learners were able to tick right statement and this was about intersection in two sets.
6. In item 7 was the easiest one and learner were able to get 95% right score in null set.
7. In symbols concept in set builder notation form only 47.5% learners got tick right option in item eight.
8. Item 14 had 46.3% correct answers. Item 14 might be changed from difference to intersection.
9. In item 10which were about complement of a set only 45% learners tick for right option. It was tough item for learners.
10. Only 40% and 47.5% of students got item 11 and 12's union and intersection answers right. Learners struggled with set operation. In item 14 only 46.3% respondents got correct answer which was about difference of two sets. Respectfully compared to other alternatives, this is low percentage.
11. In item 16 which was based on solving set and function only 40% respondents got 5 marks.
12. In item 17 only 40% got 2 marks and most of the respondent, poorly done. It was bout verification of De, Morgan's law.
13. In item 19 was about binary relation only 41.3% respondents got 5 marks.
14. Item 21 which was the easiest one and 78.8% respondents were able to get 5 marks and it was about one-one function.

CONCLUSION

This study examined and analysed Grade 10 students' and instructors' function understanding issues. The study found that students' conceptual and procedural understanding and the topic's teaching method caused issues.

Teacher content expertise also helps students comprehend the subject difficulty.

This includes background information and skills needed to understand function and content knowledge and skills learned while studying function.

1. Concept of a set, name of set and property of sets were problems for learners.
2. Type so sets, equal and equivalent sets were more difficult when solving sets.
3. Methods of representing a set and symbol which was used in builder notation form were very difficult when set in builder notation form.
4. Operation on sets, Venn diagrams Cartesian product and ordered pairs this refers to the background knowledge, concepts and sub-concepts for understanding function which were problems for learners to solving function questions.

5. Binary relation, domain and range of binary relation were important for five kinds of function seem problems for many learners.
6. The main problem for learners were verifying De Morgan's laws which sets in builder notation form.
7. The verification of the distributive properties of union over intersection and intersection over union also found very difficult for learners.
8. The learners were usually drill and practice on using to finding binary relation which involved domain in range of binary relation.
9. 9. Function was taught by drill and practise, not problems-based discovery learning like the present mathematics curriculum revisions.
10. 10. Lack of topic expertise may lead teachers to employ drill and practise.
11. 11. Research showed that five-function problems are harder for students.
12. 12. Learners struggled with domain, co-domain, and range of a function, which is crucial for addressing function problems.
13. Difference between one-one correspondence and one-one function were mere tough for many learners and did not understand paired elements well.
14. Domain and range of binary relation which involve the set of first set elements and the set of second elements of all ordered pairs were also problems for leaners.
15. Into and one-one function (subjective) were also difficult for learners.

RECOMMENDATIONS

Following are the recommendations for practice and policy makers;

1. The findings shows that the students were having difficulty in representation of sets therefore teachers must focus on this particular aspect and should make the teaching method interesting for representation of the sets.
2. The finding show that the learner were having problems to find set which are finite sets infinite sets therefore teacher must show types of sets in the early level in the teaching and learning of set.
3. The finding show that learners were having obstacle operation on sets therefore teacher should pay more attention on different operation on sets and methods operation on sets and make method operation on sets easy.
4. The finding show that the learners were having problems methods representing of sets therefor teacher have must the learner to develop representation of a in three different methods.
5. The finding show that the learners were having difficulty in solving De, Morgan's law therefor teacher must show properties of union of two sets and intersection of two sets and should make more interesting to verifying the De, Morgan's law.
6. The finding show that the learner where encounter problem when they solving

binary relation of two non-empty sets therefore teacher must focus on the solution of order pairs and Cartesian product and should make the solution of binary relation more interesting.

7. 7. The findings show that teachers have limited content knowledge on concepts and sub-concepts underlying function and different kinds of functions, so they should participate in in-service workshop training to gain more insight into the subject they teach.

8. The findings suggest that valuable student contributions should be treated more positively and acknowledged.

9. Students may acquire problem-solving methods.

10. Students need relevant issues that demand varied techniques.

11. Therefore, teachers should take refresher courses to stay current in maths education.

12. In-service education and training helps teachers improve their teaching.

13. School maths teachers may organize meetings with the support of the Head of Departments to discuss their successes and failures.

14. They may also be meeting with neighboring maths instructors to discuss ideas and practices.

15. National workshops, seminars, and conferences allow instructors to join a wider maths education professional community.

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