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Teaching of mathematics: A comparative analysis of secondary school certificate (grade x) and general certificate of education (o-level) courses of studies in Karachi

Muhammad Akhtar *, Ahmad Saeed

Hamdard Institute of Education and Social Sciences, (HIESS) Hamdard University, Karachi, Pakistan

Abstract: The important aim of school education is the development of cognitive domain of learning and within this domain; development of thinking skills (especially higher order thinking skills) is the most important goal of school education. Mathematics is a subject that can develop these cognitive faculties but the level of attainment depends on the way it is taught. Research in this area has shown that students' achievement level in mathematics is low as compared to other subjects. They perform better on those items in which memorization of facts are required whereas their performance is poor on the items requiring comprehension and skills of problem solving. It is therefore very important to have an in depth study of the ways mathematics is taught in our schools. The purpose of this study was to identify weaknesses and to find measures for raising the standard of mathematics education in the Pakistani system of studies (SSC). To achieve this purpose SSC system has been compared with its internationally recognized counterpart the GCE (O-Level) system in this study. The design of study is descriptive in nature. The data were collected from a sample of 250 schools through questionnaires for teachers (N=300), students (N=200), semi-structured interviews for the subject experts (N=20) and a comparative content analysis of question papers (1994-2013) of the examination boards of both the systems. The data collected through questionnaires were analyzed using t-test whereas the data collected through interviews and comparison of contents of the exam papers were analyzed qualitatively. Findings of the study revealed a clear difference in the assessment schemes of SSC and GCE systems of studies. GCE system was found assessing understanding of abstract mathematical concepts and their use to solve real-world problems from different perspectives whereas assessment in SSC system was not found going beyond students' mechanical ability of applying basic formulae and procedures to routine problems. The pattern, nature and purpose of assessment were found entirely different in these systems. The objectives of teaching/learning and approaches taken by teachers and students to achieve these objectives were also found significantly different. The study recommends drastic reforms in the SSC assessment system through the inclusion of constructed-response questions, giving a suitable number of application-based real-world problems to assess deep understanding of the concepts, giving unseen questions only as assessment items, curbing the approaches of selected-content teaching/studying and discouraging the trend of memorization of mathematical contents.

Key words: *Cognitive domain; Thinking skills; Mechanical ability; Real-world problems; Content-focused approach*

1. Introduction

Secondary school education is one of the important stages in the overall educational career of students. It provides a strong base for entering into higher secondary education with appropriate knowledge and skills or act as a terminal stage for those seeking employment. Quality secondary education is thus vital for a successful future, both at an individual and national level. In this regard, the importance of mathematics as a compulsory subject at the secondary school level is well acknowledged internationally, (Sharma & Sharan, 2008; Ediger & Rao, 2006). This subject contributes to the development of cognitive, affective and psychomotor faculties of students, but the extent to which it does so depends upon the way it is taught (Cockcroft Report, 1982).

Educationists agree that one of the fundamental aims of mathematics education is training of the mind (development of cognitive domain) (Bruhlmeier, 2010; Sidhu, 2008; Sharma, 2007; Taneja, 1990). Gagne (1985) agrees with this point of view and asserts that the most important area of school learning is the cognitive domain and within the cognitive domain, he focuses on thinking skills (Martin & Briggs, 1986).Therefore, the chief target of mathematics education in schools should be to develop thinking skills among students, but there are many ways of thinking. Hence the primary goal of mathematics education should be to develop thinking habits in students to enable them tackle abstractions and to induce problem solving skills in them (NCERT, 2006).

The cognitive domain is concerned with mental abilities of a learner and it deals largely with information and knowledge. It is further divided into six major categories proceeding from lower order to higher order thinking skills : knowledge (recall), comprehension (understanding), application (using knowledge in new situations), analysis (breaking things down/critical thinking), synthesis (putting things together/ creative thinking), and evaluation (judgment) (Bloom & Krathwohl, 1956).

The capability of having knowledge of contents (facts, principles, procedures and concepts) is 'information learning' which is a part of lower order thinking skills unless knowledge is applied in variant situations (Crowl, Kaminsky, & Podell, 1997). Application of knowledge in a new context is a higher order thinking skill. Application means the use of meaningful information such as abstractions, formulae, equations and algorithms in new situations (Bloom, 1956; Kauchak & Eggen, 1998; Mc Devitt, 1993). Problem solving skills are the capabilities through which an individual can solve a problem, without knowing the course of action needed to solve it in advance (Schooler, Fallshore, & Fiore, 1995). These problems need insight solutions (a sudden and new strategy for solution). Insight solutions require analysis, synthesis and evaluation (higher order thinking skills) while non-insight solutions require comprehension and application only (lower order thinking skills) (Bloom, 1956). In modern education systems, teaching is largely focused on developing thinking skills especially the skill of problem solving among students (Rani, 2008; Stacey, 2005; Lesh & Zawojewski, 2007). Mathematics is taken as the core of all subjects in the school curriculum in Asian countries like China (Li, 2008; Fan, 2004), Singapore (Soh, 2008) and Japan (Yoshikawa, 2008) because this subject is very effective in developing thinking skills and the focal point of educational objectives of mathematics teaching is the development of higher order thinking skills in the students.

Examination is an integral part of education and it is the nature of assessment in the examinations that determines the direction of the educational activities of the classrooms (Lianghuo, 2004). It is a fact that every student wants to perform well in the examination, so as a general practice, students learn in accordance with the nature and pattern of previous examination papers. Teachers also want good performance so both try to adopt approaches which can provide them with better results. However, if the assessment measures the basic content knowledge or lower order thinking skills only, all the educational activities of teachers and students will revolve around developing these capabilities (De Lange, 1999). Thus, if we want students to investigate, explore and discover, assessment must not measure just mimicry mathematics. This means that if we want to enhance the standards of mathematics education, we have to improve the standards of assessment.

Two parallel systems of formal school education operate in Pakistan: the local SSC (Secondary School Certificate), and its international counterpart, GCE (General Certificate of Education) system. SSC (matriculation) is equivalent to GCE (ordinary level). GCE is a very prestigious, internationally recognized qualification (Umbreen, 2008). It is a common perception that these two systems are creating a clear discrimination between students. By and large, GCE schools are expensive and only children of privileged class can afford to study in this system. SSC schools are generally affordable; therefore this system provides education to majority of the students.

The studies conducted in Pakistan reveal that in SSC schools, mathematics is not taught as its nature demands (Sheerazi, 2000). There is dissatisfaction among students, teachers and experts of the subject about the way mathematics curriculum is taught in our schools (Arif, 2010; Naeemullah, 2007).The students' achievement level in this subject is low as compared to other subjects. Students normally perform better on items which require memorization of facts whereas their performance is poor on items requiring comprehension and problem solving skills (Das, 2006). Tayyba (2010) supports this outlook and asserts that students attempt those questions which require simple mathematical skills and low rigor level confidently. In his study, Arif (2010) reveals that SSC curriculum does not produce higher order thinking skills in students and class activities are not linked with curriculum objectives. Teachers mostly transfer factual and procedural knowledge to students. Textbook contents are transmitted to students and their precise replication is expected through assessments (Amirali & Halai, 2010). Textbooks contents contain appropriate knowledge of mathematical rules and procedures but a number of content areas are skipped by the teachers (Perveen, 2009). This encourages the approach of selected-content study. Also, students start memorizing the contents instead of understanding the concepts and the inquiry process (Tahir, 2005).The higher levels of cognitive domain are not involved in the activities of mathematics in our schools (Mustafa, 2011; Sheerazi, 2000).

GCE is an internationally recognized system of education with high standards but education in this system is also provided by the local teachers. Teachers teaching in the GCE system are largely a product of the SSC system themselves, who mostly use the direct instruction (teacher-centered presentations of information) method for teaching in classrooms of both the systems. But how in the GCE system, they provide education of international standards? This study was conducted to answer this question by identifying the significant differences in the two systems. The study critically compares the key features of the two systems, focusing on the objectives of education, the approaches taken by teachers to teach the curriculum and the approaches of students to prepare for their examination. The study also compares the contents of question papers of the two systems, in order to identify the differences, explain the reasons for these differences and to find measures for the improvement of teaching and assessment in the SSC system.

1.1. Research questions

Following were the main research questions of this study:

1. How are the educational objectives of mathematics curriculum in GCE and SSC different?
2. How are the approaches of teaching and assessment different?
3. What is the significant difference in the contents of question papers?
4. What are the fundamental reasons for the differences and their relationships with each other?

1.2. Subsidiary research questions

1. How far are the educational objectives balanced within the cognitive domain in both systems?
2. What are the consequences of difference in educational objectives in both systems?
3. What are the approaches of teachers and students towards learning and assessment?

2. Methodology

Research Design: The study was conducted under descriptive research design. The strategy of research was mixed method research approach.

Population and Sample of the Study: Population was comprised of teachers and students in 5812 (public/private) secondary schools of SSC system (Board of Secondary Education Karachi, 2012) and 130 schools of GCE (O-Level) system in Karachi (http://www.britishcouncil.pk). Stratified random sampling design along with purposive sampling design was adopted and a sample of 250 schools (SSC: 180 &GCE: 70) was drawn from five districts of Karachi. Overall 300 teachers (grade-10: SSC=180 + grade-11: GCE=120), 200 students (grade-10: SSC=120 + grade-11: GCE=80) and 20 subject experts (teaching experience: SSC/GCE > 15 years) were selected from these schools.

Research Instruments: Questionnaires for teachers/students were used as research instruments.

Procedure of Data Collection: The researcher collected data through personal visits of schools. After taking the consent from the principals of participating schools, semi-structured interviews of 20 subject experts were conducted and the questionnaires from teachers and students got completed and collected.

Data Analysis: The analysis and interpretation for the comparison of the responses of the two groups was done using t-test. The data collected through interviews of the subject experts were analyzed qualitatively. The contents of textbooks and question papers of the past 20 years (1994-2013) of the examination boards of both systems were critically compared and analyzed.

3. Results

The research findings of this study are based on the responses of teachers, students and subject experts against the items of questionnaires given to them. The issues derived from the contents of the question papers of the examination boards (Board of Secondary Education Karachi/Cambridge International Examinations) of both systems (SSC/GCE) is another basis of the findings and a source of evidence for discussion.

Objectives of mathematics education

The educational objectives of teaching mathematics in SSC/GCE system can be summarized as:

i) Knowledge of contents, procedures and relationships (concepts).
ii) Application of attained abstract knowledge in real-life situations.
iii) Development of problem solving skills.

3.1. Knowledge of contents, procedures and relationships

A summary of the analyzed results of the responses of teachers and students on the statement that acquisition of content and procedural knowledge is the major objective of mathematics education is given in the following table.

Table 1: Acquisition of knowledge (contents, procedures and relationships)

Respondents	*Systems*	*N*	*Mean*	*SD*	*A*	*UD*	*D*	*t-value*
Teachers	SSC	180	4.33	0.861	92%	2.5%	5.5%	0.549**
	GCE	120	4.38	0.715	93%	04%	03%	
Students	SSC	120	4.34	0.881	89%	08%	03%	1.257**
	GCE	80	4.48	0.561	90%	03%	07%	

df = 298 (teachers) , df =198 (students)
tabulated value of ‘t’ at 0.05 is 1.960

Table 1 illustrates that there is no significant difference between the opinions of teachers in both systems on provision of knowledge (contents, procedures and relationships) as their major objective of mathematics education. Students of both the systems (SSC: 89% & GCE: 90%) are also in favor of acquisition of knowledge as their main learning objective.

The analysis of interview results revealed that 90% of SSC and 60% of GCE subject experts agreed that provision of mathematical knowledge for furthering the education of this subject is one of the major objectives of mathematics teaching.

SSC experts disclosed that majority of teachers are not aware of the expected outcomes of the national mathematics curriculum. Their main objective is performance (high grades of students in mathematics) by any means. GCE experts (40%) also acknowledged that performance in examination is the major objective of teachers.

3.2. Application of attained abstract knowledge in real situations

A summary of the analyzed results of the responses of teachers and students on the statement that application of attained abstract knowledge in real-life situations is the major objective of mathematics education is given in the following table.

Table 2 indicates that there is a significant difference between views of teachers as well as students of the two systems on the statement that application of knowledge in real-life situations is the objective of mathematics education. It is clear from Table 2 that application of knowledge in different real-life situations is relatively much higher in GCE system than the SSC system. The analyzed interview results confirm that the application of abstract mathematical knowledge to solve real-life problems is not the objective of education in the SSC system. 40% of SSC subject were in the favor of this objective and recommended increasing word problems in the curriculum while 100% of the GCE experts declared it the real objective of mathematics education.

Table 2: Application of attained abstract knowledge in real-life situations

Respondents	*Systems*	*N*	*Mean*	*SD*	*A*	*UD*	*D*	*t-value*
Teachers	SSC	180	3.34	1.092	54%	17%	29%	3.275*
	GCE	120	3.72	0.922	73%	15%	12%	
Students	SSC	120	3.04	0.951	47%	26%	27%	5.493*
	GCE	80	3.08	1.351	85%	05%	10%	

df = 298 (teachers) , df =198 (students)
tabulated value of 't' at 0.05 is 1.960

3.3. Development of problem solving skills

A summary of the analyzed results of the responses of teachers and students on the statement that development of problem solving skills is the major objective of mathematics education is given in the following table.

Table 3: Development of problem solving skills

Respondents	*Systems*	*N*	*Mean*	*SD*	*A*	*UD*	*D*	*t-value*
Teachers	SSC	180	3.22	1.057	51%	17%	32%	6.311*
	GCE	120	3.87	0.724	80%	14%	06%	
Students	SSC	120	3.34	1.291	56%	18%	16%	2.517*
	GCE	80	3.81	1.041	88%	04%	08%	

df = 298 (teachers) , df =198 (students)
tabulated value of 't' at 0.05 is 1.960

Table 3 shows that there is a significant difference between the responses of teachers as well as students of both systems on the question that development of problem solving skills are the objective of our teaching. The results reveal that GCE system takes problem solving as its objective of teaching while the SSC system lacks in this domain. 20% of GCE subject experts suggested increasing the contents on problem solving whereas 70% of the SSC experts suggested updating the curriculum completely.

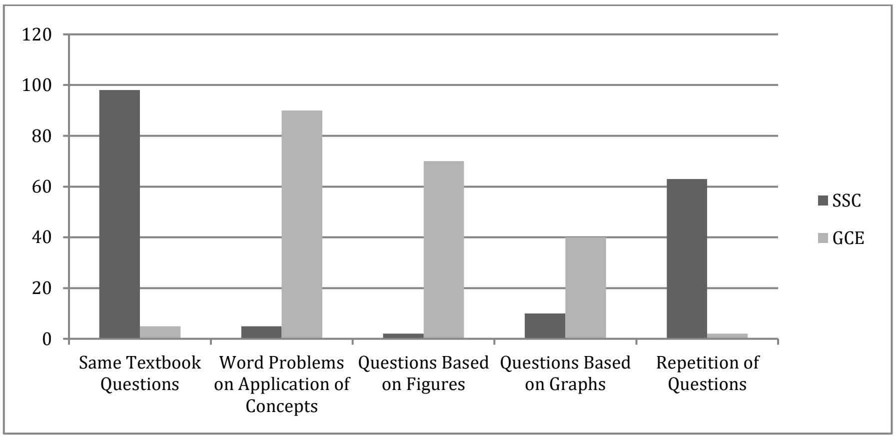
4. Content analysis of question papers

Under Board of Secondary Education Karachi (BSEK), the students of SSC Part-I (General Group) have to take a compulsory paper of General Mathematics of 100 marks whereas the students of Science Group do not take any mathematics paper in SSC Part-I. Science Group students take their mathematics paper worth 100 marks in SSC Part-II. This paper consists of three sections: Section-A: comprising 20 MCQ'S (20 marks), Section-B: containing 15 short questions (out of which 10 questions are required to be solved) carrying 50 marks, Section-C: consisting of 5 detailed-answer questions out of which 3 are required to be solved (30 marks). The use of scientific calculators is not allowed in this paper. GCE mathematics is a compulsory course to be taken by all students. It consists of two papers: paper-I (80 marks) and paper-II (100 marks). Paper-I contains 25 questions on average, all of which are required to be solved. Each question is discrete in carrying marks and the use of calculator is not allowed. Paper-II consists of 11 questions, 7 in Section-A (52 marks) and 5 in Section-B (48 marks). All questions from Section-A are required to be attempted while in Section-B, 4 out of 5 questions are required to be solved. The data collected through the comparison and critical analysis of the question papers of both systems was summarized and is presented in the following graphs for the convenience of reader.

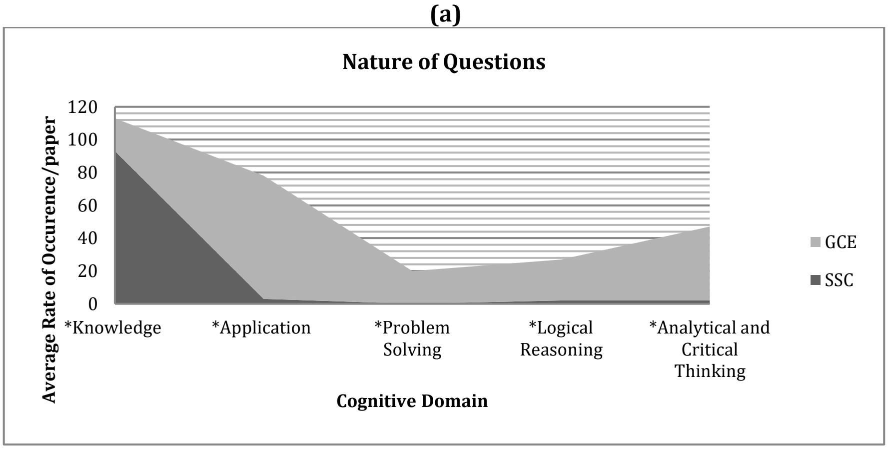
5. Approaches of teaching and learning mathematics

5.1. Approaches of teaching

Table 4 illustrates that there is a divide between the teachers of the two systems on the approaches of teaching. No significant difference was found on the content-focused approach (with an emphasis on performance) but teachers differed significantly on the content-focused approach if emphasis is placed on understanding. The approach of teaching, focusing the requirements of the class is significant while teaching with a focus on the needs of learner is non-significant. These results indicate that there is a significant difference between the opinions of teachers on the approaches of teaching mathematics. 60% of GCE subject experts recommended the approach of focusing the basic concepts and practicing their application in different situations preferably by mental calculations whereas 85% of SSC experts recommended the approach of rigorous drill.



(a)



(b)

***Knowledge** = Knowledge of formulae, procedures and relations (concepts); ***Application** = Application of abstract knowledge in a different context; ***Problem solving** = Solution of a problem by insight for which no standard procedure is available; ***Logical reasoning** = Solution of a problem on the basis of a sequence of sound and consistent justifications; ***Analytical and critical thinking** = Solution of a problem that involves breaking of given information into parts to distinguish between facts, to recognize the relationships, to diagnose the organizational principle of the given data to retrieve information and to use it in selecting the procedure with a balanced criticism.*

Fig. 1: Results of comparative content analysis of question papers based on (a) pattern (outline) of papers (b) nature of questions and their frequency

5.2. Approaches of learning

Table 5 shows that there is a significant difference between the views of students on the selected-study approach but there is no significant difference between them on the approach of comprehensive study. The analysis of responses of subject experts reveals that 90% of GCE experts and 70% of SSC experts discouraged the selected study approach of students.

6. Discussion

By and large, provision of mathematical knowledge (formulae, procedures, concepts) is the common objective of teaching in both systems (Table 1) but the analysis of the responses of SSC subject experts (90%) indicate that the overall focus of SSC system is on imparting knowledge of mathematical algorithms. The analysis of past exam papers also revealed that only textbook questions are given in SSC papers (Graph 1a). It means that precision in the recall of learned content is the prime objective of assessment. These findings verify the results of a study by Amirali & Halai (2010) who concluded that SSC assessments largely assess content and procedural knowledge of mathematics. The capability of having knowledge of contents is called 'information learning' which is a part of lower order thinking skills (Crowl et al., 1997). It means that mathematics in the SSC system develops lower order thinking skills only.

Application on the other hand is the use of meaningful information in new situations (Bloom, 1956; Kauchak & Eggen, 1998; Mc Devitt, 1993).

There is a significant difference between the two systems on the application of knowledge (Table 2). During review of past papers, application-based questions were rarely found in SSC papers whereas a GCE papers contained a significant number of application-based questions (Graph 1b). The results of a study by Mustafa (2011) indicated that in SSC textbooks, abstract mathematical concepts are emphasized rather than focusing on applied and real-life integrated activities. The findings of this study also confirm the findings of Sheerazi (2000) who concluded that SSC exams do not measure application skills. It authenticates that application of knowledge in different real-life contexts is not the objective of teaching in the SSC system.

Table 4: Showing Analyzed Results of Significant Approaches

Approaches	*teachers*	*N*	*Mean*	*SD*	*A*	*UD*	*DA*	*t- value*
Content-Focused *(with an emphasis on understanding)*	SSC	180	4.10	0.894	87%	4%	9%	3.256*
	GCE	120	4.38	0.640	93%	5%	2%	
Content-Focused *(with an emphasis on performance)*	SSC	180	3.93	0.958	80%	4%	14%	1.140**
	GCE	120	3.80	0.971	78%	7%	15%	
Classroom-Focused	SSC	180	4.08	0.879	85%	5%	10%	3.103*
	GCE	120	3.72	1.043	68%	12%	20%	
Learner-Focused	SSC	180	4.25	0.591	95%	0%	5%	1.445**
	GCE	120	4.13	0.796	87%	7%	15%	

df = 298
tabulated value of 't' at 0.05 is 1.960

Table 5: Showing Analyzed Results of Significant Approaches of Students

Approaches	*students*	*N*	*Mean*	*SD*	*A*	*UD*	*DA*	*t- value*
Selected Study *(with a focus on practice)*	SSC	120	3.02	1.375	48%	33%	19%	3.000*
	GCE	80	2.49	1.158	25%	32%	43%	
Selected Study *(with a focus on memorization)*	SSC	120	2.88	1.164	38%	23%	39%	4.459*
	GCE	80	2.18	1.041	18%	22%	60%	
Comprehensive Study *(with a focus on practice)*	SSC	120	3.91	1.188	38%	42%	20%	0.121**
	GCE	80	3.80	1.114	78%	8%	14%	
Comprehensive Study *(with a focus on memorization)*	SSC	120	2.42	1.185	22%	0%	59%	0.723**
	GCE	80	2.30	1.130	24%	6%	70%	

df = 198
tabulated value of 't' at 0.05 is 1.960

The two systems have a significant difference on the development of problem-solving skills as demonstrated in Table 3. A problem solving item is a question in which an individual does not know the course of action needed to solve it beforehand (Schooler, Fallshore, & Fiore, 1995). These problems need insight solutions that require higher order thinking (analysis, synthesis and evaluation) (Bloom, 1956). Results of content analysis, given in Graph 1b, show that SSC papers do not contain questions to be solved using problem solving skills. The results of studies by Perveen (2009) and Das (2006) are also consistent with the results this study. GCE papers on the other hand, have a significant proportion of items on problem solving. It affirms that as opposed to GCE, development of problem solving skills is not the center of attention in the SSC system.

As far as the approaches of teaching/learning are concerned, there was no significant difference between teachers of the two groups on content-focused approach (geared at good performance in the examination) (Table 4). However, teachers differed significantly on the same approach for the purpose of understanding (Table 4). Teachers significantly differ on classroom-focused approach (i.e. teaching on the basis of requirements of the class) while they have no significant difference on learner-focused approach (i.e. teaching with a focus on the needs of learner) (Table 4).

GCE students (78%) expressed their agreement on the comprehensive study approach (if focus remains on rigorous practice). Results of content analysis illustrate that items of GCE question papers are not the same textbook questions and there is a very limited choice of questions (P-I: 25 out of 25 and P-II: 10 out of 11). In addition neither a prominent pattern nor any significant repetition of questions was identified (Graph 1a). It means that in the GCE system, comprehensive study through rigorous drill is required in order to achieve good results and simple memorization of facts and algorithms does not work. The findings of a study by Perveen (2009) are also in accordance with these results.

SSC students (48%) expressed their agreement on the selected-study approach with practice (Table 5). Results of content analysis show that the items in SSC question papers were taken from the textbook. Moreover, a plenteous choice to select a question (13 out of 20) in the paper was found. In addition, a fixed pattern of sectioning and repetition of items was identified (Graph 1a). It means that in the SSC exams, selected-content study (learning of important contents/algorithms and practicing them until over learned) can give better results than the comprehensive study. Kiyani (2002), Naeem (2011) & Arif (2010) also identified weaknesses in the examination system of SSC and recommended improvement in the quality of questions papers. Findings of these studies are also in conformity with the results of this study.

7. Conclusions and recommendations

On the basis of analysis of data and findings of the study, we can conclude that excluding the fundamental objective of teaching (i.e. provision of knowledge for furthering the education of mathematics) the major objectives, approaches of teaching/learning and nature/patterns of assessment are significantly different in the two systems. SSC examinations primarily assess the content knowledge (i.e. knowledge of formulae/principles/properties and steps of procedures for solving different questions). Items of assessments do not assess application of knowledge in different contexts (variant situations). All the items are taken from the textbook without any change. Since students have solved these textbook questions prior to the exam, these items can be attempted using the conventional three-step strategy: recognition, recalling and reproduction (three R's). These well familiar items do not demand use of higher mental functions for their solution. SSC teachers, thus, mostly teach algorithms to solve sums as discrete learning units that can be easily recognized and differentiated from other units. They also leave specific content areas of the syllabus untaught. And, this is done for the following two major reasons:

(i) SSC papers have a definite and consistent pattern of items from specific content areas.
(ii) A plenteous choice of questions is given in the papers that allow teachers to leave some contents untaught.

With this approach, important contents are taught and tested again and again until over learned and students start solving sums mechanically (easily, correctly and consistently). SSC papers do not contain problems that require insight solutions (problem solving strategies). This indicates that development of problem solving skills is not the key concern of mathematics education in this system.

GCE examinations assess application of knowledge in different real-life contexts. Textbook questions are not given in the assessments. Original and novel items are constructed for exams each year. Consequently, teachers have to develop deep understanding of students about abstract mathematical concepts so that they can apply it to solve real-life problems from different perspectives. The items of papers are also mostly such real-world problems that assess higher order thinking skills (analysis, synthesis and evaluation). These papers have an appropriate proportion of items on problem solving as well. Thus, teachers have to teach heuristics (strategies) to solve these problems. The entire syllabus is taught because papers contain items from all areas of the syllabus. Although the content-focused approach of teaching (with an emphasis on performance) is common in both systems, however it takes two different routes when teachers apply it in these two systems. SSC teachers with content-focused approach generally prefer selected-content teaching, whereas GCE teachers have to go through in-depth teaching, as their assessment systems demand accordingly.

By comparing salient features of mathematics education of the two systems, the study concludes that SSC system assesses students in a way that encourages a mechanical rather than a conceptual understanding of the contents. The items of question papers assess students' mechanical ability of applying basic formulae and procedures to routine problems, but they do not assess their deeper understanding of the concepts. As a result, SSC system is producing students who are learned to mechanically apply mathematical procedures in solving routine problems but they are not mathematically competitive with the students of GCE system.

In the light of the drawn conclusions, it is recommended that the examination system of SSC be improved. Specifically, rigidity in the design i.e. a fixed model of items, a permanent position of items in the sections of paper, a predetermined choice to select the items, a consistent and successive repetition of items should be reduced. No textbook question should be given in the papers without changing its context. Application-based real-world problems that assess higher order thinking skills should be included and increased gradually in the paper. The quality of questions can be improved by constructing questions in which figures, diagrams and graphs are involved. The approaches of selected-content study and memorization of the mathematical contents should be discouraged and minimized.

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