

Secondary School Biology Teachers' Perceptions for Developing and Assessing Creative Questions: Exploring the Abilities and Constrains

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Abstract

Creative Question (CQ) was first introduced in Secondary School Certificate (SSC) examinations in 2010 and in secondary science courses in 2012. This study explores secondary science teachers' abilities and constrains to create and assess essay-type CQ of Biology at secondary level in Bangladesh. Multiple case study approach is followed under qualitative framework for this study. Data is collected through sample CQ test and interview with teachers which are analyzed with document analysis and thematic analysis respectively. This study found that in the context of Bangladesh, teachers are not adequately informed about these issues and they tend to follow different market-guides or test papers or take help from colleagues to prepare CQ. Assessing and marking the answers of CQ is a big challenge for them. According to the teachers, curriculum has no proper guideline in this issue. This study also reveals that, Biology teachers will be able to cope up with challenges in proper way if they get adequate training and enough instructions via manual or any other form. Findings of the study can be implicated for teaching practice, teacher's training, curriculum, school authority and for further research.

Keywords: *Creative questions, Secondary Biology, Teachers' perception, Assessment system, Teacher's training.*

Introduction

Many evaluation studies on prevailing SSC examination exposed that as an assessment tool previous examination system did not match with the objectives of the learning outcome-based curriculum at this level. According to these studies, students' learning and assessment remained dominated by recalling of facts or statements from the textbooks. The SSC examination, therefore, was inadequate for testing the requisite skills or contributing to the holistic development of secondary students (Hossain, 2009). So, a reformation in the assessment system was required. "Secondary Education Sector Improvement Project (SESIP) from 1999 to June 2007" was aimed to reform the SSC examination system which was a collaborative project of government of Bangladesh and Asian Development Bank. It was the introduction of Skill-based Structured Questions (SQ) in the Secondary School Certificate (SSC) examination intended to test a range of cognitive skills including knowledge, comprehension, application and higher order thinking (analysis, synthesis and evaluation). In order to accomplish the reformation goal, trainers of teachers and teachers of 11 subjects including Biology were started to be trained from 2011 (SESIP, 2010).

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A study conducted on primary school teachers' conception about CQs has found that only 45% of the total participants' teachers understand the creative method (Rab, 2016). According to Habib (2016), among the secondary school teachers, more than 40% cannot develop a creative question by their own and they purchase questions from teachers' association, seek help from colleagues and notebooks. Shabnam (2012) and Khatun (2012) analyzed the creative question system in Bangladesh like: training on CQ, teacher perception of CQ in Social Science, etc. To the best of our knowledge, no research findings has been published regarding teachers' abilities and constraints about the development and assessment of Biology essay-type CQ. It is important to explore the existing situation of teachers' working with Biology CQ in Bangladesh which will provide message about secondary level of education in Bangladesh regarding Biology CQ. In this study, it was tried to provide important information to the body of knowledge regarding the education reform in Bangladesh.

Purpose of the study and Research Questions

The purpose of this study is to explore secondary science teachers' abilities and constraints about developing essay-type creative question, assessing the answers and barrier to attain the intended learning outcomes of Biology in Bangladesh. The specific research questions are as follow-

1. To what extent secondary Biology teachers are able to develop and access the answers of essay-type creative questions?
2. What challenges teachers are facing in developing and accessing Biology essay-type CQ according to policy guidelines?
3. How these challenges act as barrier to attain the intended learning outcomes of Biology at secondary level?

Literature review

Creative question is generally considered as a tool to measure students' various levels of cognitive learning. It is used to expand students' thinking in depth, to encourage students' curiosity and to enhance their motivation to inquire. The questions have four parts (SESIP, 2010) and cover a range of cognitive skill, i.e. knowledge, comprehension, application and the group of skills referred to as higher abilities; such as analysis, synthesis and evaluation (Hossain, 2009).

Stake (1995) has argued that effective teaching and learning requires careful alignment of intended learning outcomes, learning activities and assessment. Constructivist alignment is based on two ideas. First, students construct meaning what they do to learn and, second, the teacher must align the planned learning activities and assessment with the intended learning outcomes (Hackling, 2004). This implies that teachers must plan assessment when plan unit of work. This will ensure consistency among the expectations of the intended learning outcomes, the learning activities (that will enable students to practice the new skills and construct the new understandings required to achieve these outcomes), and the assessment tasks (which will gather the information that the teacher needs to judge whether the outcomes have been achieved).



Figure 1: Effective teaching and learning process (Stake, 1995)

Bloom's Taxonomy (Bloom, 1956) serves as the backbone of today's Creative Question in Bangladesh. Bloom's Taxonomy of learning domain contains three domains of learning that are:

1. Cognitive: Mental skills (Knowledge)
2. Affective: Growth in feelings or emotional areas (Attitude)
3. Psychomotor: Manual or physical skills (Skills)

The taxonomy can be used as a teaching tool to help balance assessment and evaluative questions in class, assignments and texts to ensure all orders of thinking are exercised in student's learning (SESIP,2010).In this study, we have explored the knowledge about cognitive domain only.

From various study, it has been found that the students' learning remained dominated by recall, the straight regurgitation of facts or statements from the textbooks and the SSC examination was inadequate for developing the requisite skills or contributing to the holistic development of secondary students. Therefore, the introduction of creative questions into SSC examination was intended to test a range of cognitive skills in the basis of Bloom's revised taxonomy according to Anderson & Krathwohl (2001).

The method was first introduced in Secondary School Certificate (SSC) examinations in 2010 and in secondary science courses in 2012. Currently, all 29 subjects at SSC level have creative questions. The method is being applied in 12 subjects in HSC examinations and three subjects in Alim examinations (Khatun, 2012).

Due to the reform in education system it is very much important to know about assessment techniques and tools. Moreover, teachers' understanding about any reformation or innovation is an important issue. In order to train the teachers about creative question, Ministry of Education, the Education boards along with SESIP (Secondary Education Sector Development Project) and NCTB (National Curriculum and Textbook Board) started training programs about CQ in several districts in Bangladesh from 2007. In the view to introducing creative questions in all subjects in SSC within 2013, teachers were being trained gradually (SESIP, 2010). But teachers are still facing problems in preparing creative questions and assessing students learning outcomes from the answers. Khatun (2012) found that majority of the teachers receive CPD (Continuing Professional Development) training under TQI-SEP (Teaching Quality Improvement in Secondary Education

Project) and few teachers in urban area get training under master trainer but they require more intensive training. Shabnam (2012) claimed that ten out of twenty Social Science teachers have said that they have been facing problems after introducing creative question system in a conference organized by the ministry of Education.

Conceptual Framework

The study of Hossain (2009) finds that teachers and students were in favor of ‘new style’ papers that means in creative structure and they stated that the questions were interesting and providing opportunities for thinking. According to Khatun (2012), teachers do not understand creative question, they do not know how to teach and prepare questions according to creative system and they are even unable to make students to understand the system. As a result, they are inclined to different guide-books. Suresh Boidya (2014) stated, due to the lack of well-trained teachers the stem of CQ remains unhealthy and the questions are also unrelated to the stem. Above all, teachers are constructing their conceptions about working with CQ from training, manuals, teaching experiences, test papers, guide books, etc. It provides impact on their development and assessment of CQs.

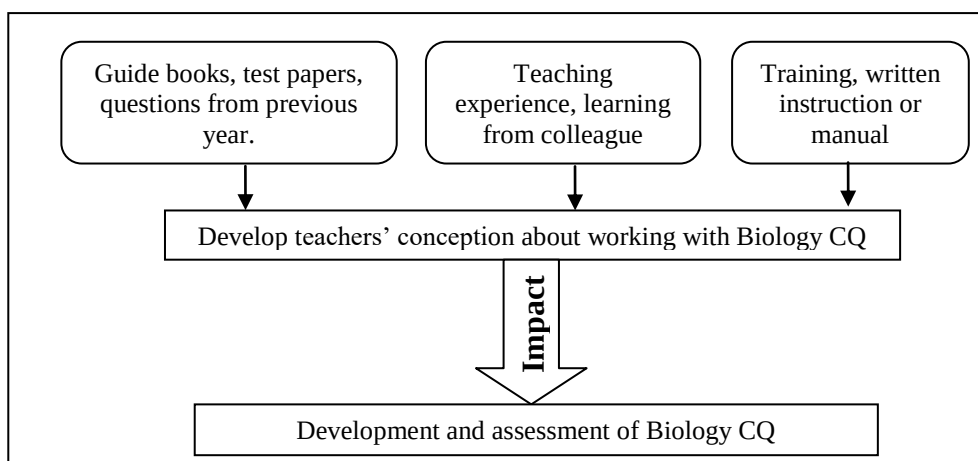


Figure 2: Conceptual frameworks for exploring teachers’ understanding about the Development and assessment of Biology CQ

Various studies show that the teacher’s conception of developing and assessing CQ is not clear and they rely on multiple sources for developing CQ. The above mentioned figure shows teachers understanding about developing and assessing Biology CQ in Bangladesh. This framework has guided us throughout the study.

Methodology

Our study was designed in the following sequence to explore the understandings of teachers working with creative question. The design layout is given below:

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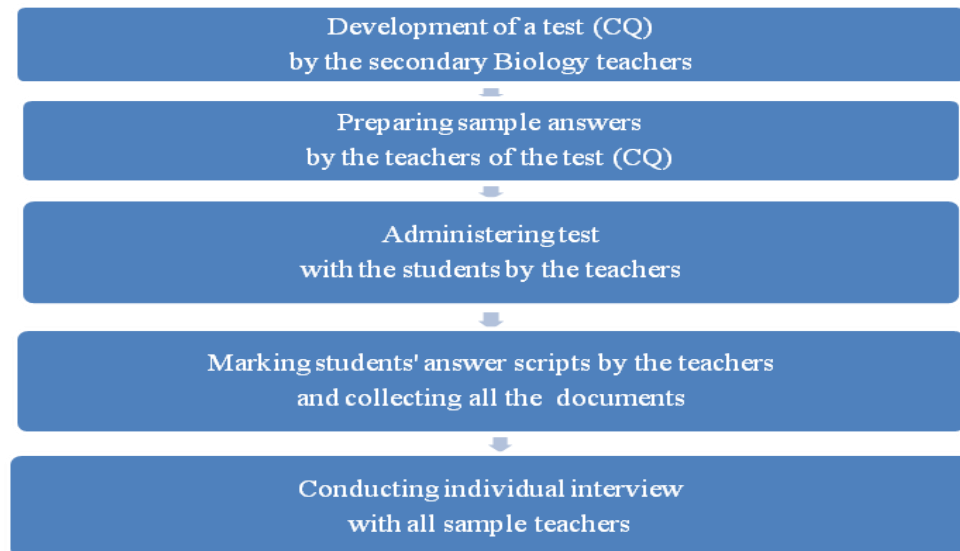


Figure 3: Research design

In the first step of the sequence, all the participant teachers had to develop a test with CQ items. Then they had to prepare a sample answer for the CQs. In the next step, the participants administered a test with their respective students and gave marks to their answer scripts. All the above documents were collected from the teachers. At the last step, a semi-structured interview was conducted with every teacher.

The study focuses on the qualitative approach through multiple case studies. In this study, one teacher with his five students of a school was considered as a case or unit of analysis (Yin, 1994) which includes the teacher who works with Biology in class IX and X. Following Creswell's (2012) suggestion, for this study we chose four cases or unit of analysis intentionally using purposive sampling strategy as we wanted to know the central phenomena by getting available information for our need. Five students for each teacher were selected for the CQ test through convenience sampling who were available and willing to work as suggested by Johnson & Christensen (2018). Four teachers were selected from four different schools.

Each teacher developed one CQ item from their taught syllabus, prepared the sample answer of the question, administered a test with selected five students and assessed their answer scripts. We have used all these documents for our analysis. Interview has been conducted with each teacher.

At first level of data analysis, we analyzed documents which were gathered from the achievement sample CQ tests by participant teachers in each test case. We have assessed those CQ questions and answers. Then, thematic data analysis was conducted for the interviews where some themes were emerged containing some sub-themes. The whole information is analyzed in the basis of the guidelines of SESIP training manual regarding "Implementation, correction and answer script evaluation" and TOT (Training of Trainers). Adequate consent were taken in every steps of conducting data collection from the participants as researcher needs to convey to

participants that they were participating in a study and inform them of the purpose of the study (Creswell, 2012).

Results

Findings from the study were analyzed in two steps. In step one sample CQ's, sample answers and assessment scripts were collected and analyzed as a part of document analysis. In step two, conducted interactive individual interview with each participant teacher was analyzed thematically. In the following part results are represented according to the research questions (RQs).

1. Results for RQ-1

To explore the teachers ability as well as their perceptions mentioned in first research question sample CQ, sample answers script and assessed answer scripts was collected from each teacher. The collected documents and responses of interview are analyzed according to three main themes. Those are listed as:

1. Development of CQ; 2. Preparing sample answer; 3. Assessment and marking of answer scripts. Each them were divided into various sub themes as below.

1.1. Development of CQ

Interview was conducted to explore more about the teacher's personal experience and understanding about developing CQ. This main theme is analyzed under the following sub-themes.

Source of guideline

While the teachers were asked about the guidelines to develop CQ, two of four teachers said that they have no proper guidelines about developing CQs either from any training or any training manuals. Sometimes they get some directions from their colleagues who have some sort of training. Teachers also take help from market guides or test papers and questions from different renowned schools. Remaining two of the teacher said that they follow SESIP guideline and have some training.

Source of stem of CQ

From document analysis, it has been found that three of the teachers have prepared stem directly from the textbook and two of the stems seem to like a statement from the textbook. One teacher has prepared the stem according to the SESIP training manual. Teachers were asked if they have developed test CQ of their own. Two of four teacher's response was positive and they have developed CQ of their own with a little help of other teachers. One of four teachers said that he used guidebook and other question sources and remaining one teacher said that he used textbook to prepare test CQ.

Focus of CQ structure (4 parts)

To explore teachers' view and understanding about the four parts of a CQ, they were asked about their focus on CQ structure. Two of them addressed that the CQ should be linked with stem and there should be four parts according to Bloom's Taxonomy. Others failed to express clear conception about four parts of a CQ. In four parts of CQ, all of the teachers have prepared questions of first and second part according to the structure of CQ which was knowledge and comprehension. Two of the teacher followed the complete structure of preparing CQ and they have prepared their

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questions in order of Knowledge, comprehension, application, and higher ability. One of the teachers repeated the order and used knowledge-based questions instead of an application-based question. Another one also does the same and he skipped the higher ability part and replaced it with comprehension based question.

1.2. Preparing sample answers

From the document analysis, it has been found that the teachers did not divide the learning levels separately in the sample answer. Most of the answers were totally directed to the textbook. No understanding, application and higher ability level is found there. Most of the question could be answered from memorization.

To know about the preparation of sample answer to assess CQ, we asked them if they prepare sample answers in a regular basis. Three of them said that they do not prepare sample answer regularly and other said that he prepares but not for the correction or enhancing the question's quality. It is only for being objective in assessing students.

1.3. Assessment and marking of answer scripts

After analyzing the marked answer scripts, it has found that two of the teachers have marked according to the SESIP manual. They have used partial marking which is evident that they have understanding about the marking criteria suggested by SESIP. One teacher has marked according to his prepared answer script which means he has no clear guideline about marking system. This gap also indicates that he is unable to understand the concept of CQ which is promoting students thinking ability. Marking system was not clear to the remaining one teacher as he did not mention why he has deducted or given marks.

Interview was conducted in order to explore the teachers' understanding about assessing students' thinking level with the help of creative question. Their understandings are described as the following sub-themes under the main theme named assessment and marking of answer scripts.

Focus in assessing CQ

The participant teachers were asked about their focus in assessing CQ. Two of the teachers could not clarify their focus of assessment of CQ. One of them said that he only marks students according to Board standard and another said that he somewhat focusses on analytical ability. Remaining two of the teachers mentioned that they have followed SESIP manual for the assessment procedure where focus is clear.

Guidelines about marking scheme

To know the source of guidelines for the marking scheme of CQ assessment, teachers were asked about the marking scheme source. Two of the teachers mentioned that they do not have any written manual or guideline for the marking scheme and they have learnt about the marking system from their senior teachers. One of other two teachers has training on assessment and another teacher has learned it from manual and seniors.

Guidelines from Curriculum

Finally, we tend to explore the contribution of curriculum in assessing Biology creative question. Teachers were asked whether they have any guideline in the

curriculum about CQ assessment but the entire participants answered negatively. This result shows that there is no guideline in curriculum about CQ assessment.

2. Results for RQ-2

The second research question was about the challenges and constraints that teachers are facing in developing and assessing Biology essay-type CQ according to policy guidelines. The challenges faced by the teachers are known from the interview and analyzed under following two themes.

2.1. Challenges for development

Teachers were asked to know about the type of problems or difficulties they face during developing creative question. Three of them declined about having any problem at the beginning of the interview and one of them said that he faces difficulties in developing CQ. He also mentioned that he does not have any clear guideline about developing CQ. From the interview it was also revealed that, teachers face problems in developing CQ because of different levels of students' merit. They realized that adequate time should be given to prepare a quality CQ. Two of them mentioned that they face problems when preparing CQs because during preparing CQ, the conceptions of their trained colleagues sometimes conflict with them. Moreover, the impacts on developing CQ of different types of teachers are found different in this study. Trained teachers try to provide quality Biology CQs as they conceive some sort of training and follow training manuals regarding CQ development and assessment. The non-trained teachers are somehow cannot provide quality CQs. There is another category of teacher who has some knowledge about CQ and they can create CQ by their own though the quality was not up to the mark.

2.2. Challenges in assessment

It was tried to know about the challenges faced by the teachers in assessing CQ from the interview. Three of them mentioned that they do not get enough time to prepare sample answers and assess the scripts due to some limitations like workloads, huge number of students per class, class load, extra official work etc. Two of the teachers mentioned that they face challenges in grading answer script because of some parents. Though the purpose of the CQ is to enhance students' creativity or thinking ability these parents do not understand that and they create pressure on teachers to give more numbers even with low quality answers. There is also pressure from school authority on students' achieved marks. If students fail to achieve good marks, they create pressure on teachers and sometimes teachers got instruction about giving extra marks from the authority. Teachers also mentioned that lack of proper training about assessing CQ is also a big challenge for them. They also mentioned that only proper training can provide them correct guideline about marking and assessing CQ. Through training, they could have better understanding about four level of a CQ and how to assess and mark them. Due to lack of proper training teachers are facing problems in assessing and marking CQ properly.

3. Results for RQ-3

The third research question was to explore how these challenges act as barrier to attain the intended learning outcomes of Biology at the secondary level. Teachers have mentioned in their interview, that the challenges they face in developing and assessing CQ's have direct impact on students learning outcomes. Two of the teachers

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mentioned that if the quality of CQ is poor, then it fails to increase the scope of students thinking level which is the main focus of CQ. Besides when the CQ structure does not follow the proper level or Bloom's taxonomy, then it creates a conflict of understanding among teachers as well as students. Others have mentioned that developing CQ requires adequate time because the aim of CQ is to promote students thinking and analytical ability. To do so, teachers also need to be analytical while developing questions which requires more time than usual. Furthermore, teachers said that lack of training and guideline impacts on intended learning outcome because proper training provides the first-hand experience over an issue and it is helpful for individual understanding. As teachers do not get any training on CQ development and assessment, they fail to teach their students properly.

Discussion

The focus of the study was to explore secondary science teachers' ability and constraints about developing and assessing the answers of the essay-type creative questions of Biology in Bangladesh which actually helps to explore teachers' perception regarding this matter. This study tends to find answers of three major questions with the central phenomenon of "teachers ability about developing CQ", "Challenges teachers face in developing CQ", and "how these challenges act as a barrier in attaining intended learning outcome."

In case of developing CQs, the study reveals that the teacher who has proper training in developing and assessing CQs tries to develop quality CQ and have a good understanding of it. They also have good knowledge about the structure of CQ, its four parts, and its assessment process. This understanding is important because quality CQ suggests using all the sub-domains of cognitive domain of Bloom's revised taxonomy in all the subjective and objective questions of every subject in secondary level of Bangladesh (Hasan, Naomee, & Bilkis, 2015). On the contrary, teachers who don't have any kind of training on developing CQ they develop poor kind of CQs which fails to assess students properly. They do not have any understanding about four parts of CQs, assessment and marking. This study also revealed a group of the teacher who understands the concept of developing and assessing the CQ partially. One part of this group of teachers got training but failed to implicate their training knowledge properly. As a result, CQs they develop also fail to maintain its proper structure and those have inappropriate stem, repetition in four parts or both. Another part of this group of teachers do not have any kind of training but they gathered knowledge about developing and assessing CQs from various manuals or senior teachers. So the knowledge they possess about CQs is not sufficient and they also fail to develop quality CQs. Davis et al (2014) said that the teachers play important role in developing and promoting students' creativity. So it is very important to provide them with opportunities to enhance their creativity and thinking through training and it will help them in exploring students' creativity too. So, proper training is very much needed in increasing teacher's idea on developing and assessing CQs. This study also explored that, the teachers develop CQ on their own, but most of the teachers are not well informed, they rely on different market-guide books or test papers for this. Repetitions are found in various parts of the CQs created by them. It is also seen that questions did not fulfill the assessing purpose or could not reach the required level of student's

thinking. This finding has similarities with the study of Jony (2009) which shows that, CQs developed by teachers of Bangladesh are mainly Knowledge based (40.59%). In addition to that he also mentioned that 33.53% of the CQs are able to promote understanding ability, 5.29% application ability and only 14.51% analytical ability of the students. Moreover, Begum & Mullick (2005) revealed from an analysis on SSC board questions that more than 90% questions are only knowledge based.

This study also explored the challenges that teachers face in developing and assessing CQs. It was found that teachers do not have adequate time in developing and assessing CQs which is one of the major challenges they face. The number of classes they take, the number of students they handle, and extra official work they do reduce their time span required to develop quality CQs. Lack of proper training and guideline is also a challenge for them. Teachers believe that proper training provides proper guidelines and this is very important for the development of quality CQs. Not having a proper guideline creates conflict among opinions and knowledge of various teachers and it hampers the quality of CQs. Moreover, in assessing CQs, teachers face challenges regarding parents' demands about students' good marks as sometimes they create pressure on teachers to provide good marks. Sometimes school authority also instructs them to provide good marks even if the answer script is not up to the mark. According to Begum & Ahmed (2007), learning is heavily dependent on assessment system and it can play an important role in students learning. So, if teachers fail to assess properly, it has negative impact on students learning.

This study tends to find how these challenges act as barrier in attaining students learning outcomes. Teachers mentioned that poor quality of CQs fail to enhance students thinking and learning ability. Teachers revealed that various challenges they face act as barrier to develop a good quality CQ and assess it properly which act as a barrier to attain students' learning outcomes. Lack of proper training and guideline may lead to poor teaching, which has crucial negative impact on students' learning. Moreover, if insufficient time is given to develop CQs and assess the scripts it will obviously reduce the quality of education and fails to achieve learning outcome properly.

Implications of the study

The findings of the study have implications for practicing secondary Biology teachers, school authority, teacher's training, and curriculum developer and as well as for future researcher.

I. Implications for teachers

The findings of the study reveals that practicing secondary Biology teachers face many challenges to develop and assess CQ properly according to the guideline because they do not have proper knowledge and training. Also they lack proper guideline and opportunity too. These findings will make them aware to take necessary measures to improve their lacking.

II. Implications for teacher's training

The findings of the study reveal that all teachers do not have proper training and any specific written instruction to prepare and assess CQ. It was also found that a trained teacher develops quality CQs and they have sufficient knowledge in assessment whereas non-trained teachers don't have these qualities. Training manual or

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instruction about CQ will help teachers to work with CQs more effectively. So, this study has implication for trainer and training planner to train teachers to train more specifically on CQ.

III. Implications for the Curriculum developer

This study finds that teachers do not get help from the curriculum. It could give a message to curriculum developer to include instructions about the assessment and developing CQ in the secondary science curriculum which will be helpful for teachers.

IV. Implications for school authority

The findings of the study reveal that teachers suffer from class loads, workloads, extra official activities etc. which hamper them to give sufficient time for development and assessing CQ. School authority can think about redesigning the schedule for the teachers to decrease teachers' workloads so that they can get enough time to develop and assess quality CQs. Moreover, school can arrange parents meeting to describe the importance and marking procedure of CQ. Also creating pressure on teachers for extra may be reduced.

V. Implication for future research

This study finds that teachers' conceptions vary from teacher to teachers and they face difficulties within developing and assessing CQs. teachers' conception about four parts of CQs, stem, etc. are not adequate. The impact of Biology CQ on students learning and how using Biology CQ becomes effective for student's learning not studied yet. Thus the impact of using Biology essay type CQ on students' learning can be studied in further research. Moreover, this study was conducted with only four teachers, so there is a scope of further research with a large population. There is a scope of further research on the Perspective of students and parents about CQs and its assessment system.

Conclusion

Teaching practice of using Biology essay type CQ, reason of variation in teachers' perceptions, constrains to develop and assess; and role of curriculum to provide support in developing CQ to the teachers was explored through this study. We did not have idea about the teaching-learning practice in developing and assessing CQ of Biology before conducting this study. This research study found that in the context of Bangladesh, though teachers are working with CQ in Biology but they are not adequately informed about this issue. It was also seen that their understanding level is also different about developing CQs. According to the researchers, Biology teachers will able to cope up with the adverse situation if they get adequate training, get training manuals and proper guideline that means enough instruction and guidance. Educationists and policy makers should be concerned and take necessary steps centrally to overcome the challenges in this issue. It can provide the opportunity to increase teacher's knowledge and result in proper students' achievement. As this study is a case study research with four cases only, it is not possible to generalize the findings of the study. However, this study may help to gain in-depth understanding of different aspects of teachers' perspective, ability and constrains about developing and assessing Biology essay type CQ.

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