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Questioning Questions - Should Questions Be Used as a Learning Tool?

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ABSTRACT
Given scientific knowledge of the effect of questions on the brain and the theory of constructivism, methodological questions arise: for example, why, when and how should questions be asked? To help find answers, the literature reviews additionally included a study of holy scriptures to create a basic data model of how questions can aid learning. The model proposes using questions as a knowledge access and linking tool rather than just a formative and summative assessment tool. Using the model, a lesson plan was developed to help n = 394 tertiary level teachers to question their personal classroom questioning methodologies. Thematic analysis of participants' responses indicated a willingness to carry the learning into their classrooms. The implications of the pilot study should be tested further, especially in STEAM courses. Teachers who are already interactive in class would immediately find this study useful.

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Background

While advances have been made in the understanding and the development of teaching and learning methodologies - both in terms of theories and learning processes over the years, and while there are highly successful teachers, the processes of teaching various subjects continue to be under scrutiny, because of the unsatisfactory feedback on learning from STEM/STEAM subjects. For example, just over 1500 students, or 16.3% of the current student body, at an open-credit university in Bangladesh, delayed taking the compulsory foundation mathematics course till their final year/semester. Given the fact that this tertiary level course is essentially a repeat of college/high school maths, this should be an unacceptable state of affairs - teaching methods at school and/or college have either instilled a dislike or fear of maths or teachers have not been able to address the student's

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concerns. In the ultimate analysis, of course, the student has to learn by himself/herself, but by virtue of the role played, the onus of creating a conducive learning environment falls squarely on the shoulders of the teacher/facilitator.

Questioning Questions

Good teachers all over the world instinctively understand the need to "hook" students into the learning material and sometimes use questions to engage the students into the learning material (Barkley, 2019, Fowler, 2019, Mangwiro & Machaba, 2022). In the teaching and learning scenario Socratic questioning methodologies have been applied to the flipped classroom to find the type of questions that best promote active learning (Avdic *et al*., 2016). Websites supporting teaching-learning centres of tertiary level institutions recommend types of questions (Sewell & Main, n.d., Center for Teaching Innovation, 2023) and ask teachers to move away from simple recall questions that teachers sometimes use to launch a follow-on or subsequent class, *i.e.,* simple recall of facts from a previous class. Interestingly, the 7E model based on the theory of constructivism (Rahman & Chavhan, 2022, Eisenkraft, 2003), recommends asking questions as one of the methods to 'Elicit' as the first 'E' to find out students' previous knowledge on the subject.

On the other hand, on the biological front, in recent years, neurological research on the relationship between questions asked and the brain (Asmus, 2017, Hoffeld, 2017) shows that the entire brain is activated, *i.e.,* in effect captivated when a question is posed. With theories and research pointing to the importance of questions in the teaching-learning scenario, there is no pedagogical guidance for teachers on why, what, when and how questions should be asked, and how exactly do questions affect learning. The nature of questions asked in the classroom therefore boils down to the perception of the subject teacher as to what constitutes an effective question to promote brain engagement and active learning in the subject. To guide question creation, it may be helpful for the teacher to understand the purpose of questioning and how it relates to learning in the subject to meet learning objectives.

To develop a better understanding, Bächtold (2013) asked a methodological 'What' question, while trying to link the theory of constructivism to the learning that takes place, - What do students "construct" according to constructivism in science education? A difficult question to answer, especially if the problem is approached simply neurologically. Bächtold (2013) therefore concluded his paper suggesting:

> "...ideally each new proposal in science education should explicitly take into account all these construction processes and the factors that support them. At the very least, it should specify clearly which construction process and which of these factors it is dealing with, rather than speaking indistinctly of "knowledge construction." (Bächtold, 2013)

Essentially, Bächtold (2013) suggests approaching the problem from a data point-of-view, *i.e.,* taking into consideration what data/knowledge should the students be linking with or adding on, to answer the question that he posed. In this connection, it would be very helpful for the teacher to know the "processes" of construction. Following this line of thinking, for a deeper understanding, other methodological questions may be asked, for example, as our brain consists of 86 billion neurons (Brainfacts.org, 2018), where exactly does current or existing knowledge lie in the individual's brain? Before looking for answers, we need to revisit what constructivist theory says about the learner. Constructivist theory suggests that knowledge is 'actively' constructed by participating learners in their own brains, in their own ways, building upon existing knowledge of the learner (Fosnot, 2013). As each learner perceives knowledge in their own way, how would a teacher/facilitator know who knows how much or what? In other words, as construction has to take place in the individual students' brain, how the teacher/student would also know the area where current perception resides has been located.

Development of Methodological Questions to Better Understand the Processes That Support Constructivism

While research has established and confirmed the positive role of questions in learning, Table I summarises the development of further methodological questions.

Table I. Methodological questions to support the theory of constructivism

Questioning Questions	
Methodological question	Elaboration
Why?	Why should a question be asked on a topic or lesson?
What?	What type of question should be asked?
How?	How should the question be asked?
When?	When should the query question be asked?
Where?	Where should the subsequent knowledge be stored or linked?
Who?	Who should ask the question?

As proposed by the theory of constructivism (Fosnot, 2013), the "construction" of new knowledge on a topic should take place at a specific site - the site at which existing previous knowledge on the topic is stored. Previous knowledge is obviously different and unique for each student. Added to this problem is the blend (Maric, et al 2015) of the four predominant learning styles that an individual student may adopt/demonstrate. The challenge is then not only accessing the current perception but engaging the learning style of the individual student as well.

Could an open-ended question like 'what do you think this is?' Or 'what would be your opinion on …?' Or 'what would be your comment on this' help? Would such a question help students independently search and access their existing knowledge or perception on a topic rather than an assessment question of what do you remember from last class? Open-ended questions allow the students to construct their own response, that may include unexpected perceptions and misconceptions. With an assessment question student hastily try to recall/repeat what the teacher said/did or what the printed material presented - this does not necessarily present what the student has understood. On the other hand, to answer an open-ended question, would the student's brain be engaged, i.e., look for self-held perceptions?

For engaging the brain in the second E, i.e., the Engage step in the 7E constructivist model, Rahman & Chavhan (2022) recommends arousing curiosity, interest and focus on the topic. This recommendation is without being specific on 'how'. Given the constructivist approach, this research proposes that without accessing current perceptions interest or curiosity cannot be aroused. Once current knowledge is accessed, curiosity can be aroused to raise questions having found gaps. So, should the role of the first question be such as to access the relevant site and perceptions in the students' brains? Once the correct site for the topic is accessed, regular pedagogical practices, including further questioning, experiential learning, practical work, collaboration, discussion, peer work, etc., can continue, helping the adding/linking of knowledge progressively at the relevant site.

The first challenge of the teacher is therefore to find/design a launching question that would allow the students to access any existing knowledge on the proposed topic. When such a question is asked, the students' brains would instinctively look for existing knowledge on the topic - this can also be achieved by simply asking the students to guess the answer or work in pairs to discuss and offer answers. Once existing knowledge is found, demonstrating this knowledge

(right or wrong) would help the teacher and the students both to "see" what knowledge/perception exists on the topic. To do this, the student's brain would have to be "engaged" as the student would be accessing and expounding existing knowledge stored at the site. If the subsequent storage of new knowledge on the subject can be appropriately organised at the site of previously existing knowledge, any subsequent retrieval process would be expected to be efficient as all aspects of a topic/subject would be available at the same site of neuron clusters, similar to the concept of a computer database table - where all similar type of data is stored. Drawing analogies with computer database organisation is not new (Zhang *et al*., 2020) or vice versa (Martin, 2016), likewise, a simple data-table-and-the-need-for-initial-access-to-the-table point-of-view has been adopted by this research to answer the methodological questions to support the theory of constructivism.

Theoretical Framework

Over the years the theory of constructivism (Educational Broadcasting Corporation, 2004; Teaching and Education, 2020) has become the recommended theory, within which questioning and questions appear to play a beneficial role (RI Department of Education, 2010; Avdic et al., 2016; GradePower Learning, 2018; Center for Teaching Innovation, 2023). Supported by neurological research on the reaction of the brain to questions (Asmus, 2017, Hoffeld, 2017), the constructivist theory has been turned into a process (Rahman & Chavhan, 2022, Fosnot, 2013, Eisenkraft, 2003) adding seven steps (7E) to constructivist instructional design. As the purpose of this research is to delve deeper into the art of questioning, the only methodological question that the literature on constructivist theory and process answer is 'where' from Table 1. The other questions on why, what, when, how and who remain unanswered.

Building a theoretical framework using these sources alone, for the purposes of building a question reasoning model, would be inadequate to help hypothesize answers to the methodological questions in Table I, e.g., why should a question be asked on a topic or lesson? In an effort to find answers for building the model, this research proposes to add an additional source - the holy scriptures - to the theoretical frame as shown in Figure 2. The proposed theoretical framework has three corners to match: scientific research and theories, action research and the holy scriptures. For the derived model to be valid, the output from all three corners must match. From the holy scriptures, verses that involve a teaching-learning situation are chosen from the story of Moses, in particular, the verses that relate the incident when God taught Moses directly, up on the mountain and trained him to face Pharaoh. The relevant verses, in this instance,

as reported in Al-Quran (Quran, 2023) Chapter 20, verses 17 to 20 (Translation by Yusuf Ali) are:

> "And what is that in thy right hand, O Moses?" [Quran, 20.17]
>
> "He said "It is my rod: on it I lean; with it I beat down fodder for my flocks; and in it I find other uses." [Quran, 20.18]
>
> "(God) said "Throw it O Moses!"" [Quran, 20.19]
>
> "He threw it and behold! it was a snake active in motion." [Quran, 20.20]

Notice that the training of Moses starts with a simple query [Quran, 20.17], similar to a question that would help begin a conversation with a child, "And what is that in thy right hand, O Moses?" Given possible alternatives to launch the training, why is a question asked? And why a question that Moses can very easily answer? As both know what Moses is holding, the query seems unnecessary, but the answer given by Moses in the next verse [Quran, 20.18] is revealing. The answer not only identifies and names the rod, this is my rod, but also elucidates on all its uses! Why and how? From where or which part of his brain would Moses find all the uses of his rod? Logically it should be the part of the brain that not only recognizes the "rod" but is conveniently stored together with all the applications that Moses has experienced. By sharing past applications, it is confirmed that Moses' brain has found the correct place or the neuron cluster or the "data table" which contains all the relevant information on the "rod". The brain is therefore focused on the area dedicated to the "rod" and its applications. Once at the site, we can see how the theory of constructivism would work. To link new experiential learning Moses is now asked to throw the rod [Quran, 20.19] and observe. The rod becoming a snake is a new experience for Moses, and the brain's "pointer" is in the right place to allow the new experience to be "added" together with the previous uses as diagrammatically depicted in Figure 1. This new application will need to link the cluster that contains the identities of snakes and its properties. We know that a link has been made, as upon seeing the moving snake Moses becomes afraid [Quran, 20.21]. Next time when Moses thinks of his rod, all uses including the fact that it can become a snake can therefore be easily and immediately accessed. The completed "table" on the rod is depicted in Figure 1. The depiction confirms the theory of constructivism and also serves to answer Bächtold's (2013) question, "what do students construct according to constructivism…?" The depiction also points to

convenient organization of ideas related to each other, supporting efficient and quick retrieval of information.

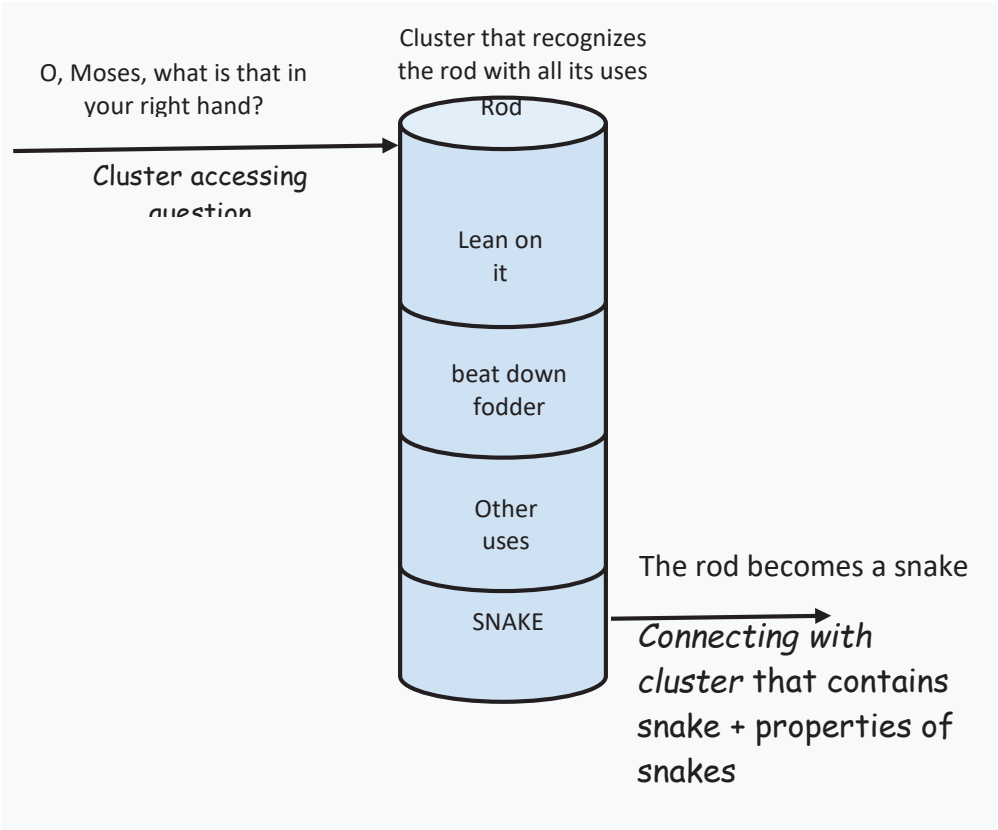

Figure 1. Visualization of how the applications of the "rod" are logically stored

Each slice of the cylindrical shape in Figure 1 logically represents the area that describes the particular use and thereby labeled as a "neuron cluster". With the added experiential learning when the rod is thrown, a new slice (SNAKE) is added to the cylinder storing the new learning while connecting with the "site" that has stored information on "snakes". As the reported incident in the scripture potentially answers the methodological questions given in Table I, the scripture reference is added to the theoretical framework shown in Figure 2.

The idea behind the theoretical framework is to bring together all references that can potentially not only corroborate but also help to answer the methodological questions that can lead to effectively utilizing the

theory of constructivism in the classroom. If applied research (bottom right corner of the triangle) proves to be beneficial, then all three corners would complement each other to help confirm the hypothesis in support of the truth.

The developed hypothesis is therefore as follows: To have a well-organized brain, any additional knowledge on a topic should be built at the "construction site" that relates to the subject. Such organization would allow for immediate retrieval of all aspects of a topic when the site is accessed. To start teaching or learning a topic, therefore, the site at which current knowledge on the topic exists must first be accessed. This may be done using a query question that the student can readily find, access and answer. As the query has to be answered from the "site" of existing knowledge on the topic, the brain is in the correct area to store the learning from subsequent activities on the topic.

To indicate that the methodology is mainly about designing an initial question to access the appropriate parts of the brain, the name Query-Based Access to Neurons (QuBAN) is coined for the methodology.

Lesson Design

A student's answer to the launching query, whether correct, incorrect or irrelevant, represents his/her perception/understanding of the topic as long as the question is designed in an open-ended manner. When the student is able to give a perceptible answer, the teacher knows that the brain is engaged or positioned at a location of any existing knowledge on the topic. A tool that allows each student to answer would be useful at this point. A survey of the students' answers would allow the teacher to discuss and give appropriately considered feedback, discuss current theory on the topic, ask a counter-question and/or give learning activities/questions to help add/link/correct knowledge on the topic. This also places the student in a position to survey his/her own current knowledge on the topic, and the inquisitive student would then be in a position to ask further questions on gaps perceived. This gives the student an opportunity to co-design the learning experience. Asking the launching question also allows the teacher to access his/her own experience of the topic and visit the appropriate parts in his/her brain. It is important therefore for both the teacher and the students to collectively review current knowledge/misconceptions so that a way forward can be jointly determined to construct new knowledge.

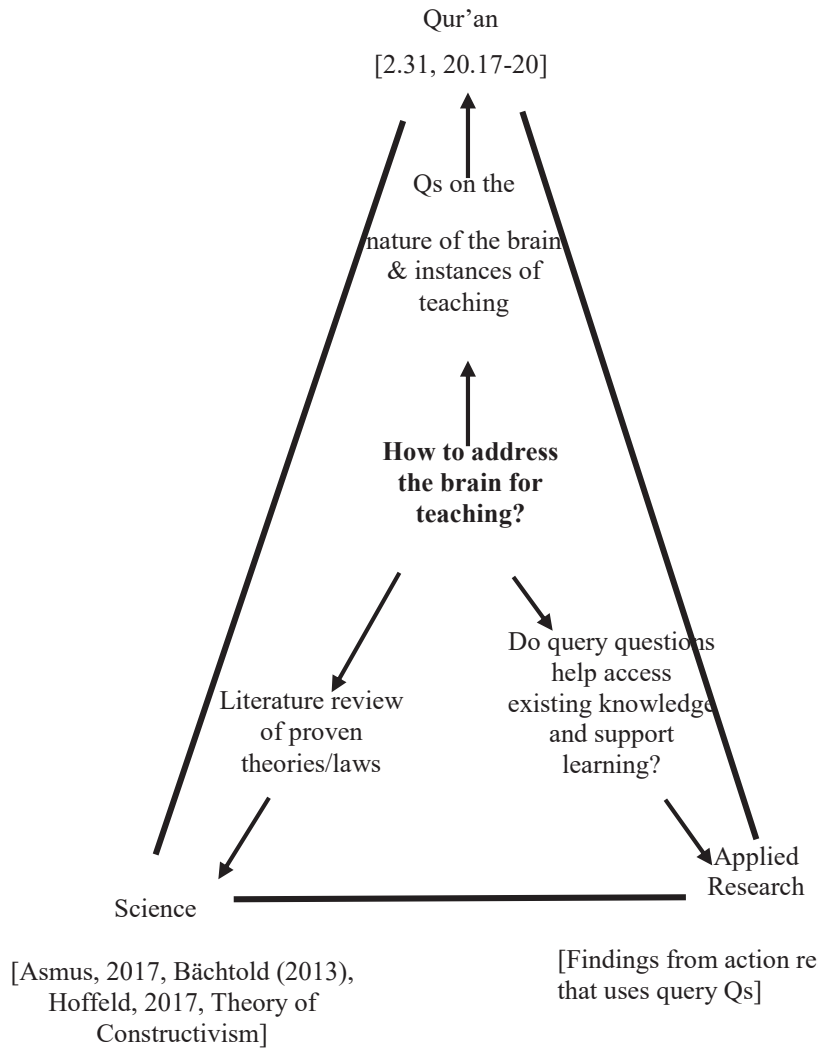

Figure 2: A unified theoretical framework for addressing the brain while teaching

Validation

Given that the teacher is able to ask an appropriate launching query question, the students' ability to answer the query question from self-perceptions is in itself proof of the success of the methodology. The answers offer an opportunity to assess current knowledge both for the teacher and the student body and open the appropriate doors for feedback and further learning. In this connection, Richardson et al., (2012) shows that to judge appropriate transfer of learning it is better to assess goal-orientation of the participants, i.e., whether they have a strategic approach to the learning they have achieved, thoughts that indicate

effort regulation and self-efficacy. To validate the methodology, we may therefore examine parting questions posed by participants (of the QuBAN methodology) to analyze whether these show intentions to carry learning further into their own situations.

Applying the QuBAN Methodology

Given that the QuBAN methodology depends on the ability of the teacher to ask an appropriate launching query, it was decided to apply the proposed model to training of teachers who had just recently been forced to go to online teaching without any training or forewarning. The overall idea of the training session was to engage the participants to design launching questions themselves for a class of their own. Given the general attitude and nature of teachers it was decided to find out the teachers' existing attitude toward asking questions in class in a survey during the online registration process. The responses to the question, what type of questions do you ask your students in the class? were thematically analyzed and plotted as shown in Figure 3. The research question, based on the output was finally: Does the nature of participant questions show a desire to apply the QuBAN methodology to their own classes?

Launching Query Design

As all the important launching questions were planned, it was decided to take into account teachers' existing mindsets regarding asking questions in the class and the timing, i.e., mostly formative questions were asked that check learning thus far or a simple recall of learning in a previous class/subtopic. The launching question should avoid existing mindsets, otherwise the teachers may revert to their regular questioning habits (as already stored in their brain) once the training is over. There would be a danger of falling into such a mindset trap if the launching question is simply, how do you start your face-to-face or online class? - as this would lead directly to current ways of asking questions (as evidenced by Figure 3). This question was actually asked as a question during registration. 36.5% of the participants who said that they ask a "launching question" subsequently admitted to this being a recall question from a previous class. So, strategically, it was decided to avoid this question at the beginning of the class and rather directly tap into teacher's immediate concerns regarding the tools they have to use for their online classes, i.e. the tools they select to start online teaching (first row, Table II) so that whenever they think of an online "tool" they should be able to recall the linked neurons dealing with the QuBAN methodology (once appropriately stored). This question is also something that they should

easily be able to answer. It was arranged so that the teachers would have the opportunity to think and respond online by selecting multiple-choice answers or by writing short sentence replies that would be displayed to all. To do this an interactive online tool available at Mentimeter.com was used. The tool allows a PowerPoint type of online presentation while allowing participants to respond to questions through a linked sister site called Menti.com. The lesson was designed using subsequent questions that follow-on and build upon the "tool" concept. The questions were prepared as Mentimeter interactive slides as shown in Table II. The lesson was designed simply by asking a series of 12 questions, allowing the participating teachers to answer, provide an opportunity to give and receive feedback on the answers and conclude through a discussion.

At the beginning of the experimental class, as a visualisation of their responses, Figure 3 was shown to the participants and the nature of questions asked was discussed. It was found that in general the teachers were more familiar with questions that gauge understanding during class rather than questions that engage students' curiosity and inquisitiveness. The launching questions (36.5%) in Figure 3 were mainly on recall of previous class materials. 3.9% however said that they ask questions to gauge interest on the topic itself. It appeared that these teachers instinctively understand the need to "hook" the students right into the topic.

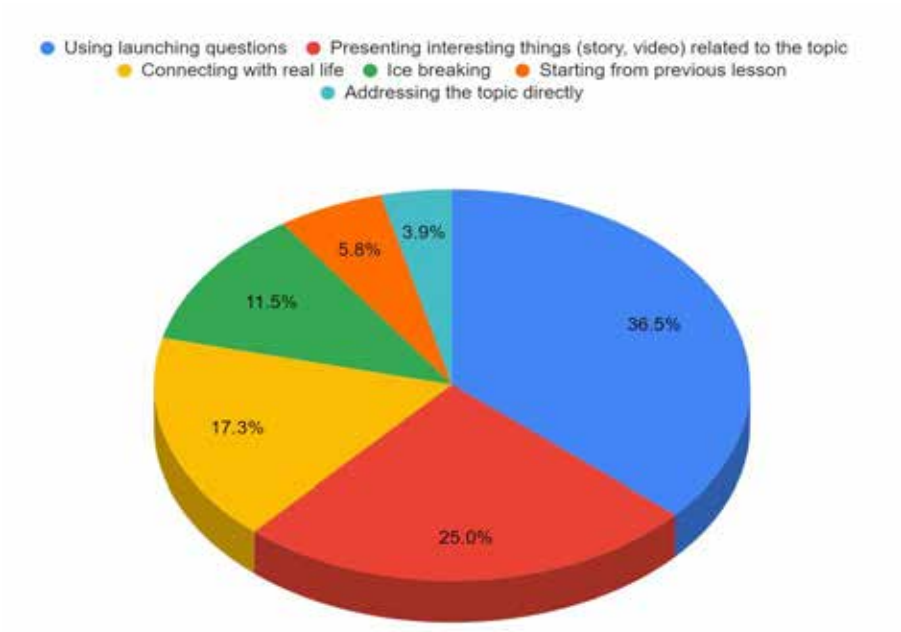

Figure 3: Response to the registration Q: "How do you start your…class"

Table II. Sequence of questions for the experimental class

Sequence of Questions	**Concept to be Accessed**	**Linked concepts that should be found**	**Forward concepts to be found and linked through next question**
1. What type of ***tools*** do you use for interaction in your ***online classroom***?	online tools	actual online tools used (existing experiences)	<student's concerns>
2. Do you feel ***students*** are motivated and interested during an ***online class***?	student	motivation	<how to motivate and engage student in a topic>
3. In your opinion how should a topic be launched? (Note: Be reminded that we need to engage the students right at the beginning of the class)	topic	launch/start a class	<how to hook student's interest?>
4. Can a topic be effectively launched with a question?	topic	question	<what type of question would gain attention?>
5. What happens to the brain when a question is asked? (Research online and find an answer. Please write your answer in one sentence)	question	types of questions	<how the brain reacts to questions posed>
6. When we address the brain, should there be any difference between face-to-face and an online class?	brain	Online class + face-to-face class	<are there other ways to continue to keep the brain engaged?>
7. In how many ways can students be engaged?	brain	Different ways to engage students	<role of questions while engaging students?>
8. What type of question should be asked to launch a class?	question	<types>	<practice to create an engaging question>

Sequence of Questions	Concept to be Accessed	Linked concepts that should be found	Forward concepts to be found and linked through next question
9. Now think of an open question to launch one of your next topics.	familiar topic	<possible questions that can be asked>	<link with the objective of the class>
10. In your opinion, what was the purpose of today's lesson?	online tools	find all linked concepts	<how can the questioning technique help students?>
11. Write a sentence on how the Q&A methodology can be used to deliver a lesson of your own.	questions	<own topics>	<are there any gaps on how to apply the questioning technique?>
12. Do you have any specific questions on how to apply the Q&A methodology to your own class? (specific question on the questioning technique)	Questioning technique	<own classroom situations and experiences>	<questions on gaps found>

Design of the Sequential Questions for the QuBAN Experimental Class

A study of the sequence of questions and main concepts in Table II will reveal how the access concept attempts to link with the next concepts that should be found for linking.

After the concept of “tool” is accessed and confirmed, links must be formed between concepts such as student motivation, questions that engage a topic, relationship with the human brain, etc. This can be done through incrementally asking relevant questions as given in Table II. The last three questions attempt to tie back to the purpose of the lesson, i.e., the objective and transfer of learning to the participants' own classes. Figure 4 shows how the answers to the first question are collected through the site menti.com and shown to everyone as a dynamic bar graph for a batch. After having discussed the answers and how they use the tools, a concluding slide as shown in Figure 5 is discussed.

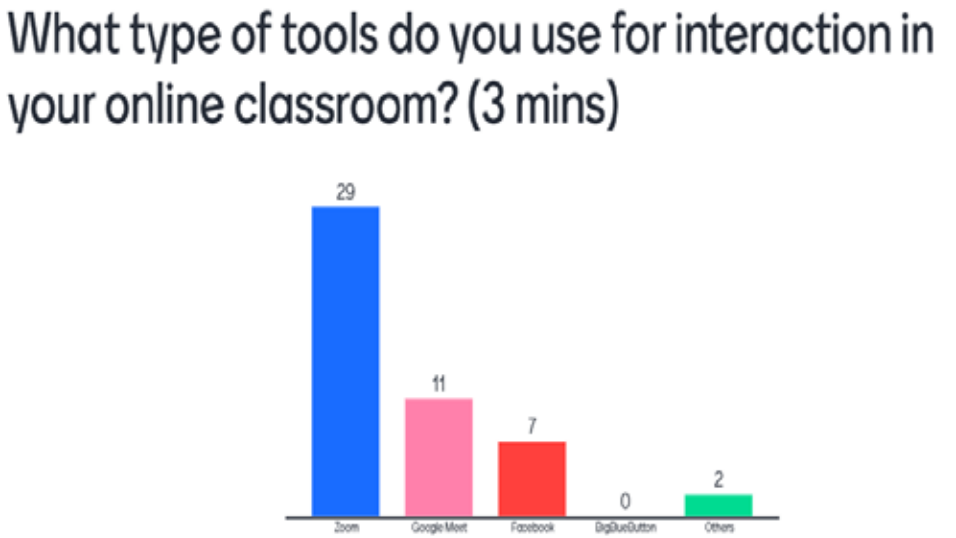

Figure 4: Participants' answers shown dynamically as a bar graph for Q1

Online Delivery of the QuBAN Lesson, Collection of Teachers' Questions and Assessment

The 12 questions of the QuBAN lesson were delivered to a number of batches of teachers who registered both within Bangladesh and outside the country using Google Meet. Google Meet was used to present the PowerPoint made in Mentimeter.com. The total participants were 311 from Bangladesh, 64 from Nepal and 19 from Malaysia. Responses to question 12 were collected in Menti.com and an inductive thematic analysis (Table III) was done. Individual batch sizes were 12 to 35.

The emerging themes identified in the questions asked by the participants are shown in Table III, together with a sample of participants' questions. Some questions show motivation and thinking towards application or transfer to their own subject practice. The teachers also started working out associated issues if and when the technique would be applied in the class. A sample of the phrases used to work out the themes are underlined in the left column of Table III. Out of the total of 394 participants only 86 or 22% asked a parting question in response to question 12. The question was not mandatory. The four themes that emerged (application question, metacognition question, similar question and didn't understand) from the questions at the end of the workshop that was titled, "Are your online students engaged?" are shown in Table III. The nature of questions

asked by the teachers shows thinking beyond what was asked in the QuBAN session. 84.9% of the questions (51.2% + 33.7%) demonstrate concerns about application of the methodology. This high percentage encourages deeper and further research into QuBAN. It would subsequently be interesting to see how many teachers actually try the QuBAN methodology in their own classes and whether they need further support.

Figure 5: A slide confirming and concluding the discussion on Q1 online "tools"

Discussions, Conclusions, and a Way Forward

Good teachers all over the world intuitively know that students need to be engaged or hooked into the subject matter right from the beginning. Accordingly, in the website blog, socialstudies.com, Fowler (2019) writes:

> Some teachers simply take attendance, others jump right into their lesson…no structured way to start their class every day…most effective and connected educators purposely plan a creative, engaging "hook" that grabs the students' attention, and sets the tone for the rest of class… When students walk into class, they must be immediately engaged. Otherwise, they will get bored, mentally wander, and turn their young minds off to learning completely.

Among the main methods of "hooking" or engagement, Fowler (2019) discusses "Do Now" activities. It is obvious that the students must ask themselves questions in order to carry out the activities. The QuBAN method essentially sheds light on the "why" and "how" behind the need for the "hook" at the beginning of the class. Understanding QuBAN will allow teachers to focus on why the hook is needed and plan exactly how to engage the students to launch a class.

Table III. Analysis of participants' questions

Sample of teachers' questions	**Question theme**	**Nature of question**	**Total count**
How can menti.com be used to Question and Answer in online classes if the class is related to a series of mathematics equations?	Application question	How can I apply what I have learned? *<question shows student is motivated to apply>*	29
How can I draw a circuit diagram in mentimeter.com?			
There are 4 to 5 zoom classes every day. For interactive class it needs more class hours. How can we minimise it?	Metacognition question	What might happen if I apply the methodology? *<question shows thinking beyond application>*	44
It seems that students need to be groomed before using the tools you have just shown. What would you think should be the time lag before having the students come up to the speed?			
Sometimes the front page of google meet becomes scrambled. It becomes OK after refreshing. Is it a network or computer problem?	Similar topic question	How can I solve other technical problems? *<thinking about technical issues>*	8
How to conduct online exams, without compromising quality?			
When lecturing, students get bored ..but I have to finish the content...how to engage them in online class?	Didn't understand	Question shows that the main point of the lecture was missed.	5
If the class is lecture oriented then how can one spend time on the student engaging process using such tools?			

The Central Launching Concept

Just as it would be helpful for the teacher to understand any existing problematic mindsets of students, it is important to understand why the neurons/concepts should be connected in a particular sequence starting from the initial target concept. In the example with Moses, God had three major concepts to deal with, rod, snake and Pharoah. What if He had started with the concepts of snake or

Pharoah first? He could have started with, O, Moses, what do you fear most in the desert? In such a case, the initial or central concept would be "snake". And then say, Ok, now throw your rod. The second linked concept would then be the "rod". Then finally say that you have to take this to Pharoah. If QuBAN was launched with the initial/main concept as "snake", could Moses be later blamed if he wondered if other snakes (those he fears) could become a rod when picked up? Appropriate choice of the initial concept is essential for a logical retrieval of concepts when needed, i.e., when standing before Pharaoh, would hooking into the concept of "snake" be useful? Hooking into the concept of "rod/stick" first as shown in Figure 1 would allow immediate recall of all its uses. The objective of a class would also have to be tied into the launching concept so that when needed, recalling the launching concept would also link with the objective. Following a threaded sequence for subsequent questions would be particularly important when teaching STEM subjects, as learning would have to support logical steps that are needed. Random launching of concepts would likely make sequential recall and logical application difficult.

What would be interesting to investigate is STEM classes initially launched with QuBAN followed by the regular active learning classroom activities that are designed in a logical sequence - whether the subsequent application and retention improve.

Tying the Objective to the Launching Concept at the End of the Lesson

Recommended lesson planning activities generally follow Gagne's Nine Events (Northern Illinois University Center for Innovative Teaching and Learning, 2020) where immediately after gaining the students' attention, the students are to be informed of the learning objectives. While one of the recommended methods of initially gaining students' attention is through questioning (event 1), spelling out the objective of the lesson is the 2nd event. In contrast, however, the QuBAN lesson plan requires the objectives to be tied back into the launching concept at the end. Both methods allow for the objectives to be adjacently situated with the launching concept, however, linking back to the objectives at the end would allow students to add meaning and motivation to the learning that has taken place as proposed by QuBAN. This would also place the student in a position to evaluate his/her own learning. While the objectives are essential for the teacher to guide preparation of the lesson, novice learners may not be able to relate to them if the terms used are new and unrelated to their personal experience. As the meanings of the terms used in the objective are likely to be unknown, delivered at the beginning may be intimidating rather than inviting or motivating. As an example, how would the use of the term "SUBTRACTION" - "Children, today

we are going to learn Subtraction" sound to youngsters hearing the concept for the first time? The term would have a meaning after having shown examples from the students' lives where subtraction would be needed, e.g., checking the change after buying some chocolates using their own pocket money. Therefore, if Gagne's Event 2 was moved to just before Event 9, i.e., just before "enhance retention and transfer to job", the differences between the learning imparted would be interesting to compare.

The QuBAN questioning methodology provides an instructional technique to engage the students into new topics in a way that addresses the development of neuron clusters that build on and are related to existing concepts - following the theory of constructivism. The methodology allows for the neuron cluster to be organised in a manner that makes subsequent retrieval and application of all related concepts immediate and therefore easy to recall and use.

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