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Questioning as a learning strategy in primary science

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Abstract

In 2008, there was a change in the local primary science syllabus. It moved from being theme-based and mainly knowledge-based to that of theme-based and inquiry-based. There are many aspects to inquiry-based learning, one of which is students using questioning as a learning strategy. The purpose of this study was to (a) examine the use of questioning as a learning strategy in primary science, and (b) discuss the relationship between student questioning and learning in science. A Primary Six class of thirty-five students was selected for this study. This class was taught special questioning techniques by the teacher which involved Dr Sandra Kaplan's Model, a question web and question prompts. The study is centred on the socio-scientific issue of 'Alternative Energy'. It included a debate which involved eight students with four of them having opposing points of view with regards to the issue of 'Alternative Energy'. Data were collected from students' written reflections, written reports, a questionnaire, a debate and pamphlet-making. To a large extent, students found that questioning helped them to probe deeper into the topic on 'Alternative Energy'. Consequently, students were motivated to find out more and expressed what they had found out about the topic through their pamphlet-making. The pamphlets made by them were exhibited in public in a schools' carnival at Suntec City.

Questioning as a learning strategy in primary science

Introduction

Students may adopt either a deep approach or surface approach to learning (Chin and Brown, 2000). Related to the two approaches are learning strategies that are characteristic of the respective approaches. Some learning strategies facilitate learning and these include summary-writing, prior knowledge activation, self-questioning and question-answering (Pressley et al, 1989). Other learning strategies focus on products of learning like rehearsal, repetition and categorization (Brown, Campione and Day, 1981), the emphasis being more on rote-learning skills. Over the years, there has been a shift from remembering facts to "learning how to learn" skills, which is towards more independent learning. This move is in the direction of transferring more of the responsibility of learning from the teachers to the learners.

According to Schodell (1995), "In science, critical questioning is at the heart of the scientific approach." It is also observed that there is a gradual shift in the research from teacher-questioning to student-questioning in the academic realm. There is an increasing number of educators who have begun to highlight the importance of student questions in the learning of science (Marbach-Ad and Sokolove, 2000; Chin, Brown and Bruce, 2002; Graesser and Olde, 2003). According to Harris (2000), questioning that is used appropriately by both teachers and students can transform a classroom from a traditional lecture setting into a lively student-centred community.

Since the late 1970s, researchers like Rowe (1978) believed that questioning strategies was a key attribute of inquiry-based teaching. Students learn through asking their own questions, and not from just answering questions from teachers (Moll and Whitmore, 1993).

By allowing students to generate questions, explore and interpret what they see, teachers can stimulate students' appetite for explanation (Deal & Sterling, 1997).

Background to the problem

In the context of Singapore, primary students are required to purchase science textbooks in almost all mainstream schools. Perhaps, only the Gifted stream students are exempted from this. Primary science textbook writers have to follow guidelines laid down by the Ministry of Education. Students usually treat their textbooks as the main source of information and tend to memorize facts. This constitutes a surface approach to learning. Some students would also purchase 'booster notes' or assessment books which contain notes as study materials. Few use the learning strategy of self-questioning and the deep approach to learning (Gwan, 1996).

In addition, learning in the local classroom tends to be the outcome of mainly teacher-directed instructions rather than on students' own inquiry. Local school teachers frequently follow the IRE (Initiation, Response, Evaluation) method (Mehan,1979). Basically, the teacher will ask a question and wait for the students to respond. The teacher will evaluate the answer to the question and then follow up by some elaboration or further explanation. This does not allow for much student questioning and in fact, Dillion (1988) noted that students' questions are rare and may be limited to the end of the lesson, which is the usual case in local schools.

In some instances, when students' questions occur, the teacher may interpret them as a challenge to authority and choose not to interrupt the flow of the lesson to consider them (Baird & Northfied, 1992). This is a common occurrence in local schools. In addition, teachers in the local primary schools are 'generalists', in that, they teach all subjects in the primary curriculum. The majority of primary science teachers are not trained specifically to teach science; many learnt on the job and accumulated science knowledge through years of

teaching science. As a result, some teachers may not be confident enough to answer the students' questions. However, teachers are encouraged to move from teacher-centred teaching to student-centred learning. One aspect of student-centred learning is that of student questioning. As such, it will be helpful to find out more about the use of questioning as a learning strategy in student-centred activities. Students in our local schools have a common tendency to depend on their teachers to provide them with the knowledge and answers. In this twenty-first century with an emphasis on new skills in terms of learning, our students need to move towards taking ownership for their learning and turn from being passive learners to independent learners.

Objective of the Study

The objective of the study is to find out how the questioning strategy planned and implemented in this study may be used in the learning of science based on a socio-scientific issue of 'Alternative Energy'.

Methodology

The Participants and the School

In this Primary Six class of 35 students, every one is a high achiever in terms of academic performance. This class is known as the Sophia Blackmore Class (SBC) and all of them have passed at least the first round of the Primary Three streaming test for Gifted Education. The school in the study is an all-girls government-aided school with a total enrolment of about 1 300 students.

Sandra Kaplan's Model and Icons

In this study, students were trained to ask questions based on Dr Sandra Kaplan's model on depth and complexity (Kaplan, 1997). The SK model or the depth and complexity model introduces 11 basic icons which represent various aspects of knowledge and

understanding with accompanying prompts and questions of inquiry, ranging from the most basic level to the higher thinking skills level. The icons provide the students with a structured flow in their thinking processes as each icon serves as a focal point to stimulate thinking, and it has the flexibility of any combination of the icons, depending on the subject matter. The 11 prompts are: language of the disciplines, details, patterns, unanswered questions, rules, trends, ethics, big ideas, interdisciplinary relationships, over time, and different perspectives. Sample questions for the prompts include the following:

- Language of the disciplines – What terms or words are specific to the work of _____ (disciplinarian)?
- Unanswered questions – What is still not understood about this area?
- Ethics – What dilemmas or controversies are involved in this area?

Setting for the Study

The topic for this study was on the social-environmental issue related to "Alternative Energy". This topic ties in with the Ministry of Education syllabus on the chapter of "Energy". The main body of the chapter was first taught to provide the students with knowledge and conceptions on the sources, types and conversion of energy. The total duration of these lessons, which were held in weeks 3-4 of term 1, took 6 one-hour sessions over 2 weeks. The modes of teaching included direct teaching using Powerpoint slides from textbook resources and teacher questioning via IRE.

The class was then divided into small groups of four members each. This was to facilitate the activities (i.e. Activities 1 – 5) in the later stage. These activities took about 9 one-hour sessions which were conducted during the post-examination periods in term 2 and term 4. Activity 6, an individual task, took another one hour after activity 5. The details are summarized in Table 1 below:

Table 1. *Summary of Activities*

Time-frame	Duration	Activity	Description
Term 2 Week 9	2 one-hour sessions	Activity 1: KWHL chart with SK model	11 questions are formed by embedding key questions from SK model into the KWHL chart (by the teacher)
Term 2 Week 9 & 10	2 one-hour sessions	Activity 2: Question Web	The use of 'what', 'why', 'when', 'who', 'how' to form questions (by the students)
Term 2 Week 10	2 one-hour sessions	Activity 3: Question Prompt Report-writing & Reflections	The use of 8 process skills questions to elicit thinking (6 by the teacher and 2 by the students)
Term 4 Week 7	1 one-hour session	Activity 4: Debate	2 teams of 4 students each argue on the topic 'Alternative Energy is Good for Mankind' (A total of 8 students only)
Term 4 Week 7	2 one-hour sessions & Homework	Activity 5: Pamphlet-making	FAQ-style or informative-style of brochure done by individual students (a total of 35 students)
Term 4 Week 7	1 one-hour session	Activity 6: Questionnaire	5 questions given to the 35 students and a 6th question given to the 8 debaters

Procedure

The 35 students in this study were first introduced to the 11 icons of the SK Model which had been taught to them earlier in Primary 4 during their science lessons on topics like "Heat" and "Light". The students were familiar with the use of these icons in terms of organizing their knowledge and concepts based on the associated questions of inquiry.

Next, the students worked on tasks that were specifically designed for discussion and questioning on the topic of "Alternative Energy". They had to compare the pros and cons of

traditional energy sources against alternative energy sources and to write a report on it. They also discussed the different forms of alternative energy and any other issues related to alternative energy. There were 9 groups of 4 students each. After this preliminary discussion, the students were ready to start their activities.

Activities

There were altogether three questioning activities (viz. KWHL-chart with SK model, Question Web and Question Prompts) on Alternative Energy for which students first worked individually and then in small groups. Students were always briefed verbally by the teacher on the procedures of each activity.

Activity 1: K-W-H-L Chart with SK Model

The SK model's key questions were embedded in the broader framework of the KWHL chart (Ogle, 1986), which is frequently used in primary school as an inquiry organizer. In this study, this organizer is used as the overarching framework for detailed questions from the SK model to be asked.

K represents "What I **K**now"

W represents "What I **W**ant to know"

H represents "**H**ow will I find information?"

L represents "What I **L**earned"

The students discussed in groups before individually writing their answers to each question, which was based on a certain aspect of the SK model. All the eleven SK icons which are related to the different aspects of questions of inquiry were parked into the KWHL chart according to similarity in terms of grouping. For example, students were taught key words relevant to the chapter on Energy. Hence, the SK prompt of "Language of the Discipline" with the question "What terms or words are specific to this topic" was parked under "What I Know" in the KWHL chart. Another example would be the question "What is

still not understood about this area?" The SK prompt of "Unanswered questions" would be appropriate for "What I Want to Know" in the KWHL chart. Students in the primary school are usually not fully aware of the ethical issues involved in the production of alternative energy. Hence, it was appropriate to include the SK prompt of "Ethics" with the question "What dilemmas or controversies are involved in this topic?" under "What I Learned" in the KWHL chart. A list of relevant websites was given to the students to source for answers to the questions.

Activity 2: Question-Web

Students were again given some time to think and then talk about questions they had in mind on Alternative Energy. This 'pre-talk' before doing the Question-web was necessary to facilitate the thinking process. The simple set-up of a Question-web was explained to the students. The use of 'what', 'why', 'when', 'where', 'who', and 'how' was prevalent in the Question-web. The students were required to individually plan their own question web on a given template. The usefulness of this activity in stimulating the students to find answers to their questions was determined from the data collected in the "Reflection" exercise.

Activity 3: Question Prompts

Questions based on Chin (2006)'s questions in developing students process skills were also implemented. Questions to tease out students understanding of process skills in comparing, generating, evaluating, decision-making, and creative problem-solving were asked in the form of question prompts. Students were given a short time to take a look at the eight given questions. They were then given four articles to read. Three of these articles were news and Forum-page articles taken from The Straits Times which were published at various times while the fourth article was a BBC article. Students were required to generate two questions by completing the questions that were given as starters. These two questions

were “What would happen if …?” and “What are some possible reasons for …?”. Students were given time to write their individual reports and complete their own reflections.

Debate

At the end of the three questioning activities, the nine groups of four members each had to make a stand for or against the use of alternative energy based on the debate topic: Alternative Energy is Good for Mankind”. The word “Good” literally implies something positive for mankind. All 9 groups were given the chance to present their stand and the best speaker from each group was picked by the class to participate in the actual debate.

Pamphlet-making

This study culminated in the production of educational pamphlets. Some guidelines like doing it in the FAQ style or informative style were given. The pamphlets were exhibited in Suntec City during the November 2008 Schools’ Carnival which was organized by the National Environmental Agency, Singapore. This carnival is an annual affair to highlight environmental issues and promote environmental awareness among local school children. The 2008 theme for the carnival was “Clean and Green Singapore”.

Perception Questionnaire

Finally, a perception questionnaire was administered to the whole class at the end of this study. The aim of this questionnaire was to find out the extent to which questioning had helped students in their understanding of the topic on Alternative Energy from the students’ perspective.

Results

Types of Questions

In this study, the questions asked by the 35 students in the first three activities can be categorized in the following manner, with examples given below:

- Knowledge-factual

  e.g. What are examples of alternative energy?

- Comparison

  e.g. The general view is that traditional energy harm the earth. But is alternative energy any better?

- Unanswered

  e.g. What would happen if we ran out of traditional energy?

- Analysis and explanation

  e.g. Why can't we switch to solar energy?

- Problem-solving

  e.g. How can we face the problem of a dwindling supply of traditional energy?

- Decision-making

  e.g. Why not make it mandatory for solar panels to be installed?

Generally, students could provide reasonable answers to the knowledge-factual type of questions with answers like "We can save energy through recycling, reusing and reducing" and "Alternative energy include energy from the sun, wind, hydroelectric power station, biomass, tides, nuclear power station and geothermal sources." Students could answer factual questions posed by themselves or their classmates when they search the internet. By doing so, one student wrote that "I not only answered my question, but also chanced upon new facts and learned more."

In the students' pamphlets, they also answered questions like "Why do we need alternative sources of energy?" and "What are the advantages and disadvantages of alternative energy?" In their written work, they reflected the importance of "using alternative energy carefully so as not to cause more pollution or increase global warming and in the

current state of the world energy crisis, we are to use traditional energy wisely and not to waste what we have right now."

Open Report

In the report-writing, students could express clearly the facts and information about the various types of alternative energy; the advantages and disadvantages and the environmental issues related to the use of fossil fuels. For example:

> "Resources from the sun (solar), earth (geothermal), wind (wind power), agricultural crops and animal waste (biomass), landfill and methane gases (biogas) and other sources like fuel cells are examples of alternative energy resources. These resources are abundant and are renewable." (Student SO)

Repeatedly, the common themes that surfaced in these reports included the following:

- Financial cost of alternative energy

  e.g. "Cost is one factor. The price of alternative energy is much higher than the price of traditional energy. Thus people prefer traditional energy." (Student BE)

- Limitations of alternative energy

  e.g. "No country depends fully on wind to generate all their electricity as when there is no wind, no electricity is produced." (Student SE)

- The need to source for alternative energy

  e.g. "Alternative energy is much sought after nowadays as the supply of fossil fuels is running low…" (Student ET)

- Alternative energy and the environment

  e.g. "Solar energy is free. It also does not cause pollution, unlike many other sources of energy." (Student CL)

- Students' stand on alternative energy

e.g. “Wind is a good alternative source of energy, but it is not good as a main source of energy because it is not reliable.” (Student SI)

Students’ Reflections

On the whole, students found that questions help them to gather information, organize the ideas, identify points of view, dig deeper and raise more issues related to alternative energy. Students wanted to use questioning as a learning strategy because it made them want to learn more. Examples of students’ responses include:

> “Yes, questions help me to think deeper into the topic and more ideas are formed. For example, when will we depend on alternative energy for more than half of our energy needs? I ask this question because the world seems to be using more and more energy, like electricity.” (Student ET)

> “Yes, questions help me to organize my thoughts better on the topic and as I question myself, I find my answers. For example, I want to know why alternative energy is expensive. I realize that the process of getting energy from alternative energy sources, like solar energy, comes from expensive materials and technology which needs a lot of money. So, if the items in the making of solar energy are expensive, then the cost of solar energy has to be expensive.” (Student JY)

Students also reflected that questions were helpful in their discussion on alternative energy. They had to support their answers with specific examples. Student PA wrote:

> “Questions widen and deepen discussion on this topic of alternative energy. For example, I don’t just accept that alternative energy is good and fossil fuel is bad. I want to know the advantages and disadvantages of both alternative energy and fossil fuel.”

Student SY also commented that “Questions help to identify points of view: what are different points of view of e.g. businessmen against environmentalist?”

Student BE’s reflection was:

> "Yes, but I also want to ask (question) others. Using self-questioning gets me thinking and it makes me want to learn more. On the other hand, asking others and sharing your knowledge with them is good too because they get to learn as well."

Based on the data collected from the students' reflections, there appeared to be three recurring themes:

- Questioning is a way to clarify doubts and misconceptions
- Questioning enables one to gain a better understanding of the topic
- Questioning makes one think deeper and propels one to want to learn more

Students had expressed in their reflections that they agreed on the common point that questions are helpful and needful for them to work on the topic "Alternative Energy". Through questionings, they understand the topic much better in terms of breadth and depth. This is often translated into their work. They are also motivated to find out more about the topic as one question would lead onto another in order to satisfy their quest for more knowledge and understanding. From the students' reflections, a positive relationship between questioning and students' work has surfaced.

Debate

The proposition team put forward the following claims, reasons and questions, to support their stand:

- The world's population is increasing and since fossil fuels are non-renewable, there is a need for alternative energy.
- The financial cost of the initial set-ups of some alternative energy is high but it is a justifiable cost and it will be recovered in the long run. Most other forms of alternative energy, like wind and solar energy, are free.
- How much more harmful can alternative energy be as compared to traditional energy in polluting the environment?

- Countries are using alternative energy in greater numbers, so it cannot be wrong.

The opposition team rebutted and put forward the following claims, reasons and questions to support their stand:

- The returns are small as compared to the investment in alternative energy, as some evidence has shown (e.g. solar energy is only about 10% efficient currently). Is the payback in the long run for the huge investments in alternative energy worthwhile?
- Since alternative energy is very expensive, it might be more worthwhile to use the money to repair the negative effects of using fossil fuels.
- What happens if alternative energy causes more harm to the environment? For example, biofuel can cause carbon disruption in the air.
- Strong political support is needed to substantiate the drive for alternative energy. Poorer countries won't be able to do so.

At the end of the debate, the judges had their discussion. The following are some highlights and patterns that they had observed:

- Both teams had done intensive research and given deep thought to the presentation of their arguments. The advantages and disadvantages of whether alternative energy is good or bad were well argued.
- The issue of sustainability was addressed by both teams.
- The financial and environmental costs were addressed.
- The opposition had pointed out several important issues like alternative energy could be pollutive and the low returns to large investment of alternative energy.

The team that won the debate was the opposition team.

Pamphlet-making

In addressing the types of questions asked by students, the pamphlets appeared to slant towards answering more of the lower-order type of questions. Basically, the content in the pamphlets dwelled on the knowledge-factual type of questions and providing appropriate answers. An example of a knowledge-factual question would be: "What are the different types of alternative energy?" and the answers would be: "Biomass, wind energy, solar energy, hydro power – with descriptions given of the stated alternative energy" (Student ME).

However, there was a minority of students who tried to move beyond doing the lower-order questions and the appropriate factual answers to more problem-solving type of questions and answers. Student IS presented her pamphlet by suggesting ways to conserve energy at home, in school and on the road. Student GL asked the question: "What can we do to help save the Mother Earth?" and she also tried to analyze the deeper issues into environmental damage by asking the question: "What are the linking problems to this issue?". She wrote a small section in her pamphlet as follows:

> "When we burn fossil fuels, carbon dioxide is emitted into the air. Carbon dioxide is considered a green house gas, thus contributing to global warming. Global warming then in turn causes the thinning of the ozone layer and if humans are exposed too much to the ultra-violet rays, we might develop skin cancer and other skin diseases."

Perception Questionnaire

There were altogether six questions in this open-ended perception questionnaire on "Questioning as a Learning Strategy on the topic – Alternative Energy". The number and percentages of students out of a total of 35 students who answered positively to questions 1 to 5 were recorded. The 6th question had only eight students answering since it was a question based on the debate. A summary of the quantitative findings is shown in Table 2 below:

Table 2. *Responses to Perception Questionnaire*

No.	Question	No. who answered positively	%
1.	Does the KWHL chart help you to learn better on this topic? Please explain.	28	80.0
2.	Does the SK model help you to question and learn better? Please explain.	29	82.9
3.	Does the 'Question-Web' activity help you to organize your questions better on the topic? Please explain.	26	74.3
4.	Does the 'Question Prompts' activity help you to think deeper about the topic? Please explain.	26	74.3
5.	Does doing the brochure on Alternative Energy help you to comprehend the issues with deeper insights? Please elaborate.	30	85.7
6.	(For those involved in the debate only) Does participating in the debate bring you to a higher level of understanding of the issues involved in Alternative Energy? Please elaborate.	8	100.0

Question 1

<u>Does the KWHL chart help you to learn better on this topic? Please explain.</u>

80.0% of the students in our sample group felt that the guided questions helped them to recall facts, think about issues related to the topic and lead them to ask more questions. However they were some who did not find it helpful. One student who did not find it helpful wrote, "No. I usually map things out in my mind and would not need a KWHL chart, although it might help if I need to recall a fact or question I have forgotten." (Student ET). This student had her own preferred way of learning - using mapping to help her.

Question 2

<u>Does the SK model help you to question and learn better? Please explain.</u>

Altogether, 82.9% of the students in our sample group felt that using symbols/icons help them to question better by providing a way to approach the topic. One student wrote that "it makes learning and remembering things easier." (Student JA). These students were usually

visual learners who liked to associate different aspects of learning with icons. Some found the icons interesting as it was a refreshing change from the usual method of using words alone to describe scientific concepts.

Question 3

Does the Question-Web activity help you to organize your questions better on the topic? Please explain.

74.3 % of the students in the sample group agreed that the web helped them to organize their ideas and thoughts which they could share with their friends. In addition, the web helped them to focus on key words and phrases (e.g. global warming) and this in turn assisted them to research more into these areas.

Question 4

Does the Question Prompts activity help you to think deeper about the topic?

74.3% of the students in the focused sample group felt that the prompts directed them to think from different perspectives and think of areas related to alternative energy that they never knew even existed. However, some of the students did not find it helpful. One of them wrote, “No. I only thought of the basic concepts. I did not think deeper.” (Student XA). This student did not attempt to think more. Perhaps, she was not interested in the topic.

Question 5

Does doing the brochure on alternative energy help you to comprehend the issues with deeper insights? Please elaborate.

85.7% of the students in focused sample group felt that doing the information brochure had an impact on their understanding of alternative energy. They had to research into the topic and in the process, they had gained useful knowledge. The majority expressed satisfaction in gaining more understanding and knowledge in doing the brochure. However, there were some who did not find it helpful. One of them wrote,

"Not really. It is just basically putting together what you have found out into a brochure." (Student YS).

Question 6

Does participating in the debate bring you to a higher level of understanding of the issues involved in alternative energy? Please elaborate.

100% of the students in the sample group felt that the debate posed arguments from different points of view and in preparing for the debate, they were motivated to dig deeper into areas in which they were uncertain of. Thus they had to think at a higher level and question more.

Discussion

From the results of the activities and analysis of the information reports, perception questionnaire and debate, the following surfaced:

- Questioning helped students to think deep into the topic on alternative energy.
- Students find questioning helps them in their learning. They understand the topic on alternative energy much better.
- Questioning helped students to find answers to their own questions on alternative energy.

Students posed questions after they had thought about what they wanted to ask and summarized their learning in report-writing and reflections. Students' questions helped them to build up their understanding and increase their knowledge to the extent that they had the confidence and content-matter to engage in arguments as shown by the debate and producing the pamphlets for public display.

In carrying out this study, it was not easy to find time to conduct the study at shorter intervals between activities due to the tight school schedule and the curriculum. The only available periods were the window periods of post-examination weeks in May and October.

The wide time gap in between activities might have an effect on the results of the study. Some students might have forgotten what they had learnt. In fact, one student had expressed surprise when she was asked to complete the questionnaire because she had almost forgotten the series of activities that she was involved in from the beginning of the year. On the other hand, some students benefited from the long time lapse in between activities. These students were those who were the reflective type who needed time and space to think through questions and issues that had surfaced during the course of the various activities.

A further point to note in the implementation of the activities is the sequencing of Activity 1 and 2. Activity 2 involved a simple question web with the 5 "W's" for the students to focus their attention on the questions to be generated. The more 'demanding' Activity 1 involved a combination of KWHL-chart and SK model with 11 questions for the students to think about and provide answers. In terms of progression of the level of difficulty from a lighter task to a heavier task, it might make good sense to start off doing the question web first before moving onto the KWHL-chart with SK model. Another worthy point to note is in the design of the question web. Data collected from the students in this study showed that students could not focus on relevant aspects of Alternative Energy, like, the pros and cons of using alternative energy and traditional energy. It might be useful to redesign the question web by clustering perspectives on alternative energy from various people, like, politicians, environmentalists, industrialists, scientists and journalists.

Implications

From this study, the students from this Sophia Blackmore class had benefited both in terms of the amount of knowledge gained and the depth of understanding on the topic 'Alternative Energy' through the use of questioning as a learning strategy. The question asked then would be, "Is questioning as a learning strategy helpful in other science topics or even in other subjects?" One area that can be looked into involved small-group learning

through peer-questioning. In addition, the question that can surface would be: “What impact does this study have on the students’ desire to want to conserve energy?” It might be interesting to look into the change in thinking that may in turn affect students’ change in future behaviour. The bigger question would then become: “Could this study support the view that education is the basis to change behaviour?”

Limitations

The participants in this study were high-ability students. Using the same methodology in this study to work on another sample may not have the same results.

Conclusion

There is evidence in this study from the students’ open report, reflections, debate, pamphlet-making and questionnaire to suggest that having student ask questions does affect their work positively. It would then mean that student questioning is a helpful and meaningful learning tool in primary science as shown in this study. In terms of classroom practice, this may translate to more student-centred learning through questioning. However, students must be guided to ask relevant questions that relate to their subject of study. Therefore, in terms of inquiry learning, the teacher’s role would then be that of a facilitator of the lesson instead of the giver of knowledge.

In the context of primary science education in Singapore, it may be of interest to both the teachers, who are the instructional experts, and the students, who are the learners, to work towards a change in the way science is presently taught in the local classrooms. There is a reduction in content knowledge in the new science syllabus implemented in 2008. This may be an opportune time to discard didactic teaching methods in our classrooms and adopt the student-centred inquiry-based method of teaching for certain topics.

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