A NEED FOR COLLABORATIVE MOBILE LEARNING
IN FORM TWO SCIENCE

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ABSTRACT
A survey of 30 Form 2 students in a boys’ school in the Klang Valley shows that most
students have access to computers and mobile phones, and already use ICT for their
homework assignments and to communicate. SMS is also widely used by students to
communicate. Students surveyed also indicated that they wanted more time and opportunity
to review their studies and to work in groups with friends. Students would also be willing to
use SMS and online groups for learning.

INTRODUCTION
There seems to be a need to communicate as students collaborate and work in groups while
learning science (Brown, 2006; Cosgrove & Schaverien, 1996; Greeno, 1992; Olitsky, 2007).
This need could be addressed through the use of communication tools (Osbourne and
Hennesy, 2003) for collaboration and communication while the student is mobile.

In a formal school environment, students’ need are seen as the optimal performance desired
by the school as an institution, and is normally related to student achievement. However,
there may be other unstated needs (Piskurich, 2000) such as the need to improve the
environment; the lack of incentives; motivation to study; or other affective factors.

In this study, the needs analyzed are limited to the personal needs of the students in relation
to communicating in science. Communicating is one of the science process skills required by
the Ministry of Education.

By analyzing the needs, a needs assessment is done. A needs assessment assists in
gathering information to make “data-driven and responsive recommendations” (Rossett,
1995) on the context and environment. In this study, information will be gathered on the
perceptions and feelings of students on learning and communicating in science.

PROBLEM STATEMENT
In teaching science, two important aspects are the scientific knowledge and the scientific
methods. Scientific knowledge is the content while scientific methods are the science process
skills and reasoning skills (Abruscato, 2000; Trowbridge, Bybee and Powell, 2000).
Communicating, one of the science process skills, does not seem to be emphasized enough
in the science classroom. However, it is believed that information communications technology
can be used to encourage communication and collaboration in science, even when students
are out of the classroom (Osbourne & Hennesy, 2003). Hence, this study seeks to discover if
the need for communication exists among Form 2 students in the science classrooms, and
whether these students would be willing to use information communications technology,
namely mobile technology and online collaborative groups, for learning.

The results of this study would benefit policy planners and teachers to determine if there is a
need for communication in science and the choice of communication tool to be used. With the
needs of the student in mind, instructional activities and materials can be designed using the
preferred communication tool.
PURPOSE OF THE STUDY
This study seeks to find out the situation regarding Form 2 students’ use of computers and mobile phones, and their preferred learning methods for science and communication strategies with technology.

Research Objectives
The objectives are to investigate:
- to what extent Form 2 students use computers and mobile phones.
- what learning methods are used by students
- the students’ need for a tutor/facilitator when not in the school environment
- problems students have in learning science
- which content areas students find difficult
- the preferred methods of learning science
- the forms of online communications students use.

Research Questions
1. What are the types of technology that students have access to and the frequency of use of these technologies?
2. What are the preferred learning methods used by students?
3. Do students need contact with a tutor/facilitator when not in the school environment?
4. What problems do students have in learning science?
5. What are content areas in Form 2 Science that students have difficulty in?
6. What are the preferred methods of learning science?
7. What form of online communications do students use?

LITERATURE REVIEW
Nature of science and science education
Science is defined as “the body of knowledge people build when they use a group of processes to make discoveries about the natural world”(Abruscato, 2000, p.2). Science consists of both the content and the scientific and reasoning processes. Scientific knowledge (content) is built using scientific reasoning processes and may be conducted individually or in collaboration with other scientists “within a community of peers” (Hogan & Fisherkeller, 2005, p.96).

Scientific methods, which consist of science process skills and scientific reasoning, use the processes of scientific inquiry to discover science knowledge (Abruscato, 2000; Trowbridge, Bybee and Powell, 2000). The science process skills are observing, classifying, using space/time relationships, using numbers, measuring, communicating, hypothesizing, experimenting, controlling variables, interpreting data, predicting, inferring and defining operationally. (Abruscato, 2000; KPM, 2003).

Communication in science
One of the science process skills is communication to pass information among individuals or groups of individuals, in the form of words or symbols (Wolfgang, 2000). The construction of knowledge and thought is supported by social and cultural processes such as communication (Hoyle & Stone, 2000; Champagne & Kouba, 2005). Vygostsky’s social constructivist view is that scientific knowledge and procedures should not be taught, but should be constructed by learners in the course of a discussion (Greeno, 1992; Karpov & Haywood, 1998). However, these discussions should allow learners to contribute their own ideas based on their current understandings of concepts and principles (Greeno, 1992). So, in order to assist learners in building their understanding of scientific concepts and principles, learners must be given sufficient activities for during discussions (Greeno, 1992). In addition, teachers must be more aware of the difficulties learners experience when trying to comprehend the vocabulary and language structures of science, and thereby link the science knowledge to the learners’ personal experience (Ellerton, 2003).

In the social interactions during the discussions, learners usually acquire the tools of scientific language and symbols, and scientific verbal knowledge from the teacher (Karpov & Haywood, 1998). However, teachers provide individualized support for scaffolding, targeted to learners.
who require support, and show patterns of the words, symbols and models of scientific language (Hoyle & Stone, 2000). Hence, developing the language skills, example, listening and speaking skills, in scientific discussions are important for planning, sharing and developing ideas and understandings in science as well as critical thinking skills (Hoyle & Stone, 2000; Ellerton, 2003).

In fact, many researchers have shown that social interactions have motivated learners to be engaged in carrying out activities successfully to build their knowledge meaningfully in science (Brown, 2006; Cosgrove & Schaverien, 1996; Greeno, 1992; Olitsky, 2007). Even learners at elementary school level between Grade 8 and 10 can participate in science discussions (Brown, 2006; Greeno, 1992; Olitsky, 2007). However, the success of the discussions would depend on the learners’ understandings of the language, their motivation, beliefs, and whether they have assimilated into the culture (Brown, 2006).

**The use of technology in teaching science**

Technology can be used to deliver science content and teach the scientific method (Jonassen, 2000; Osborne & Hennesy, 2003). Technology, namely information communications technology (ICT), has been used in many areas of science education. Computer-based tools and the internet has enabled the curriculum and the pedagogy of science to move out of the classroom (Osbourne & Hennesy, 2003) as a large quantity of real data and other statistics are available online, example real-time Air Pollution Index. However, before this data is made used of, the learner will required the scientific knowledge and reasoning skills to reflect critically and analyze the validity of the online resources (Osbourne & Hennesy, 2003).

Technology can help encourage collaborative learning as students work together on projects in science and share their knowledge and expertise (Osbourne & Hennesy, 2003). In fact, Osborne & Hennesy (2003) found that teachers believed that communication technology can provide a medium for discussion among students. In fact, discussion forums, e-mails and wikis could allow work in progress to be improved upon by students. In addition, communication technologies enable students to e-mail experts in the field of science and technology to get feedback and have authentic discussions (Osbourne and Hennesy, 2003).

Language is important for communicating during science lessons, and communication, through discussions and collaborations, is important for building scientific knowledge. Information communication technology, even though it has not be used much (Osbourne and Hennesy, 2003), has the potential to facilitate communication, and the learning of science, out of the classroom.

**METHODOLOGY**

**Design of the Study**

The study used questionnaire as an instrument for data collection. The participants of the study were thirty eight (38) Form 2 students in a boy’s school in Petaling Jaya. Although the school is an urban school, however students in the class selected were from different socio-economic status.

**The instrument**

The instrument, Survey on the Use of Technology in Science was developed to investigate the following areas: Use of technology; Learning methods; Science learning strategies; and Communication strategies

The instrument consisted of a variety of questions, from open-ended questions, to gauge the opinions of subjects, and multiple choice questions. The instrument considered the following:

1. The use of computers and mobile technology
   - The number possessing a computer and/ or mobile devices such a mobile phone
   - The frequency of use
   - The purpose of use

2. Need for a more personalized learning in science
• Methods of studying
• Reminders for work and assignment
• A need to have an expert on-hand
• A need for frequent and regular contact with tutor/facilitator
• Learning on demand, or while waiting for a bus

3. Need for more engaging modes of learning
• The use of SMS
• The use of online collaborative groups
• Need for collaboration with peers, tutor/facilitator

An expert in science and another in instructional technology, were asked to check the validity of the instrument.

FINDINGS

Types of technology tools students access

More than half the students (65.8%) have access to a computer with internet connectivity but almost three quarters have access to mobile phones (73.3%). Some (18.4%) even have the more expensive smartphones with 3G connectivity.

In Table 1 below, more than half the subjects (55.2%) used computers with internet more than twice a week. Computers with Office applications were less often used with 39% using the computers more than twice a week. On the other hand, mobile phones were used by more than 75% of subjects more than twice a week. However, 71% had never used a smartphone, a mobile phone with internet access.

There were some subjects who did not respond to this question. When interviewed, some subjects admitted that they did not understand the meaning of Office Applications, and Smart phones with 3G. They were not familiar with the terms and did not use these tools.

Table 1: Frequency of use of computer and mobile phone

<table>
<thead>
<tr>
<th>Tool used</th>
<th>Frequency</th>
<th>Computer with Office Applications</th>
<th>Computer with Internet</th>
<th>Mobile phone</th>
<th>Smart phone with 3G access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>Never</td>
<td>7 19.4</td>
<td>5 13.2</td>
<td>4 10.8</td>
<td>22 71.0</td>
<td></td>
</tr>
<tr>
<td>Seldom</td>
<td>7 19.4</td>
<td>0 0.0</td>
<td>8.1</td>
<td>2 6.4</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>8 22.2</td>
<td>12 31.6</td>
<td>2 5.4</td>
<td>1 3.2</td>
<td></td>
</tr>
<tr>
<td>Often</td>
<td>5 14.0</td>
<td>3 7.8</td>
<td>9 24.3</td>
<td>3 9.7</td>
<td></td>
</tr>
<tr>
<td>Very often</td>
<td>9 25.0</td>
<td>18 47.4</td>
<td>19 51.4</td>
<td>3 9.7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>36 100.0</td>
<td>38 100.0</td>
<td>37 100.0</td>
<td>31 100.0</td>
<td></td>
</tr>
<tr>
<td>No response</td>
<td>2 7</td>
<td>1 3</td>
<td>7 22.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 below shows that subjects largely use computers for entertainment (71.1%) like playing games. Computers with internet access are also used for communication (60.5%). However, some subjects do make use of computers with internet access for study (42.1%).

Table 2: Purpose of use of computer and mobile phone

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Computer with Office Applications</th>
<th>Computer with Internet</th>
<th>Mobile phone</th>
<th>Smart phone with 3G access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
<td>No. (%)</td>
</tr>
<tr>
<td>Communications</td>
<td>17 44.7</td>
<td>23 60.5</td>
<td>34 89.5</td>
<td>10 26.3</td>
</tr>
<tr>
<td>Entertainment</td>
<td>27 71.1</td>
<td>27 71.1</td>
<td>16 42.1</td>
<td>9 23.7</td>
</tr>
<tr>
<td>Study</td>
<td>12 31.6</td>
<td>16 42.1</td>
<td>2 5.3</td>
<td>1 2.6</td>
</tr>
</tbody>
</table>
Preferred learning methods
Subjects preferred to learn by the following methods: reading notes or textbooks (81.6%), hearing the teacher’s explanation (76.3%), and practice or do activities in groups (63.2%). Less than a quarter preferred using interactive multimedia materials or discussing with friends (18.4% and 17.1% respectively).

Contact with a tutor/facilitator
Many subjects (78.9%) have experienced encountering a problem while they were studying out of school and had wished (76.3%) to contact an expert after school hours. However, only half (50%) had felt that they needed to obtain an answer immediately.

More than half the subjects (65.8%) felt that time spent waiting for a bus could be put to better use and almost a quarter (71.1%) were willing to receive notes while waiting for a bus and using SMS for learning. Those who disagreed on using the mobile phone cited reasons such as the small screen size, lack of use of mobile phones, a preference for books and that mobiles are not meant for learning.

Problems in learning science
Three quarters of the subjects (76.3%) liked studying science. However, the difficulties most seem to have is recalling facts (57.9%), followed by understanding concepts (44.7%).

Difficult content areas in Form 2 Science
Among the Form 2 science topics, more than half the subjects (60.5%) found the chapter on “Nutrition” difficult, followed by “The world through our senses” (31.5%). One reason cited is because there are a lot of facts to remember in these two biology-based topics.

Preferred methods of learning science
More subjects preferred to read notes (76.3%) and do more exercises (71.1%) when learning science. More than half would not mind spending more time for revision (57.9%) and have more time to discuss scientific concepts (55.3%) as well as find ways to solve problems (55.3%).

In practice, the majority of subjects (84.2%) admit that they have discussed with friends problems in learning science, and that they like group work and activities (86.8%). Subjects would also like to receive feedback on work in progress (76.3%), rather than at the end of the activity (28.9%).

Forms of online communications used
Instant messaging or electronic chat (with 44.7% using more than twice a week) seems to be the preferred method of communication compared to emails (36.3%).

It is confirmed that the internet has been used for homework assignments by most subjects (76.3%). Furthermore, even though only about half were willing to discuss online (50.0%) and use online groups (52.6%), more were willing to use online groups for learning (73.7%). Those who were not willing to use it cited reasons such as lack of internet connectivity, the impersonal nature of online communication, and preferring studying on their own.

DISCUSSION
Most subjects have access to mobile phones as compared to computers. However, as mobile phones are not allowed in schools at the moment, there is reluctance among some subjects to admit that they own a phone. However, as the price of phones decrease, more and more students seem to own mobile phones. Some interesting points are that although some subjects were not able to access computers, but almost all had access to a television. In addition, more subjects could access a mobile phones compared to computers. Some subjects had access to the higher technologies of the more expensive smart phones.

When the frequency of use was compared to the tool that the subjects had access to, it was found that the percentage of use was higher. Computers with internet access were used once a month and more frequently by a larger number of subjects (86.8%) compared to those
(65.8%) who could access a computer with internet. Similarly, mobile phones were used from once a month to more frequently by more than three quarters (81.2%), compared to 73.7% who had access to a mobile. This indicates that these tools could be accessed when the need arose. At the moment, the computer was used for entertainment, communication and to assist in their studies. Mobile phones were limited for communication and sometimes for entertainment.

The subjects seem to prefer learning through the use of notes and textbooks and having more practice in their work, thus preferring a teacher-centered instruction. They were not averse to contacting a tutor after school for help in their studies. In fact many would welcome constant feedback on their work. Some would not even mind receiving notes through text messages on their mobile phones when they were out of school. This could be attributed to the fact that most students had difficulty recalling facts in science, and saw this as a means to aid their memory work. This was further confirmed when subjects choose topics which had a lot of factual knowledge as difficult topics.

Most subjects liked group work and group activities in science. They could discuss problems in learning science with friends and wanted to receive feedback. A number of the subjects (79.9%) had used Instant Messaging on the computer to chat, and even though many had not used online groups before (47.4%), many were willing to use online groups for learning (73.7%).

Based on the findings the possibility of designing a collaborative mobile learning environment for Form 2 science exists as there seems to be a need for such an environment. However, it is understood that these findings are limited to a small group of subjects in an urban school, and may not indicate the perceptions of all Malaysian students.

In designing a collaborative mobile learning environment, there will be several limitations. The access to these tools and devices would have to be provided for the students. Students who did not own mobile phones should be provided with one, and the school computer laboratory should be available for students who did not have computers to access the online group discussions at home.

This form of learning may not cater for all students. The use of a mobile phone to deliver content may not be suitable for those who did not like to read small text on a small screen, or for those who needed a quiet environment for undisturbed learning. The online collaborative group would also have limitations, as some students may hesitate to contribute in online discussions, or may prefer other forms of learning, such as memorizing facts. Different individual have different learning styles, and different preferences. It is hoped that the collaborative mobile learning environment would be able to cater to the needs of some of the students, some of the time, and after school hours. The implementation of collaborative mobile learning environment for learning science could be carried out to determine its effectiveness.

CONCLUSION
In conclusion, there is a need for assistance in recalling facts, and learning concepts in the learning of Form 2 science. There is also a need for more group work and activities to assist learning and obtain feedback. A collaborative mobile learning environment, consisting of an online discussion group for group discussion and problem solving activities; and the pushing of text messages to mobile phones could be designed to meet the needs of the subjects.
REFERENCE


