

# Web-based Tools for Science Teaching in Lower Primary School

**Lye Sze YEE**

*Beacon Primary School*

lye.szeyee@beaconpri.edu.sg

**Abstract:** This paper presents the preliminary findings of the use of Web-based Tools, like Tagul for generating Word Cloud and Forum for Asynchronous Online Discussion, in Science Teaching for a class of 9-year old pupils. The affordances and the implementation of the tools for Science Teaching are discussed in this paper. This exploratory case study of such tools provides encouraging evidence that the tools have the potential to engage the pupils in meaningful learning.

**Keywords:** AOD, Word Cloud, Web-based

## Introduction

Currently, Primary 3 pupils have only 2 45-min periods weekly for Science. The pupils are generally very enthusiastic about Science and always want to share. Usually, there is not enough time for class room discussion for all to participate. There is thus a need to look at how Web-based tools can help to solve such problem. In this paper, a set of free and easily available Web-based IT Tools (like Tagul and Forum) are used. Due to the Web-based and the asynchronous nature, such tools allow Science learning to take place even outside the physical classroom. Such tools allow the pupils to construct and share what they have known with their peers. In the process of such construction, the pupils are engaged in higher order thinking like critical thinking and analytical reasoning [1]. They need to make "certain choices and it is in those choices that the learning process lies" [2]. Such construction of their own knowledge makes learning more meaningful as the learners own their learning [3].

## 1. Literature Review

### *1.1 Tagul - The Word Cloud Generator*

Tagul (<http://tagul.com/>) is free online word cloud generator. A word cloud is a visual depiction of word frequency in a given text. Greater emphasis (it may be font size or colour) will be placed on word with higher counts. One unique feature of Tagul, unlike other word cloud applications, is that the word is actually a hyper-link to a Google Search of that word. This allows the pupils to easily navigate to find out more about the word. Although the usual word cloud generators are not designed for teaching, there are potential uses in education as "astute teachers recognize that such toys are much more than that when they can be used to engage students in creative and critical thinking" [4]. Tagul can be used as knowledge construction and co-construction tool as the pupils contribute words on the topic of the interest. Together with their classmates, they are building a model of their

understanding of the topic. The Word Cloud is generated, thus helping the pupils to externalize their mental model.

### *1.2 Forum - The Asynchronous Online Discussion*

Forum supports asynchronous online discussion (AOD). AOD provides a platform where all pupils can participate in discussion, without the need to meet face to face. This will help to encourage the shy pupils to participate [5]. AOD allows the instructors and pupils to keep a record of their discussion [6]. This can allow the pupils to reflect and review on their learning progress from time to time. By reading, critiquing on others' posts, AOD allows the pupils to collaborate, gain different perspective and construct their knowledge together [7].

### *1.3 Pedagogical Approaches Supported by Tagul and Forum*

During self-regulated learning, the learner owns the learning and takes initiative to work toward self-improvement. As proposed by Pintrich [8], self-regulated learning will involve the use cognitive learning strategies, self-regulatory strategies and resource management strategies. The Web-based tools proposed, Tagul and Forum, provide pedagogical affordances that support some of these strategies. For example, the Web-based tools can support elaboration (one of the cognitive strategies). The tools require the learners to post what they have known, or comment on others' posts. Unlike the traditional face-to-face teaching, the Web based-tools allow all the pupils to have equal opportunities elaborate on what they have known. Such questions asking and answering are important as it supports comprehension, reasoning and problem solving [9].

The asynchronous nature of the Web-based IT Tools supports the use of self-regulated strategies as it allows the learner to have time to plan, monitor and regulate their learning. They have time to think and reflect before they contribute their post/comment [3]. The word clouds by Tagul, the asynchronous discussion in the Forum are always be available on the Web. As such, there is a record of their learning and the learners can track and monitor their learning progress from time to time.

To achieve effective self-regulated learning, the learners must be motivated and eager to learn [10]. The use of the proposed Web-based tools will engage the learners in active learning as they are "compatible with the way students now prefer to learn" [11]. Web-based activity will appeal to the young learners who are digital natives [12].

The Web-based tools also support dialogic discourse which can enhance the learning experience for the pupils. Scott [13]. suggests that learning will be improved if the learners have a well-mixed of both authoritative (teachers' talk) and dialogic discourse (teacher and pupils' talk). A typical classroom setting will favour authoritative discourse as it saves time. The Web-based tools can help to complement the classroom teaching by supporting dialogic discourse outside classroom time. The Web-based nature of the proposed IT tools means that question asking and answering can take place anytime so long there is Internet connection. Such questioning activities will help the learners to construct their own knowledge as questions can encourage the learners to think and help the learners to discover their misconceptions [14].

## 2. Implementation of Web-based Tools for Science Teaching

### 2.1 Method

In this case study research, the research questions of interest were:

(1) How effective can the tools help the pupils to learn Science Concepts like Animals and Plants?

(2) What are the necessary conditions for engaged learning to take place using these tools?

In this case study, a class of 34 pupils (mixed ability) is chosen. They are to use Tagul to contribute their answers to question on Diversity. For example, the questions can be “Name the different type of non-flowering or flowering plant” or “Name the different materials that objects are made up of”.

A Forum was created in the school Learning Management System (powered by Moodle). As suggested by Wong, Hew and Cheung [15], the pupils were organized into groups of 5. Each pupil is to contribute to the Group Forum. The questions posted in the Forum are mainly used for the pupils to reflect on what they had learned (like “Describe an animal” or “Creating ‘Material’ Riddle”).

This is a work-in-progress paper. The preliminary finding is based on both the qualitative and quantitative data which complemented each other. The qualitative data (provided the dept) collected were teacher’s reflection and observation, focus group discussion with pupils and the forum postings. On the other hand, the quantitative data (provided the breath) collected were statistics logs in the Moodle and the pupils’ perception survey.

### 2.2 Findings

Tagul provides opportunities for pupils’ inputs to be recorded on the Web. The pupils can use the Tagul to reflect and rehearse on what they have learned. With the possibility that the inputs are viewed by others, some pupils tried to come up with interesting word. For example, in asking for the inputs on the different flowering plants, one pupil suggested Titan Arum. His contribution was acknowledged in class and pupils were encouraged to click on the word to find out more. It was observed that the pupils were simply awed by such “big names” given by their classmate and wanted to find out more by clicking on the big words.

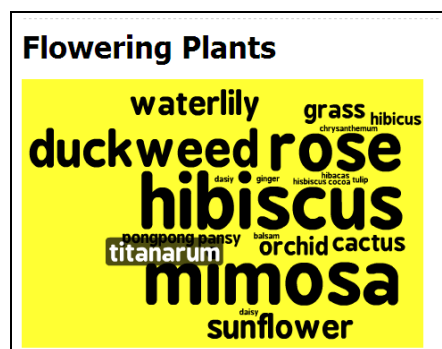


Fig 1.1: Word Cloud on Flowering Plants

From classroom observations, the pupils were generally interested in reading what their friend have written and answer the posting. Such view is supported by the perception survey in which more than 70% of them enjoyed contributing and viewing other post. From the Forum Postings, the high ability pupils were more likely to build on and criticize their friends' ideas. Some pupils even suggested new topics like cells or posting questions for their classmates (See Figure 1.2).

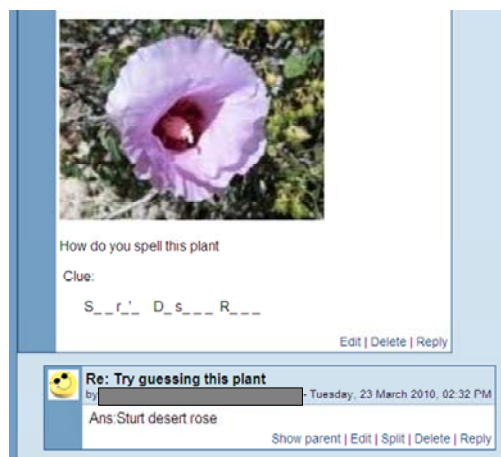


Figure 1.2. Pupils' Initiated Topic

The low ability pupils were also contributing their views too. For example, they were supposed to post a riddle on Material on the Forum. As shown in Figure 1.3, Pupil B, the weak pupil, modified Pupil A's riddle by changing the properties. This illustrated that Pupil B was thinking and not just copying blindly.

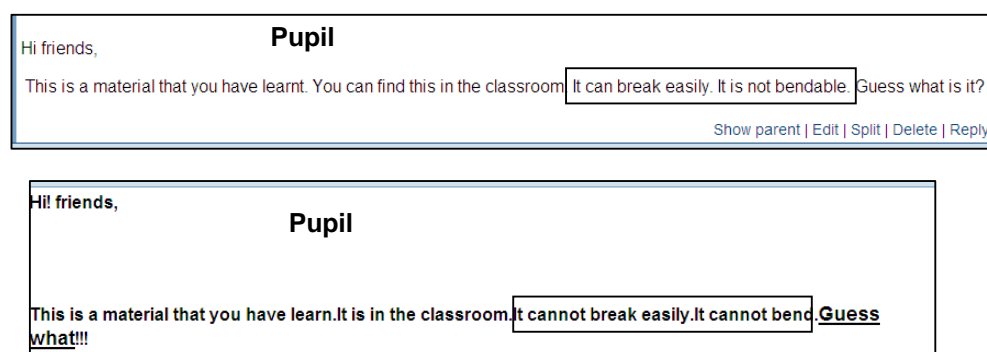


Fig 1.3: Pupils' Posting

From the experience of using the tools for the past few months, these were the possible conditions for engaged learning to take place using the tools:

- (1) There is a constant to promote the Web-based Tools in class. Pupils, who make it a point to access the Web-based Tools, at home will be praised and outstanding post/contributions are highlighted. Moreover, the pupils are also allowed to use the Web-based Tools during school time. Such access in class will hopefully get them "hooked" to the tools and they will be motivated to access them at home. The access to computers in class also provides opportunities for pupils without Internet access at home to use the ICT-tools.
- (2) As in any technology intervention, the teacher plays an important role. The use of the tools must be in line with the teacher's pedagogical belief and they view "technology as the means to an end, rather than an end itself" [16]. This will give the teacher the discipline and motivation to facilitate the pupils' postings almost daily and promote the use of such tools (for example, encouraging and acknowledging their contributions). The teacher must also constantly reflect on the use of the tools and how best this can engage the pupils.
- (3) The pupils must find the questions posted of interest to them. In this way, they are more likely to contribute and build on their friends' views. For example, for teaching on Diversity of Materials (Non-Living Things), the pupils are more interested in the posting and answering riddles posted by their friends. Another question posted on the same topic (on getting them to explain why the material is used for making an object), the contribution rate

is lower. Designing the right question is important as the right question will enthuse and get the excited about posting their views.

(4) There must be parental support at home to encourage the pupils to use the tools even at home. From this study, 60% of the Forum activity occurred in school despite a letter being sent out to explain the rationale for such Web-based activities. Most parents still believe in the traditional “worksheet” way of learning. Thus, there is a need to promote such Web-based activities so that they can see the educational value of such tools.

## Conclusion

The exploratory study of the Web-based tools provides encouraging evidence that there is potential for use in teaching of Science. The Web-based tools provide opportunities for discussion to take place even outside the physical classroom. Pupils are engaged in meaningful learning as they are learning from their friends and owning their learning. They are externalizing what they have learned. Such externalization of their model is important as this will engage them in higher order thinking as they need to make sense of what they have known. One of the greatest challenges is to get the pupils to actively participate in the Web-based tools even at home. Parents do not view such Web-based activities as “real learning” and would rather their child to be doing learning sheets.

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