

Integrating writing and technology into mathematical learning. A study of its effect on high school students' mathematics achievement and attitude

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Recently teaching and learning with understanding has been a focus issue in mathematics education, and it is believed that teaching mathematic well calls for increasing understanding of the math we teach, seeking greater insight into how children learn math. This leads to an increased interest in students' works of writing mathematically. Students' writing can reveal how they view their mathematics instruction and based on these resources teachers also have the opportunity to know if their students understand the math concepts they learn in school. However, the writing done in secondary school mathematics classrooms of Taiwan has been extremely restricted. Besides the time consuming factor, teachers don't know what writing tasks to assign is another reason to restrict this application.

The purpose of this study was to design writing materials and if appropriate manipulating software were developed to help high school students explore the writing works. A quasi-experimental design was also used to study its effect on high school students' understanding of mathematics and their attitude toward mathematics. A virtual classroom was created on the web (<http://inforscience.nctu.edu.tw>) so that students in the experimental group could type their answers and submitted their works to. When students completed submitting their works to the destined site, the teacher gave feedbacks and graded the assignments on the web. Ten writing works were assigned to the students in the experimental group during the study semester (see figure 1, figure 2 and figure 3).

作業	標題	張貼者	公告時間	截止日期	繳交
1	第十次作業	anita	2003-06-30 09:15	2003-07-10 23:59	繳交
2	第九次作業	anita	2003-06-16 18:43	2003-06-23 18:43	繳交
3	第八次作業	anita	2003-06-03 17:31	2003-06-10 23:59	繳交
4	第七次作業	anita	2003-05-22 14:38	2003-05-31 23:59	繳交
5	第六次作業	anita	2003-05-09 16:45	2003-05-18 22:59	繳交
6	第五次作業	anita	2003-04-22 08:51	2003-05-03 23:58	繳交
7	第四次作業	anita	2003-04-01 22:56	2003-04-12 23:59	繳交
8	第三次作業	anita	2003-03-29 22:15	2003-04-12 23:59	繳交
9	第二次作業	anita	2003-03-07 21:35	2003-03-23 23:59	繳交
10	第一次作業	anita	2003-02-21 12:46	2003-03-07 23:59	繳交

[新增作業]

Figure 1 The virtual classroom (Hsinchu high school 104) and ten assignment

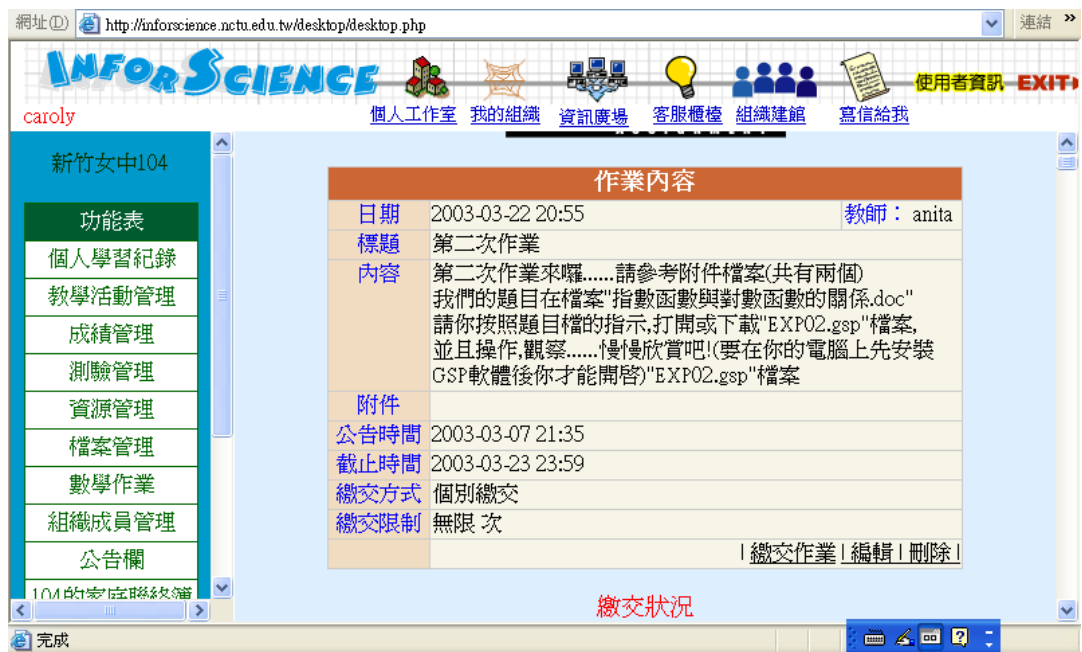


Figure 2 One example of the assignment



Figure 3 Students submitted their works to the destined site, and the teacher gave feedbacks and graded the assignments on the web.

Result

Results from this study showed that the experimental group did perform better than the control group on the achievement test at a significant level ($*P<0.05$). More discussions occurred among students in the experimental group. However, the amounts written by students were small. Students prefer to solve the problems by writing short answers to respond to the writing works, and few used their words to explain their reasoning process.

The study showed that writing mathematically on the web did not change students' attitude toward mathematics at a significant level. Possible reasons to influence the experimental effect are time consuming of writing mathematically through computer and students acceptance as well as unfamiliarity of the mathematical writing work. We suggested that having preservice teachers participate in this writing activity might help them understand students' reasoning processes as well as students' learning difficulties. Teachers with this help may be more willing to the use of writing as a learning tool in their mathematical classrooms.

A surprising finding from this study

It is easy to realize that the number of intersections of the exponential function ($y = a^x$) and the logarithmic function ($y = \log_a x$) depends on the value of the base a . We design an instructional tool for students to explore. One of our students found that there are three intersections between the exponential and logarithmic functions. At the beginning, we thought this would be a mistake of GSP. However, this leads to a new discussion among the research team and we found unexpectedly that there are really three intersections under some values of a . It is determined analytically that these two functions have three intersections if and only if a lies in the open interval $(0, e^{-e})$.

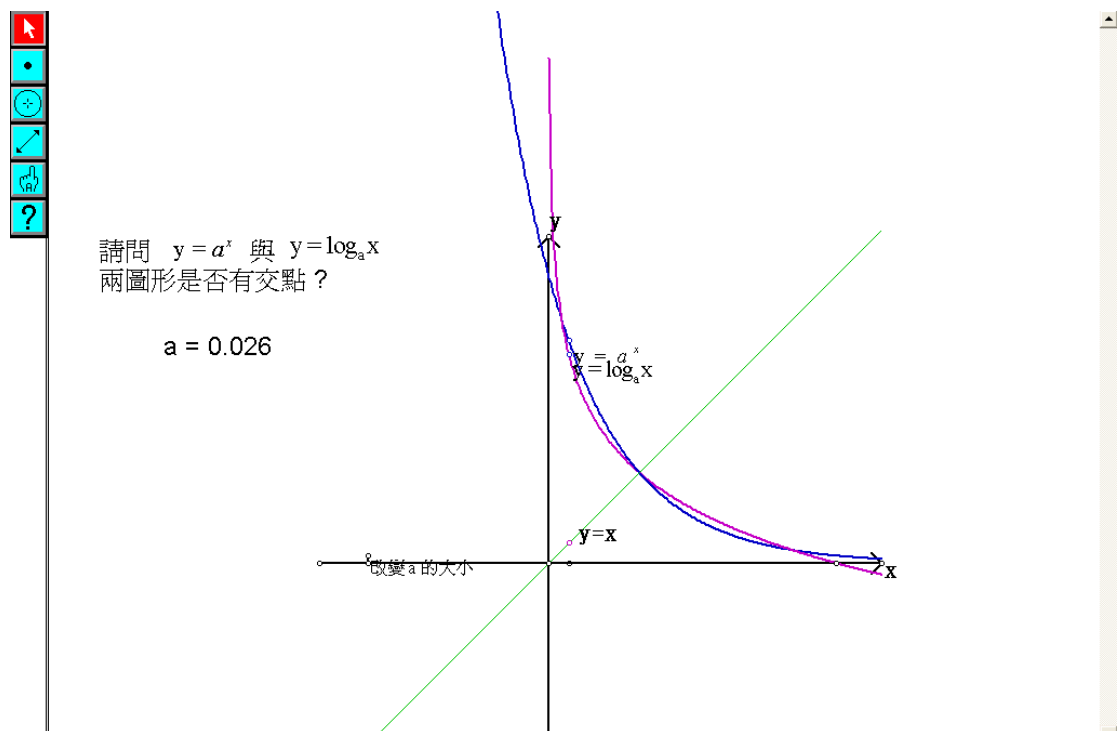


Figure 4 The GSP shows the three intersections between exponential and logarithmic functions when $a=0.026$.