Timely feedback process on assignments using Maple T.A.

Jeadong Shim[1], Junhong Ha[2]

[1,2] School of Liberal Arts, Korea University of Technology and Education, Korea

sjd@kut.ac.kr[1], hjh@kut.ac.kr[2]

Abstract

Assignments are an important tool in improving education; assignment scores have always been integrated in students' final grade. Comments given back to students for the assignments submitted are also a crucial part of improving learning. Nevertheless, the promptness of the feedbacks has been difficult to manage in that the process is extremely time-consuming. In the paper we will be talking about how Maple TA could be a useful tool in improving this aspect of teaching.

1. Introduction

Maple TA is a user-friendly web based system for creating tests and assignments, automatically assessing student's response and performance. It supports complex, free-form entry of mathematical equations and intelligent evaluation of the response, making it ideal for mathematics. It allows the teaching staff to easily construct assignments, gives students a more trouble-free access and provides instant feedback. In times of low budget and lack of staff, like the present, Maple TA can also be a great alternative to hiring additional Teaching Assistants (T.A.). Since creating assignment questions for problem banks require much effort and time, we are planning on joining forces with the staff members of a number of universities to produce the excellent sets of problems. With this aim in mind, we will be introducing how Maple TA is being utilized in our university's calculus courses.

This paper consists of two parts. In section 2, we present the existing assessment items and rates for the grade of calculus 1 in our university. We also explain the reality of current feedbacks of assignments based on the questionnaire. In section 3, we will talk about the efficiency and necessity for maple TA. Also we discuss the advantages and disadvantages depending on the introduction of Maple TA. In addition, we will offer the newly improved rate of assessment items.

2. Conventional assignment process

Mathematics is an essential tool in the engineering education because of cultivating the power of understanding of the engineering subjects and improving students' solvability of the open-end problems. One way to achieve these is to provide students with the chance of solving various leveled problems and give helpful feedbacks on the students' answers and solving processes. Incorporating such assignment evaluation in students' final grade is also essential. Grading components of our calculus course were as the following: midterms 30%, final 30%, attendance 10%, quiz 10%, assignment 10%, presentation 10%. Despite having various components, the previous patterns suggest that mid-term and final exams had been played a major role in the students' final grade with almost all students given full points for the assignment component. This may suggest the lack of thorough evaluation of the assignment, proposing the need of precise criteria for the process.

We recently conducted a survey to study how students approach the assignments and their opinion on the quantity and difficulty of the assignments and the feedback process. The 80% of students responded that they do the assignments by themselves, the 20% of the students said that they copy other students' answers. Many students had submitted the unfinished reports because they could not solve the given assignments. Most of students considered the difficulty levels to be relatively reasonable, but the quantity was too much. More than 90% answered that they had never received any feedback for the assignments. It was evident from the survey that assignments were not adequately utilized as a learning tool. The absence of feedback is largely related to an issue of time; having overpopulated classes makes the commenting and grading process incredibly time consuming for the instructor.

3. Newly improved assignment process

To resolve the feedback issues discussed above we can either reduce the number of students per class or employ TAs (Teacher's Assistants). Considering the current system and financial situation of our school, however, these are not feasible solutions. Instead our university has decided to introduce Maple TA. In 2007 our university installed Maple TA to the university computer system in order to computerize all assignments and quizzes of our mathematics courses. Maple TA not only allows the access of the assignments and quizzes to be done through computer it also gives the instant automatic feedbacks. Also, in Maple TA Built-in tools provide statistical analysis of results, from the student, assignment and question point of view, so you can get the results you want in the form you need. Compared to the conventional assignments, quizzes, and exams that are executed off-line, Maple TA is being recognized as a more effective, economical alternative.

There are over 14 question types and 20 sub-types, including Maple-graded, multiple choice, fill-in-the-blank, matching, clickable image, and numeric with margins of error. Also it has a ability to provide hints and feedbacks to students for each question. Furthermore it has sophisticated randomization tools designed for the creation of mathematical objects, such as polynomials, matrices and prime numbers.

Following is an example that shows how to create an algorithm that solves and grades a derivative problem.

Let us consider the easy problem of derivative of (ax+b)n. Then the algorithm is coded by

```
$a = range(10);
$b = range(9);
$n = range(10, 100);
$answer=maple("diff(($a*x+$b)^$n, x)");
```

Here a, b are the randomly selected integers between 1 and 10, and n is the randomly selected integer between 10 and 100. Thus there are 9000 different problems making it unlikely for students be given a same problem. This will prevent students from cheating and encourage them to rather actively discuss the assignments with colleagues or teachers. Submitted answers will be automatically checked via Maple soft (developed by the computer algebraic system), eliminating the errors that may arise in the process and giving instant feedbacks to students which will enable them to seek a help immediately.

Our university has been testing Maple TA in College Algebra and Calculus I since 2007. Some problems has appeared in using the program due to being inexperienced. For people who want to introduce Maple TA we list up a few problems. Functions and variables are carefully to be chosen because the answers can be very complicated. The instructors must provide all users with enough information about how to enter answers written by the exact Maple language. Most of complaints are raised by the wrong Maple language despite it is very easy. It is natural to make various questions in the problem-bank and build an enough system which can support Maple TA. Finally since Maple TA is not read the answers at all, it is recommended to contact to the instructors. Any user may consider it as his own fault and he may spend too many time to find the correct answer. Despite shortcomings we have observed some positive improvements in the quality of education since time spent in during classes for quizzes could be eliminated and instructors did not need to spend as much time checking assignments. Also the instructor can analyze the student's response and reflect the results in the classes like as providing proper knowledge suitable to each student.

In 2008, by changing the server, upgrading the program to a newer version, and expanding the number of problems in the problem-bank we were able to secure the program. The following table is one example in the grading book in the fall semester in 2008.

Showing 50 of 71			HW4	퀴@4	HW3-1 08...	HW3	HW2	HW1	퀴@2	
	Last name	First name	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Total
Average Score			2	1.1	8.3	11.8	10.2	9.8	6.4	
Total Points			25	27	22	22	13	14	13	136
	Baek	Inseop	-	-	-	-	-	-	-	0
	Choe	Yohan	-	-	-	-	7	-	-	7
	Choee	Yohann	-	-	15.67	-	-	-	-	15.67
	Choi	Hyungjin	-	-	-	0	10	0	5	15
	Choi	Jieung	-	-	-	-	-	-	-	0
	Choi	Jinuk	-	-	-	13	12	0	8	33
	Choo	Donghan	-	-	-	19	11	13	10	53
	Eom	Sangcheol	-	-	-	-	12	13	0	25
	Eomm	Sangcheol	-	-	-	-	-	-	-	0
	Heo	Jihye	-	-	-	19	13	13	9	54
	Hong	Seunggil	-	-	0	18	13	13	5	49
	Hong	Taehoon	-	-	-	-	-	-	-	0
	Jang	Hanseul	-	-	-	-	13	0	11	24
	Jang	wooseok	-	-	-	17.17	7	-	8	32.17
	Jangg	Hanseull	-	-	17	-	-	-	-	17
	Jeon	Changhyun	-	-	-	13	8	7	10	38
	Jeon	Myeongheon	-	-	-	15	10	12	13	50
	Jeon	Sunghyeon	-	-	-	18	12	12	12	54
	Jeong	Suyeong	-	-	-	-	13	11	9	24
	Jeongg	Suyeongg	-	-	18	-	-	-	-	18
	Jo	Seongyeon	-	-	-	15	13	14	13	55
	Jo	Sungkyu	-	-	-	-	0	-	3	3
	Jung	Seolbin	-	-	-	17	12	13	12	54
	Jung	Woojin	-	-	-	11	11	14	-	36
	Kang	Honglim	-	-	-	15	11	10	-	36
	Kil	Inho	-	-	-	12.5	13	12	13	50.5
	Kim	Byeunaheen	-	-	-	11	-	9	-	20
	Kim	Dongwook	-	-	-	13	12	0	-	25
	Kim	Hyeongseo	-	-	4	-	-	-	-	4
	Kim	Hyeonseo	-	-	-	16.5	12	0	11	39.5
	Kim	Hyungbae	-	-	-	18	13	13	12	56
	Kim	Hyungon	-	-	-	-	11	-	-	11
	Kim	Hyungseo	-	-	-	-	10	13	0	23
	Kim	Minhoi	-	-	-	16.67	-	-	-	16.67
	Kim	Seokim	-	-	-	-	-	-	-	0
	Kim	Seungchan	-	-	18	13	12	13	0	56
	Kim	Taeyong	-	-	-	14.67	10	13	-	37.67
	Kim	Wonjin	-	-	0	18	12	14	12	56

The improved system has received positive responses from the students and we consequently modified the rate of the courses' grading components in this year's College algebra for social science majors, Calculus I and College Algebra curriculum: midterm exam 35%, final exam 35%, attendance 10%, and Maple TA assignments 20%.

For the new grading policy we increased the Maple TA assignment weight to 20% while eliminating the quizzes and presentation components. Quizzes and presentations were utilized to constantly monitor students' learning. Since Maple TA fulfilled this purpose we have decided to replace them. Such changes removed the time consuming processes thereby increasing the quantity of time dedicated to teaching and improving the quality of education. In order to supplement Maple TA's inability to check the problem solving processes we have developed an on-off line assignment method. Students printout their assignments, solve them, submit the answers online and submit the solving processes to their instructors. To evaluate the efficiency of this newly implemented system we will be conducting any survey at the end of this semester.

4. Conclusion

Despite the importance of assignment in learning, various factors have made its utilization be inadequate; to improve this, our university has employed the Maple TA system. Program instability and errors initially gave us problems but with a long testing period and improvements made we are hearing positive reports from students and instructors. In other words, Maple TA is being recognized as a great alternative to constantly monitor students' learning and to give them instant feedback. It also reduces class time being spent on quizzes and presentations, resulting in the increase in the quality of education. We are certain that Maple TA will be a useful tool for the universities to reduce the cost while improving education, if hereon universities cooperate to establish a stellar problem bank.

5. References

01. Heck, A. & van Gastel, L. (2006a) Diagnostic Testing with Maple T.A. In: M. Seppälä, O. Xambo, O. Caprotti (eds.) WebALT 2006 Proceedings, 37 - 51. Electronically available at: http://webalt.math.helsinki.fi/webalt2006/content/e31/e176/webalt2006.pdf
(18 March 2008).
02. Jeadong Shim and Junhong Ha, (2008) Using Maple TA in mathematics education, 227-229, Proceedings of Korean Soc. for Eng. Edu.

03. Rasila, A. & Harjula, M. & Zenger, K. (2007) Automatic assessment of mathematics exercises: Experiences and future prospects. In Reflektori 2007 Symposium of Engineering Education Proceedings, 70-80. Electronically available at: http://www.dipoli.tkk.fi/ok/p/reflektori2007/refl07paptodo/nettiin/Reflektori2007.pdf
(18 March 2008).