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Practice on a Workshop Utilizing Web-based Investigation System for Teachers' Judgments on Students' Performance

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Abstract: In this research, we developed and evaluated a workshop utilizing Web-based Investigation System for Teachers' Judgments on Students' Performance (Wits). The aim was to facilitate teachers to reflect on their teaching methods and consider how to improve them based on the analysis results of Wits. When a user inputs the data of students' actual performances of examinations or tasks along with the data of teachers' predictions, Wits automatically calculates the accuracy of teachers' predictions based on a statistical model. We designed and conducted a workshop for teachers to use Wits and to hold a group discussion on the results shown by Wits and how to improve their teaching methods. The results of a questionnaire and recorded discussion implied that through the activities of the workshop, the participants were able to recognize students' learning impasses that they had not expected. In addition, we need to add other activities that support teachers in their endeavor to consider students' essential learning impasses and how they should deal with it.

Keywords: Teachers' judgment, teacher education, students' impasses, web application, workshop

1. Introduction

It is important for teachers to acquire the skills to predict their students' performances accurately in order to provide suitable instructions. The authors have developed a web application named Web-based Investigation System for Teachers' Judgments on Students' Performance (Wits) that enables an easy analysis of teachers' judgments of their students' performances (Nakaya et al., 2017). When a teacher inputs the data of their predictions and the students' real performances, Wits automatically calculates the accuracy of the teachers' judgments based on Uesaka et al.'s model (2017). In this model, the alpha value reflects the accuracy of teachers' predictions. An alpha value that approaches 1 indicates that the teacher's prediction matches the students' real performance. In contrast, an alpha value lower than 0 indicates that the teacher's prediction contradicts the students' real performance.

Wits aims to facilitate teachers in reflecting on their teaching methods and considering improvements based on the results of the analysis. In most cases, when a teacher's prediction is a mismatch with the students' actual performance, it is because the teacher has overestimated the students' performance. In other words, although students did not understand the teacher's explanation of the topic, the teacher is of the opinion that they did. Using the analysis result from Wits, teachers can identify these gaps and consider ways to improve their teaching methods.

In this research, we designed and conducted a workshop for teachers to try to use Wits and to hold a group discussion about the result shown by Wits and how to improve their teaching methods. This paper reports the design and discusses the results of the workshop.

2. The System Design of Wits

Wits can be accessed through a webpage (https://wits.dokkyomed.ac.jp/pre/index_en.html), so that anyone can use it for free. Users can analyze teachers' judgments by the following steps: first, a user inputs the number of teachers, names and number of tasks, names and number of categories of each task, prediction data, and students' real performance data (Table 1 shows an example of a data frame); second, Wits calculates alpha values using statistical R programs for the model; and third, the user can view the summarized data. Figure 1 shows Wits screens for data input and for the analysis result.

Table 1

An Example of a Data Frame for Wits (Average Calculation)

	Options of a Task (Categories)				
	37m	38m	39m	40m	No answer
Students' real performance	27.78 %	46.83 %	11.9 %	5.56 %	7.94 %
Teacher 1's prediction	60 %	5 %	5 %	30 %	0 %
Teacher 2's prediction	75 %	5 %	5 %	10 %	5 %
Teacher 3's prediction	40 %	10 %	10 %	10 %	30 %

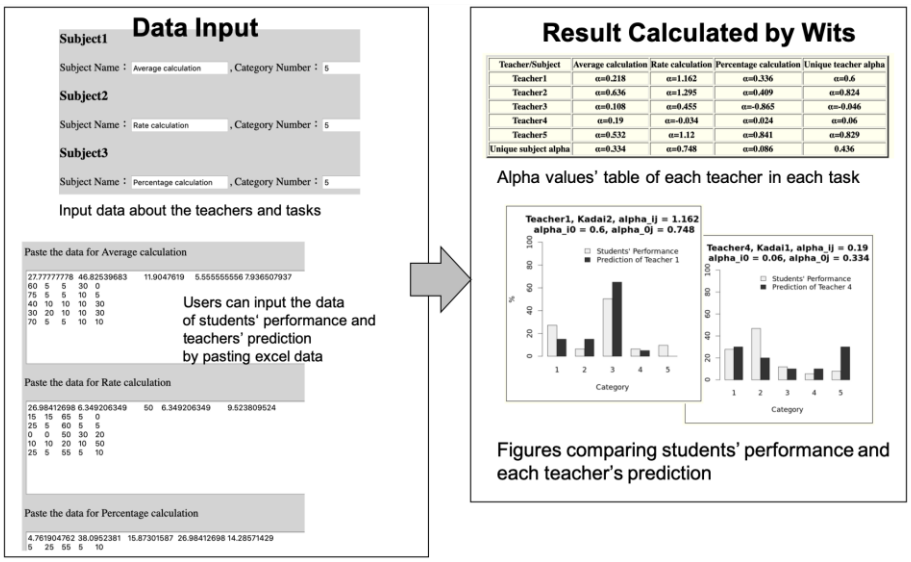

Figure 1. Wits Screen

3. Outline of the Workshop

In order to support teachers in utilizing Wits to improve their teaching methods, we designed and implemented the following workshop. Prior to the workshop, we asked participants (teachers) to conduct an examination in their classes and to predict their students' performances. The examination comprised mathematical tasks about conceptual understanding. During the workshop, one of the authors first explained the outline and aim of the workshop to participants. Second, the participants input the data of their students' performances and their predictions on Wits and analyzed their judgments. Third, focusing on the tasks of the examination for which the accuracy of their predictions were not so good, they discussed the reasons for the differences between their predictions and the students' real performances and how they could improve their teaching methods.

We conducted this workshop in February 2019 with thirteen mathematical teachers at an elementary school in Japan. We collected the following data: log data of Wits, audio and movie of the workshop, a questionnaire about the usability of Wits, and questionnaires that asked what kind of issues their students faced and ways to solve it. The questionnaire about students' problems was administered before and after the workshop.

When discussing the analysis results of Wits, the participants were split into four groups. One participant had not prepared the prediction data, therefore we excluded the data of the group to which that teacher belonged and analyzed the data of the ten teachers belonging to the remaining three groups.

4. Results and Discussion

We concluded that the teachers could recognize students' learning impasses about conceptual understanding and why the impasses occurred. According to recorded discussion data, all the participants mentioned that they had not expected their students to have learning impasses with certain tasks until the Wits results showed the inaccuracy of their predictions. For example, one of the tasks for elementary school students in the sixth grade was as follows: "The average of Tom's three-time softball throw was 36m. When he threw a ball again, the score was 40m. What is his average score of all the throws?" The options given for the mathematical task were 37m, 38m, 39m, and 40m. All the teachers predicted that percentage of students who chose "37m" would be more than the percentage of students who chose "38m," but in fact it was completely opposite. About a half of the students chose "38m" and only 27% of the students chose "37m." The teachers expressed surprise on realizing the gap between their predictions and the actual result. Moreover, they inferred from the analysis results that the students remained in shallow understanding and did not deeply understand the concept of "average" so that they calculated as follows: (36 + 40)/2.

In contrast, few of the participants were able to consider improved their teaching methods based on students' essential learning impasses. During the group discussion, some teachers mentioned ways in which they could improve their teaching methods for a specific task. In terms of the example on the average calculation task, a teacher said that it would be better to facilitate students in writing down a score table and plotting the average scores to be calculated. However, regarding the questionnaire about a general question asking the teachers to write down improved teaching methods, they could not apply the improvement to other situations. Therefore, we need to add other activities that support teachers by enabling them to consider students' essential learning impasses and how to deal with them.

In terms of the usability of Wits, eight teachers agreed that they could use the application easily. They could input the data and understand the summarized results. The log data of Wits also corroborated that they could use Wits smoothly because it took less than five minutes for all the participants to use Wits from the first page to the analysis result page. In contrast, two of the participants conveyed that they were able to use Wits because of our instructions, so they wanted improvements to be made to the interface. Moreover, the participants responded in the questionnaire that it could be hard for them to prepare the data. Therefore, one solution is to develop Web-based tests and incorporate these into Wits so that teachers only have to input their prediction data.

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