NISAWA, Yoshiki
Kyoto

Practical considerations regarding educational guidance using a portfolio

1. Introduction

The learning sciences feature many studies of student learning (Sawyer, 2014), and basic matters relating to student learning researched in the learning sciences include: 1) the importance of deeper conceptual under-standing, 2) a focus on learning in addition to teaching, 3) the creation of a learning environment, 4) the importance of basing teaching on the learners' existing knowledge, and 5) the importance of reflection. These five points suggest that students' learning consists of their own independent efforts, and likewise in Japan, emphasis is placed on students' independent learning efforts.

At the same time, by the results of PISA2015 and TIMSS2015, there may be students not actively engaged in learning, which requires that teachers improve their teaching (Ministry of Education, Culture, Sports, Science, and Technology, 2018).

We introduced a portfolio as a way to solve this problem. We use an OPP (One Page Portfolio) sheet for the portfolio, in which students write down their learning history for each class and self-evaluate their learning by looking back on it as a whole (Hori, 2019). The purpose of this study is to examine what kind of learning history can be gleaned from the students' accounts in the OPP sheets as well as what kind of lesson improvement they can facilitate for the teachers.

2. Methods

In this study, we use OPP sheets based on OPPA (One Page Portfolio Assessment) theory (Hori, 2019), which involves students answering questions pre-learning about what they will learn, summarising the most important points for each lesson during learning, and reviewing and organising what they have learned post-learning, all on a single sheet of paper. It was created by Hori, a science education researcher.

The OPP sheet consists of four items: I. Unit title, II. Essential questions before and after the learning, III. Learning history for each class, and IV. Self-evaluation after the learning. The following gives an overview of each item.

I. Unit title: The students enter the heading here. This is to properly indicate the textbook chapter or section as a whole being learned.

In: P. Ebers, F. Rösken, B. Barzel, A. Büchter, F. Schacht & P. Scherer (Hrsg.),
Beiträge zum Mathematikunterricht 2024.
57. Jahrestagung der Gesellschaft für Didaktik der Mathematik. WTM.
https://doi.org/10.37626/GA9783959872782.0

II. Essential questions before and after the learning: The questions are set by the teacher, asking about the key contents that the students are expected to understand or the essence of the learning contents. The questions are the same before and after the learning because the purpose is to check the students' conceptual changes through learning.

III. Learning history: At the end of each class, students write down what they think is the most important thing taught in class. It turns out that students have retained as learning outcomes. If the contents differ from the teacher's intentions, the contents may be revised for the next class.

IV. Self-evaluation after the learning: The students review their learning of the chapter or section as a whole as well as note how their under-standing and perceptions have changed before and after the learning. This enables the students and teacher to grasp the students' conceptual changes when comparing the units before and after the learning.

The following shows the actual initiative.

Participants: 17 public middle-school 2nd-year students (13–14 years old)

Learning contents: The goal is to confirm the properties of triangles deductively. Specifically, the properties of isosceles triangles are derived based mainly on the properties of congruent figures and the congruence conditions of triangles. Most of the properties related to isosceles triangles have been learned through experiments and measurements in elementary school, but deductive thinking is learned here.

Teacher in charge: Has worked as a middle-school mathematics teacher for five years.

Class dates: November 21, December 11, 12, 13, 15, 2023

Method: Of the 50 minutes of class, the last 5 minutes or so was spent filling out the OPP sheets.

3. Results

From amongst the OPP sheets of the 17 participating students, the following discusses the contents of representative students A.

First of all, regarding the essential question before learning, the class teacher asked the students to 'Write down as much as you know about isosceles triangles'. The reasons for this are (i) to grasp the extent to which the students remember the properties of isosceles triangles, be-cause the contents of the upcoming learning will be deductive reasoning about what they have already learned in elementary school, (ii) that it gives the students readiness, (iii) that it is easier for students to extract knowledge that they remember when asked

a simple question, and (iv) that it would likely make it easier to judge the post-learning changes.

Student A's answer to this question was 'a triangle with two equal sides' The lesson plan was not changed at this point be-cause the students' responses were almost exactly what the teacher had expected.

Next, regarding the learning history of each class, students learned how to determine the height of a tree using the properties of a right-angled isosceles triangle in the first class. Regarding what they thought the most important thing was in that day's class, Student A showed how to measure the height of a tree by drawing an illustration. As for questions and impressions, they wrote 'I first doubt-ed if this is possible to calculate'.

In the second class, the students learned about the terms definition and theorem, the definitions of isosceles triangle, base angle, base, sharp angle, and obtuse angle, and the theorem that isosceles triangles have equal base angles as well as the proof for this.

Regarding what they thought the most important thing was in that day's class, Student A made illustrations with notations for obtuse, right, and acute angles, and regarding questions and impressions, he indicated base angle, base, and apex angle in the isosceles triangle illustration.

Student A did not write what the teacher had intended the most.

The OPP sheet shows that after the third to the sixth classes, Student A missed some of the things that the teacher considered important.

The essential question after the learning was the same as before the learning: 'Write down as much as you know about isosceles triangles'. Student A wrote 'Two sets of sides are equal, the base angles are equal, and if you draw a bisector of the apical angle, it will be perpendicular to the base', and in the post-learning self-evaluation [reflecting on the learning], 'Before class, I only knew that an isosceles triangle has a sum of interior angles of 180°, but after class, I knew what I wrote for the essential question after the learning'.

4. Discussion

With respect to the essential question before the learning, by reviewing the responses of all students in the class, the teacher can gauge the students' understanding of what they are about to learn. From this, the teacher who taught the class said that it became possible to concretely visualise what kind of lesson should be conducted, which was clearly different from the past. It also gave the students a readiness to learn the properties of isosceles triangles.

Regarding what the students thought was the most important thing in each class, meaning their learning history, form the second class, Student A did

not write about the meanings of the definitions and theorems that were dealt with in class. Thus, starting from the next class, the teacher consciously used the words 'definition' and 'theorem' distinctly. Based on what the students wrote about what they think is the most important thing taught in each class, the teacher can check the level of the students' understanding and adjust their teaching as they go. The teacher in charge had never made such improvements in class before, so being able to decide on concrete improvements for the next class based on student accounts may be considered beneficial for both students and teachers. In fact, the teacher made similar observations after class. Similar class improvements were made from the third to the sixth class.

Writing about the essential question after the learning: This is an opportunity for students to check their own learning outcomes, with the teacher also communicating the students' conceptual changes via comments on the OPP sheet. Thus, it appears to be an opportunity to improve students' self-efficacy and metacognitive skills.

There is unresolved issue with this initiative. We want to consider ways to judge how this may affect students' math performance.

5. Conclusion

The most important thing when using the OPP sheet is that the student writes down their honest understanding of the learning contents and what they think is the most important thing taught in each class. It was clear that based on the students' accounts on the OPP sheets, the teacher can grasp their level of understanding of the learning contents, which can be used to immediately improve the lesson contents. This is an effect of using the OPP sheet is that it is beneficial to both students and teachers.

Acknowledgements: This work was supported by JSPS KAKENHI Grant Number JP20K02895.

Literature

Hori, T. (2019), *One Page Portfolio Assessment (OPPA): The Potential of the One Page*, Toyokan Publishing Co., Ltd.

Ministry of Education, Culture, Sports, Science, and Technology (2018), *Commentary on the Middle-School Course of Study (2017 Notice): Mathematics*, Nihon Bunkyo Shuppan.

Sawyer, R.K.(2014), *The Cambridge Handbook of the Learning Sciences* (2nd ed), Cambridge University Press.