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Proceedings of the Annual Meeting of the Cognitive Science Society

Title

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Permalink

<https://escholarship.org/uc/item/1rf114qz>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 27(27)

ISSN

1069-7977

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Publication Date

2005

Peer reviewed

Understanding the Nature of Verbalization in Collaboration

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Collaborative situations are believed to serve as promising knowledge-integration environments, because they solicit multiple solutions to a set of problems and provide learners with natural chances to seek common principles among them. Verbalization of commonalities has been identified as important, but its details need to be studied further. Here I set a collaborative situation where six children solved a math task and discussed commonalities of their solutions. Detailed analyses of their behavioral and verbal data revealed that the way each child solved the task, what kind of commonalities s/he verbalized and how s/he summarized the experience were consistent and unique. In designing collaborative situations, instructors should pay close attention not only to the multiple solutions that the students produce but also to who verbalizes what for helping each student restructuring his/her own understanding.

Task and Class in Focus

A forty-five minute class was devised for sixth-graders to teach common law of fractional multiplication through two sets of activities centered around the “origami task” (Shirouzu et al., 2002), where children were asked to get “three-fourths of two-thirds” of a square sheet of origami. Solving activity was devised to solicit different solutions from the children, which was followed by the teacher’s request for finding a commonality among them. The purpose of this activity was to help students grasp the abstract common law of the fraction calculations. The six children made five types of solutions using the paper, and finally found their area as one-half by the algorithmic calculation ($2/3 \times 3/4 = 1/2$) at the end of the unit. They were asked to report the gist of that class five months later.

Comparison of Three Children

Three selected boys, Y, N, and F, are examined how their solving behavior affected verbalization of commonalities and how such verbalization led to contents of reports.

Solving Experience

Figure 1 shows the solving processes taken by the three in a simplified way, representing creases by thick lines and cut by detached rectangles. For example, starting from the leftmost original paper, Child N made thirds in the middle of solving and cut out the rectangle of one-fourths of two-thirds to leave the shaded area as an answer (“N’s first” in Fig.1). His trial was shared among the class to motivate the rest to propose alternatives. Child N changed the direction to cut out the rectangle in his second trial, while Child F happened to solve it in the same way as N’s first trial. Child Y first attempted to solve it as N’s second trial, but then saved the step of folding the two-thirds into four parts, by dividing it into halves and cutting out its one-fourths.

Thus, Child N succeeded in completing two different procedures both of which naturally mapped the two fractions on the paper along the task instruction, but Child Y shifted to reinterpret the creases externalized on the paper. Each experience appeared to provide orientation for seeking procedural difference or conceptual commonality among solutions respectively, both of which Child F seemed to lack.

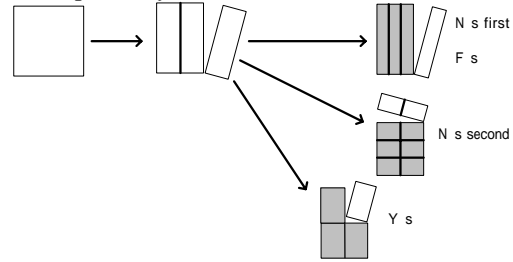


Figure 1: Solving processes taken by the three children

Verbalization at Commonality-Seeking Activities

Commonality-seeking activities took forms that the teacher presented two solutions for comparison and children answered them as the same or different in the dimensions like the form, procedure and area. For example, N’s first and second ones are different in the form and procedure but the same in the area. Table 1 presents what commonality each child verbalized sooner than any other children. Child Y verbalized the abstract commonality “area,” while N did the visible and concrete ones and F did none. At the end of the class, Y explained that the area was one-half by fractional multiplication and common among all of their solutions.

Table 1: Verbalization at commonality-seeking and reports

	Commonality	Report	
Y	“area”	“ $2/3 \times 3/4 = 1/2$ ”	“origami” “ $3/4$ of $2/3$ ”
N	“procedure” “shape”	“shape”	“origami” “ $3/4$ of $2/3$ ”
F	---	---	“origami” “ $3/4$ and $2/3$ ”

Abstraction at the Reports after Five Months

Table 1 shows pieces of actual expressions included in their reports. Although the task instruction “ $3/4$ of $2/3$ ” and the material “origami” are shared, the algorithmic expression “ $2/3 \times 3/4 = 1/2$ ” or the visual property “shape” are found only in who verbalized them.

This consistent pattern indicates that verbalization, which is based on one’s own experience, creates abstraction of situations as a basis for sustainable understanding.

References

Shirouzu, H, et al. (2002) Cognitively active externalization for situated reflection. *CogSci*, 26 (4), pp.469-501.