

The Effect of Drawing Generated by Students on Idea Production and Writing in Grade 4

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Abstract: This study explores the effect of student-generated drawing on idea production and writing performance of fourth grade children. The drawings and notes were created by 22 students in grade 4 using an online multimedia environment--Knowledge Forum--to advance their understanding of optics. The findings indicated that children who drew more while writing produced significantly more words, sentences, idea units, and earned higher overall idea grade in writing than did those who drew less in writing. The results suggested that it was the combination of drawing as a planning strategy and as an external support for representing ideas in knowledge building that contributed to its effectiveness in making differences in idea production and writing of fourth grade children.

Keywords: student-generated drawing, idea production, writing, knowledge building, graphical literacy

1. Introduction

Children's drawing and writing have long interested researchers and educators of young children. The relationship between drawing and writing has been discussed and studied in relation to the children's literacy development (Calkins, 1986). Dyson (1982) stated that drawing provided the meaningful context for writing while not simply an illustration of writing. Olson's (1992) research suggested numerous benefits of the integration of drawing and writing, and referred to it as "the visual-narrative approach."

Drawing as a planning strategy and graphical representation of ideas for writing. Drawing is one way children gather and organize ideas for writing (Dyson, 1986). Planning in writing is critical for young writers. Bereiter and Scardamalia (1982) indicate that children experience problems in generating text and these are mainly problems in finding content, not in finding the language to express it. Carlson (1963) observed that fourth, fifth, and sixth graders who were provided special stimulus materials (pictures, records, toys) wrote longer and more original compositions and used a more versatile vocabulary than students in the control group who were writing on an assigned topic. Drawing is also a graphical representation of the ideas in text. Ideas in writing are made explicit and clear by drawing. It is a form of reflection on writing and vice versa. Researchers described student's drawing can be used to present main ideas and generate summary statements in writing (Rich, 1994). Specifically, student-drawn text illustrations seem to be most effective in situations that relate to conceptual recall, problem solving, and explanation of systems or processes (Mayer, 1993, 2001). Drawing is an effective tool for writer's presenting scientific concepts, laws, and illustrating their details and subtle properties.

Drawing as a scaffold for idea generation and improvement in knowledge building.

Young writers rely on their drawings as an idea bank or a reference point to prompt them as to what should come next in their writing. Drawing serves a mnemonic function, an external support that causes children to recall the idea to which it is referred. Scardamalia, et al. (1982) found that young children, when provided with the external support of questioning, produced more words in their texts. Young children can be taught to utilize their drawings as a tool, not only to transcribe old ideas, but to discover new ones. They can discover the power that drawing can bring to the writing process by focusing in on the connections between ideas. Drawing is one of the activities that encourage writing in a young child that will lead to that child's progressive growth as a composer of ideas (Temple, et al., 1998).

Knowledge building pedagogy attaches much importance to idea advancement through collective responsibilities and interactive discourse in a communal space. Knowledge building practice is initiated by students' authentic problems, real ideas in an online multimedia environment--Knowledge Forum®--supporting multiple representations of ideas. It also creates opportunities for high-level literacy practices, including extensive and authentic writing. The graphical tools for representing students' knowledge lead to gaining skills in graphical representation of concepts (Scardamalia, et al, 1994). Researchers conclude that Knowledge Forum experience leads to student gains in graphical literacy (Scardamalia & Bereiter, 1993). There has been limited academic study of the role of drawing in writing of elementary children. The present study seeks to explore the effects of drawing on idea production and writing performance of fourth grade children.

2. Methods

2.1. Participants

Participants were 22 students (11 girls and 11 boys) in grade 4 (Sept., 2001 – Jun., 2002) from ICS, who studied science: optics. Over one year of educational work reported in this study students were engaged in knowledge building. Knowledge Forum was integral to their work. It included tools for graphical as well as textual representation of ideas. Students chose the representational form best suited to the expression of their ideas. In knowledge building practices, students assumed collective responsibility for communicating, elaborating, evaluating, and improving ideas, working in a public forum where they built on, commented, and in other ways helped each other advance their understanding. They received no instruction in use of graphics, but were supported in the expression of ideas by peer feedback and an easy-to-use graphics palette that allowed them to co-author and revise graphics.

2.2. Data collection and analysis

This study reported on one aspect of a longitudinal case study of the 22 students' classroom based activities for deep understanding of light. The researchers examined all the entries of notes and graphical representations in eight *views* in Knowledge Forum (*note* and *view* are basic features of Knowledge Forum). Quantitative methods were adopted and Content analysis (Chi, 1997) for qualitative analysis was used to assess the quality of the notes' transcripts and graphical content, and to evaluate students' understanding level of light. For measuring idea production in writing, an "idea unit" (Budd, et al, 1967) was

used as a way of analyzing meaning of text. A coding scheme adapted from Zhang et al. (2007) was applied to analyze the idea units of notes, and to evaluate the overall quality of the idea units: theoretical/conceptual idea units and factual idea units. Four dependent variables were selected as measures of idea production and writing performance: number of words, number of sentences, number of idea units, and overall idea grade. The total 332 notes consisted of 90 graphical notes with 108 drawings and 242 non-graphical notes. The 22 students were grouped into two sets by the average number of drawings ($M=4.91$): the low-drawing group of 11 students and the high-drawing group of 11 students. Each student's drawings were examined and their overall drawing scores were evaluated by a drawing rubric (Gan, et al., 2007) (inter-rater reliability over 30 sampled graphical representations $r=0.84$, with differences resolved through discussion).

3 Results

The performance of the low-drawing group and high-drawing group on producing idea units in the graphical notes and non-graphical notes was analyzed with MANOVA using 'group' as an independent variable: did children who drew more pictures while writing produce better performance as measured by number of words, number of sentences, idea units, and overall idea grade? The results are presented in Table 1.

Table 1. Avg. performance of 22 students in graphical notes and non-graphical notes

	Graphical notes		Non-graphical notes	
	M	SD	M	SD
Notes	4.09	2.57	11.00	7.00
Words	72.60	45.74	55.83	36.82
Sentences	4.84	4.01	3.46	2.40
Idea units	3.28	2.07	2.42	1.83
Overall idea grade	8.40	5.69	5.72	4.78
Drawing	4.91	3.37	--	--
Drawing scores	11.2	2.0	--	--

Table 1 showed the average performance of the 22 students in the graphical notes and non-graphical notes as measured by seven variables. The results indicated that, on average, all students used more words, sentences, idea units, and got higher overall idea grade in the graphical notes than did they in the non-graphical notes. It appeared that the students utilized their drawing as an idea bank, and as a concrete, external support to prompt them to produce more ideas in writing.

Table 2. Avg. performance of low-drawing group/high-drawing group in graphical notes.

	Low-drawing group		High-drawing group	
	M	SD	M	SD
Drawing	2.36	1.01	7.45	2.94
Graphical notes	2.14	1.03	6.05	2.09
Notes	14.27	6.32	15.91	6.90
Words	67.53	27.89	77.66	59.66
Sentences	3.95	1.47	5.72	5.46
Idea units	2.86	0.99	3.69	2.77
Overall idea grade	13.79	4.89	52.12	34.11
Drawing scores	25.57	10.31	86.70	43.00

The results in Table 2 showed that students who drew more in their notes wrote more words, sentences, idea units, and got higher overall idea grade. These students in the high-drawing group drew more pictures (M=7.45 vs. 2.36), wrote more words (M=77.67 vs. 67.53), more sentences (M=5.72 vs. M=3.95), produced more idea units (M=3.69 vs. M=2.86), and especially, earned higher overall idea unit grade (M=52.12 vs. M=13.79) and higher drawing scores (M=86.70 vs. 25.57) than did those in the low-drawing group.

Table 3. F-values for two-group's performance in graphical notes and non-graphical notes.

	Graphical notes			Non-graphical notes		
	df	F	p	df	F	p
Words	1	14.451	.001	1	1.198	.287
Sentences	1	9.729	.005	1	.831	.373
idea units	1	15.909	.001	1	1.140	.298
Overall idea grade	1	13.615	.001	1	1.523	.232
Drawing scores	1	21.030	.000	--	--	--

The results in Table 3 revealed the significant differences between the low-drawing group and high-drawing group in the graphical notes as measured by five variables ($p < 0.05$). It also demonstrated that there were no significant differences in words, sentences, idea units, and overall idea grade in the non-graphical notes between the low-drawing group and high-drawing group.

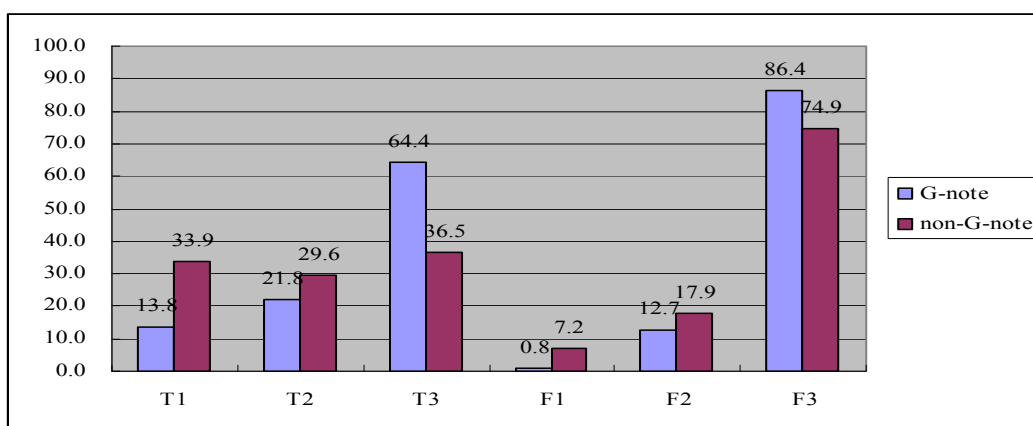


Figure 1. Percentage of conceptual or factual idea units in graphical/non-graphical notes.

Figure 1 demonstrated the percentage of T1 (pre-scientific theoretical idea unit), T2 (mixed) and T3 (scientific) in total of the theoretical idea units of the graphical notes and non-graphical notes, and the percentage of F1 (unelaborated factual idea unit), F2 (mixed) and F3 (elaborated) in total of the factual idea units of the graphical notes and non-graphical notes. Concerning the factual idea units, there were no great changes in F1, F2, and F3 between the graphical notes and non-graphical notes, indicating that the students knew most of the scientific facts, excepting that few were pre-scientific ones or misconceptions. It seemed that the drawings didn't have distinct effect on children's understanding of the scientific facts. However, concerning the theoretical idea units, there were great changes in T1, T2 and T3 between the graphical notes and non-graphical notes. T1, T2 and T3 respectively accounted for about one-third of the total theoretical idea units of non-graphical notes; but T1, T2 and T3 respectively accounted for 13.8%, 21.8% and 64.4% of the total theoretical idea units of graphical notes, indicating that drawing supported conceptual change, theory-building and idea improvement (Gan, et al, 2008), and further facilitated deep understanding of the content knowledge of optics. The spearman's correlation coefficient between the overall idea units and drawing scores of 22 students was 0.862, $p=0$, indicating that there was a positive correlation between these two factors. The higher the drawing scores were, the higher the overall idea grade was, and vice versa.

4. Conclusions and implication

Some important findings were resulted from the study. First, significant differences were found between the two groups in the performance of words, sentences, idea units, and overall idea grade in the graphical notes; but there were no significant differences in the non-graphical notes. Those indicated that student who drew more pictures while writing tended to produce more words, sentences, idea units, and earn higher overall idea grade; but there was no such effect while students wrote non-graphical notes. Such result showed that drawing while combined with writing appeared to be beneficial to idea production and writing. The more students drew, the more idea units and overall idea grade they produced. Second, no matter what group students belonged to, the same students did better in the graphical notes than did they in the non-graphical notes, indicating that drawing became an effective planning for writing, and an external representation of ideas in writing. Third, there was a positive correlation between drawing scores and overall idea

grade. It meant that picture seemed to release energy in children for writing, just as Sealey, et al (1979) stated, “in many classrooms where there is art of a varied and high standard, the writing is of corresponding quality.”

Knowledge building has been shown to yield advantages in literacy (Scardamalia, 2003). Just as Scardamalia mentioned that students using Knowledge Forum have shown significant gains in literacy even without any special attention to it, naturally, graphical literacy and textual literacy as two kinds of multiliteracies are “by-product[s] of knowledge building” (ibid.). The progression of knowledge building through interaction with graphical representations culminates in the sharing and communication of improvable ideas, in both graphical and text form, to other peers in the elementary classroom. This study suggests that sustained and collective knowledge building practice in Knowledge Forum can engage students in graphical and textual literacy work. Patterns are beginning to emerge that are worthy of reporting and require further investigation for testing the actual effects between experimental group and control group in future.

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