

Facilitating a Common Core Approach to Argumentation with Diagramming and Peer Review
Final Report: July 1, 2015 to June 30, 2017
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With the internal grant from the Learning Research and Development, the PIs undertook a two-year study of how to introduce teachers and students to argument diagramming (AD), first in a manual pencil-and-paper process and, in the second year, using ArguPod, a prototype, user-friendly, web-based diagramming tool that supports the AD process using tablet, laptop, and other computers. ArguPod was developed by Ashley's Intelligent Systems Program graduate student, Mohamad Falakmasir.

In each year, we engaged eight high school English Language Arts (ELA) teachers in a multiple-day professional development session using argument diagramming, after which the teachers applied the techniques with their own students over a period of about four weeks. Then, the teachers participated in a debriefing session where they told us how the instruction went.

The goal of the professional development was to teach the instructors how argument diagramming could help their students to read and write arguments by helping them to experience for themselves how AD makes explicit an argument's structure and the relationships among the arguments components. The project employed an IFL ELA unit, "The Pursuit of (Un)Happiness," that engages teachers (and later their students) in reading two texts, "Does Trying to Be Happy Make Us Unhappy" by Adam Grant and "Pursuing the Science of Happiness" by Andrew Guest, and focuses students on comprehending and analyzing complex arguments.

After reviewing basic argument components and definitions, the teachers diagrammed the arguments in the Grant text. In the first year involving manual paper-and-pencil exercises, the teachers selected sentences and highlighted them with marker pens in colors corresponding to the argument components. They made a post-it for each component and constructed a diagram representing Grant's argument. The teachers performed these activities with a combination of seat work and small-group discussion. Next, they moved on to diagramming Guest's argument using the same manual techniques. Although the Guest text is more complex, the teachers followed a recommended procedure of identifying evidence first, which often takes the more obvious forms of concrete examples, cited references or studies. The teachers then used both diagrams to help them plan and make their own written arguments across the two texts. In particular, they wrote about how Grant and Guest would respond to a quotation from Victor Frankl.

With this experience behind them, the teachers subsequently engaged the students in their ELA classes in the same activities of manually highlighting sentences according to their argument roles, diagramming authors' arguments and using the diagrams to plan their own arguments. Over the four-week period, the teachers engaged the students in seat work and small group discussion much as they had done. In the debriefing session, the teachers reported that the classroom sessions engaged the students' interest and that they collected student-constructed diagrams that were generally well-formed and comprehensive. The teachers also reported that some students spontaneously used argument diagramming to plan their own arguments and for feedback on the quality of their arguments.

In the next year, we repeated the same instructional session with the same teachers, but this time the teachers used a prototype version of ArguPod and then instructed their students in using the program. Diagramming the arguments in a text with ArguPod is a two-step process. First, students use ArguPod to annotate the text in terms of a simple argumentation scheme with four sentence roles or types: claim, counterclaim, evidence, and reason. In ArguPod's reading and annotation screen, the student selects a sentence that plays any of these roles and marks it by dragging the cursor. A pop-up menu then invites the student to select one of the four argument sentence types (that is, claim, counterclaim, evidence or reason). When the student selects a type, the corresponding highlighting color is applied to the marked text and the student moves on to select another sentence. Upon completing some annotations, a student moves on to the second step, diagramming the argument. ArguPod's diagramming screen assembles

correspondingly colored nodes for all of the highlighted sentences. The student then moves the nodes around into a graph (by dragging them) and connects the nodes via links.

Our initial hypothesis was that diagramming arguments with ArguPod is an effective way to teach students the basic argument components of claim, evidence, reason, and counterclaim. ArguPod's creation of digital versions of annotated texts and diagrammed arguments made it much more feasible to observe and measure such indicators of learning as the degree to which students agree in their identification of structurally important sentences and their classification of their roles in the argument. If the above hypothesis is correct, one would expect that the more argument diagramming students perform, the higher the level of agreement.

In this connection, in the second year of the internal study, at the suggestion of the teachers, we introduced a short third article, "The Track-Star Economy" by James Surowiecki for students to gain additional practice diagramming after completing the Grant and Guest articles and the writing-across-texts exercise. The Surowiecki piece was not about the concept of happiness, but instead, it addressed immigration, the focal topic of the next unit that the teachers used with students.

We expected that the level of agreement would be higher in the annotation of this third article than in the first two. In fact, the number of students' agreements normalized by unique spans did increase over the course of annotating and diagramming the three articles. This measure is the number of times students annotated the same span of text in each document and selected the same category. We normalized the counts by dividing by the total number of unique spans students annotated. The number of student agreements with an "expert" annotation, normalized by unique spans, also increased over the course of annotating and diagramming the three articles. We evaluated statistical significance of the improvements. The normalized agreement among students and the agreement with "expert" annotations both increased significantly with $p < 0.01$.

For both years, the teachers observed that students appeared to regard the work as novel and interesting, if challenging, and that the students appreciated that the teachers had found argument diagramming to be challenging as well. These Pennsylvania teachers believed that the argument diagramming activity aligned well with the state's Keystone Exams, especially in requiring working on a computer; they anticipate the Keystone exams will soon be computerized. The teachers remarked that ArguPod made it particularly easy for teachers to review individual students' argument diagrams on-line or via printing them out and, thus, helped them assess how well students are understanding the lessons on argumentation.

Based on the work supported by the LRDC internal grant, the PIs intend to submit an application in August, 2017 for an IES Education Technology grant entitled "Argument Diagramming and Annotation to Support Teaching and Learning."