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RESEARCH AT GROTON-DUNSTABLE REGIONAL HIGH SCHOOL

During the second semester of the 2008-2009 school year a research study was conducted with grade 10 English classes. The study was designed to determine if students who were taught using Visible Thinking, an instructional approach developed at Project Zero at the Harvard Graduate School of Education, would have an enhanced ability to think more critically.

Teachers were trained in the use of Visible Thinking Routines by a representative from Project Zero. While only three teachers in this group were part of the study, a total of twelve teachers participated in the training. In order to maintain the integrity of the study, only teachers of grades 9, 11 and 12 were invited to participate. A professional development day was provided for all teachers electing to participate. This initial full day meeting was held in Cambridge at Project Zero. During this training, teachers were provided with background on the work of Visible Thinking, Project Zero and Thinking Routines. The greater part of the day was spent learning about the routines to be implemented and practicing their use. Follow-up by the Visible Thinking trainer occurred four more times throughout the duration of the study. Follow-up meetings were held at the high school and lasted for ninety minutes. In between visits by the trainer, during study group sessions teachers shared lessons, discussed instructional strategies and examined student work.

For this study, the tool used to measure critical thinking was the Watson-Glaser Critical Thinking Appraisal (WGCTA). Students were pre- and post-tested using the Watson-Glaser Critical Thinking Appraisal, a well respected instrument. The WGCTA is comprised of five tests, each designed to examine a different area of critical thinking. The five tests are:

1. Inference. Discriminating among degrees of truth or falsity of inference drawn from given data.
2. Recognition of Assumptions.
Recognizing unstated assumptions or predispositions in given statements or assertions.
3. Deduction. Determining whether certain conclusions necessarily follow from information in given statements or premises.
4. Interpretation.
Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted.

5. Evaluation of Arguments.

Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular issue. (Watson & Glaser 2006, p.3)

Visible Thinking

VT includes sets of routines or protocols that foster critical thinking. VT routines are not a curriculum but rather a set of tools teachers can implement across the disciplines. These routines invite inquiry, map questions, and provide opportunities for all students to participate in classroom discussions. Due to their multimodal approaches, these routines use student knowledge and interest to dig deeper into the subject area. These routines have been designed to develop the students' ability to make connections to previous learning, both in school and out, and to tap into learning across the standard academic areas.

A key component of Visible Thinking involves the documentation of student thinking so it can be shared, reflected upon, and expanded. Use of the VT routines provides both students and teachers with a variety of strategies to share their thinking and provides sets of routines allowing students to access new ideas and concepts. By using these routines, according to Project Zero (2007), "teachers develop and use a language of thinking, they make the classroom environment rich with the documents of thinking (both processes and products), they look for opportunities for student thoughtfulness, they use thinking routines to support and nurture student thinking, they model and make their own thinking visible, and they send clear expectations about the importance and role of thinking in learning".

Critical Thinking

There are many definitions of critical thinking. For the purposes of this study critical thinking was defined as:

- (1) an attitude of inquiry that involves an ability to recognize the existence and an acceptance of the general need for evidence in what is asserted to be true;
- (2) knowledge of the nature of valid inferences, abstractions and generalizations in which the weight of accuracy of different kinds of evidence are logically determined; and
- (3) skills in employing and applying the above attitudes and knowledge.

Critical Thinking is also conceptualized as results-oriented, rational, logical and reflective evaluative thinking, in terms of what to accept (or reject) and what to believe in, followed by a decision concerning what to do (or not to do); then to act accordingly and the take responsibility of both - the decisions made and their consequences. (Zoller as cited by Muri et al, 2007. p. 356)

Habits and Dispositions

Research on critical thinking is seen as encompassing two distinct elements: cognitive and affective. Within the critical thinking movement, the term *disposition* contrasts sharply with the term ability. This idea is supported by well respected educators and leaders in the field of critical thinking including Debbie Meier, David Perkins, Shari

Tishman and Ted Sizer. These prominent educators agree that critical thinking has two parts: the ability to think critically and the disposition to use the ability.

Dispositions focus not on the abilities of the individual, but on how and when the individual chooses to use them. “Dispositions concern not only what people can do, but how they tend to invest their capabilities – what they are disposed to do, hence the term dispositions” (Perkins, Tishman, Ritchart, Donis & Andrade 2000, p. 270).

Students involved in this study were also pre and post tested using the California Critical Thinking Dispositions Inventory (CCTDI). This test is considered to be the one of the best at measuring a students’ willingness to use their cognitive skills.

The Results

This research was framed by three research questions:

Research Question 1:

Among 10th graders, are there differences on the Watson Glaser Critical Thinking Appraisal scores (pretest vs. posttest) by group (control vs. experimental)?

Research Question 2:

Among 10th graders, are there differences on each of the eight disposition scores from the California Critical Thinking Disposition Inventory (CCDTI) (pretest vs. posttest) by group (control vs. experimental)?

Research Question 3:

Research question 3 asks if there differences on final 10th grade scores and MCAS scores by group (control vs. experimental).

To examine research question one, two independent sample t-tests were conducted to assess if differences exist on 10th grade students scores on the Watson Glaser Critical Thinking Appraisal (WGCTA) for test (pretest vs. posttest) by group (control vs. experimental). Testing for significant differences looks at changes over time or differences between groups or subgroups. When looking at differences in the mean, the *t* test is used. The *t* test is the most commonly used method to evaluate the differences in means between two groups. There are several types of *t* tests, but the most common is the two-sample *t* test, also known as the student's *t* test or the independent-samples *t* test. In theory, the *t* test can be used even if the sample sizes are very small (e.g., as small as 10), as long as the variables are normally distributed within each group and the variation of scores in the two groups is not reliably different (Statistica, 2007). Reliability is the degree to which the measurements of a test remain consistent over repeated tests of the same subject under identical conditions. An experiment is reliable if it yields consistent results of the same measure. It is unreliable if repeated measurements give different results. The two-sample *t* test examines whether two independent populations have different mean values on a particular measure.

Two dependent sample t-tests were conducted to assess if differences exist on 10th grade students scores on the WGCTA for each group (control vs. experimental) by time (pretest vs. posttest). The independent sample *t*-test is an appropriate statistical analysis when the scope of a research question is to assess if differences exist on a continuous (interval/ratio) dependent variable by a dichotomous grouping independent variable (Pagano, 1990). In this case the continuous dependent variable is WGCTA scores (pretest vs. posttest) and the groups are dichotomized (control vs. experimental).

The results indicated the instruction using Visible Thinking routines did enhance critical thinking skills. Those students in the experimental group showed greater growth in critical thinking than did those in the experimental group when post-tested using the WGCTA.

To examine research question two, 16 independent sample t-tests were conducted to assess if differences exist on each of the eight dispositions (truth, open-minded, analytic, system, confidence, inquisitive, mature and total) scores from the California Critical Thinking Disposition Inventory (CCDTI) for time (pretest vs. posttest) by group (control vs. experimental). Sixteen dependent were t-tests will be conducted to assess if differences exist in CCDTI scores for group (control vs. experimental) by time (pretest vs. posttest).

The independent sample *t*-test is an appropriate statistical analysis when the scope of a research question is to assess if differences exist on a continuous (interval/ratio) dependent variable by a dichotomous grouping independent variable (Pagano, 1990). In this case, the continuous dependent variable is CCDTI scores (pretest vs. posttest) and the groups are dichotomized (control vs. experimental).

The result of these test showed that there was no difference between the control and experimental groups.

Research question three was examined using two independent sample t-tests which were conducted to assess whether there are differences on final 10th grade scores and MCAS scores by group (control vs. experimental). The independent sample *t*-test is an appropriate statistical analysis when the scope of a research question is to assess if differences exist on a continuous (interval/ratio) dependent variable by a dichotomous grouping independent variable (Pagano, 1990). In this case the continuous dependent variables are 10th grade scores and MCAS scores and the groups are dichotomized (control vs. experimental).

Again, the results indicated that there was no difference between the control group and the experimental group. One of the reasons for this can be explained that the MCAS exams are not designed to measure critical thinking.

Conclusion

The results of this study indicate that VT was successful in enhancing critical thinking and makes a strong case for embedding VT into existing curriculum. In addition, these results make a strong case for developing a culture of thinking in secondary school classrooms. The notion of a thinking culture is discussed by Fluellen in his paper *Words for the Mind: Analysis of Thinking*. He suggests that as a precursor to Visible Thinking a culture of thinking be established in the classroom. In *The Thinking Classroom: Creating a Culture of Thinking* by Tishman, Perkins and Jay (1995), Tishman and her Harvard colleagues describe the tools and environment needed to create a true culture of thinking in the classroom. They indicate that the elements of the thinking classrooms are: modeling, explaining, interacting, and feedback and that these, at any level, develop an environment conducive the development and enhancement of thinking skills.

The term routine is an important element of VT. Classrooms are places where routines and protocols assist in the management of day-to-day operations. All classroom teachers have routines for taking attendance, going to lunch, collection homework, etc.

By developing a culture of thinking, thinking and the use of routines becomes the norm – what is anticipated and expected. Students will respond to “act in ways cued and supported by the surrounding environment” (Brown, Collins, & Duguid, 1989; Costa, 1991; Perkins, 1992 as cited in Tishman et al 1992). “But over time, students get frequent experience in the four forces. Also, as the culture of thinking matures, students, in addition to the classroom teacher, model, explain, interact and give feedback” (Fluellen 2005, p.2).

Groton-Dunstable Regional High School is in a unique position to advance research in this area to support the academic and social growth of its students. As a school we have a history of doing extremely well on the state assessments (MCAS). Our faculty is skilled and knowledgeable in both their content area and pedagogy. In addition there exists a unique and special collaborative spirit within the faculty that supports engagement and the sharing of information and ideas. Most importantly, the relationship between faculty and students is also one of collaboration and trust. While by all measures an excellent school, Groton-Dunstable can do more for its students by a developing critical thinking skills and embedding habits of mind or dispositions into every classroom.

Our teachers are interested in pursuing this line of inquiry and practice. The following are statements from GD faculty.

1. The protocols have stimulated much more conversation in those classes in which I have used them.
2. Using the routines has made it more evident to me that students actual enjoy and benefit from the opportunity to converse/think more deeply about their work; I feel they have had the spontaneity of free-thinking squelched in recent years.
3. I think using the routines on the high school level allows us to better develop the thinking strategies that colleges and universities are complaining students lack.
4. The routines inform my teaching practice because of the immediacy of the feedback that they afford. They actually make it more enjoyable for me, as a teacher, to push student thinking further. I find it stimulates them mores that other methods I was using.

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