Technology Rich Classrooms: Effect of the Kansas Model

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Abstract

The Kansas State Department of Education (KSDE), through the Technology Rich Classroom (TRC) Project, has offered Enhancing Education through Technology (EETT) competitive grant awards to grades three through six in Kansas since 2003. This study examined the effects of a Technology Rich Classroom environment including differences in pedagogy and student engagement; and use of technology in terms of classroom management, pedagogy, and student engagement. The pilot study described in this paper provides some evidence that including technology in a classroom, training teachers how to use the technology, and providing support for technology use may change many aspects of learning.

Technology Rich Classrooms: Effect of the Kansas Model

Introduction

Since 2003, the Kansas State Department of Education (KSDE) has offered Enhancing Education through Technology (EETT) competitive grants for Technology Rich Classrooms. These grants are funded through the Title II Part D initiative of the Elementary and Secondary Education Act, or No Child Left Behind (NCLB) as it has been referred to more recently. EETT defines the federal goals for educational technology. As stated in the Title II Part D section, “The primary goal of this part is to improve academic achievement through the use of technology in elementary schools and secondary schools.” (U.S. Congress, 2002) Additional goals are to a) ensure that students are technologically literate by the time they finish 8th grade, and b) to encourage effective integration of technology resources through training and curriculum development of research-based instructional methods. To achieve these goals, KSDE implemented the Kansas Technology Rich Classroom (TRC) Program.

The Technology Rich Classroom grants are awarded to Local Education Agencies (LEA) by the Kansas State Department of Education. Eligible applicants include LEAs with the highest numbers of percentages of children from families with incomes below poverty line. After the review process but before grants are awarded, priority points are given by KSDE to schools that are listed as “on improvement” for academic achievement, and for those that have not received funding in Technology Rich Classroom Program. Each grant provides equipment and training for four elementary classroom teachers per school in grades 3-6. LEAs apply for funding of $100,000 and must provide a match of $50,000 for the first year of the grant. This funding covers the expense of standardized equipment in each classroom, a .5 FTE TRC Facilitator, and local and statewide professional development.

Once awarded, standardized equipment of a teacher laptop and 2:1 student to computer ratio of laptop or desktop computers, a projector, an interactive whiteboard, internet access, productivity and curriculum-related software, and a printer are installed in each Technology Rich Classroom. In addition, each TRC teacher receives a web camera and microphone headset, a USB Flash drive, and a Digital Camera for use with the TRC Program. This is a minimal list of grant-related equipment. Grantees may purchase additional equipment to be used in the Technology Rich Classrooms.

A .5 FTE TRC Facilitator is required as part of the state grants. This Facilitator's time is dedicated to the participating TRC Teachers. The role of the Facilitator is similar to an Instructional Coach in the area of Educational Technology. They provide some troubleshooting strategies, but are employed to assist teachers with pedagogy and curriculum within a technology-rich environment. This includes, but is not limited to, modeling, co-teaching and observing lessons, co-planning lessons, finding curriculum resources, and providing individual and small group professional development. The Facilitator supports on-going, job-embedded professional development through the functions of a professional learning community.

TRC Teachers receive 10 professional development days as part of their participation in the program. These are typically "pull-out" days where a substitute teacher is provided for their classrooms and the TRC cadre can meet with the Facilitator. The Facilitator is responsible for planning the agenda, based on the needs of their teachers.

In addition to the job-embedded and local professional development, TRC Teachers participate in statewide TRC events. Advanced Learning Technologies (ALTEC^) is contracted to provide program management and professional development for the statewide Technology Rich Classroom Program. The statewide professional development events support the TRC Program and collaboration between teachers participating in the grant. There are 4 statewide events that teachers participate in throughout the year, and 5 statewide events for Facilitators. It is estimated that TRC Teachers receive over 150 hours of professional development as a result of this intervention.

By contrast, the comparison group for this pilot study is that of Typical Classrooms. Typical classrooms may have some of the same required equipment as the Technology Rich Classroom, but likely have much less and almost certainly not all, or are required to share the equipment across grade levels or curricular area. Student access to technology in Typical Classrooms is generally limited to a few computers in the classroom and the computer lab (or cart) when the teacher schedules this time. It is not the anytime/anywhere access that one might find in a Technology Rich Classroom. These teachers also do not have access to the TRC Facilitator or the additional professional development that is provided in the TRC Program. Oftentimes, in Typical Classrooms, teachers are presented new ideas in a workshop or in-service day, but follow up and implementation is the responsibility of the classroom teacher. During this pilot study, Technology Rich Classrooms were matched with Typical Classrooms in the same school or districts, when possible, to provide some general equivalence in terms of curriculum, student demographics, and administrative support.

Literature Review

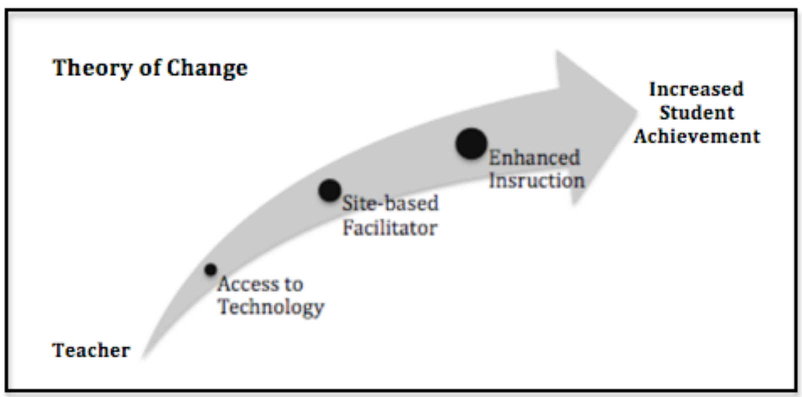
The Kansas State Department of Education has chosen to target the competitive portion of Enhancing Education Through Technology funds available to Kansas schools under Title II, Part D of the ESEA Reauthorization, No Child Left Behind, to assist schools with student and teacher empowerment to infuse technology into an engaging and active environment that enables the learner to become a technologist, problem solver, researcher and communicator. The assumption is that powerful technology integration strategies cannot emerge without hands-on, "real" learning opportunities for students and teachers. Technology is a powerful tool, but it is only a tool. Effective teaching practices must first be in place before technology can be utilized to its fullest potential. Through the power of technology, learning can happen anytime and anywhere. It is up to educators to provide realistic and meaningful learning opportunities both in and outside the classroom.

Technology can increase the versatility and value of learning and create an engaging learning environment for students. Those Kansas schools already implementing technologies have learned that effective teaching practices and on-going, high quality professional development must be in place before technology can be utilized to its fullest potential.

In order to continue building on the promise these technologies can bring to schools, it is essential to look at the results of these technologies when deeply integrated into classroom instruction. It is known that teachers move beyond surface integration of technologies when support and professional development focus on content, pedagogy, and the blend of technology into both domains (Wetzel, Zambo, Buss & Padgett, June, 2001).

The purpose of the Technology Rich Classroom Program is to provide evidence that technology integrated into the learning environment and supported by strong, on-going professional development can produce positive change in the classroom that results in improved student learning. In order to achieve this, it is believed that classroom teachers must have access to technology resources. The technology equipment, software, and online access promote integrated, inquiry-based learning, as opposed to isolated learning about technology. Because all teachers may not know how to effectively use a technology-rich environment, a site-based Facilitator provides on-going, job-embedded professional development to assist the teacher to enhance instruction. This enhanced instruction will lead to student outcomes such as increased achievement on state standardized exams. (Figure 1)

Figure 1. Technology Rich Classroom Theory of Change



Access to Technology

The United States has invested over 40 billion dollars on information and communication technologies (ICT) infrastructure over the past ten years (Dickard, 2003). This extraordinary investment in technology holds potential for contributing to school effectiveness and improvement (Anderson & Dexter, 2005). Although the presence of computers as well as computer use in our schools is increasing, the frequency of use is fairly low, with teacher use exceeding student use (U.S. Congress, 1995; Vannatta &

Fordham, 2004). Additionally, when the quality of classroom use is scrutinized, it is discovered that these powerful technologies are most often being used for low-end applications, such as drill and practice and using word processing programs for composition of text. This is after years of increases in access to computers (Barton, 2001).

Professional Development

The Technology Rich Classroom Program goes beyond just providing equipment and access to technology in the classroom. Professional development is key to teachers' successful implementation of the project. According to the National Staff Development Council, professional development occurs when teachers, principals, and other educators update their knowledge and skills during their career (Sparks & Richardson, 1997). Staff development is essential because teacher learning and student learning are connected. Students cannot achieve high levels of learning and performance unless teachers, principals, and other school employees are continuously learning (Sparks & Richardson, 1997). Effective professional development programs lead to meaningful adult learning and enhanced student achievement.

Within the TRC Program, the assumption has been that professional development using a coaching approach to support the integration of technology into math, reading, and science instruction, allows for a richer and more successful use of technology in instruction (Becker, et al., 1999). The professional development continuum has been structured within a coaching framework that provides teachers with skills in using technology as well as addressing their view of student-centered learning and the value of technology as an instructional tool (Russell, Bebell, O'Dwyer, & O'Connor, 2003).

To support this framework in the classrooms, the TRC Facilitator serves as a coach for their teachers. Showers and Joyce (1982, 1996) are commonly attributed as the first researchers to seriously explore the promise of coaching, calling their model "peer coaching" (Ross, 1992). Several coaching models have evolved, such as peer coaching (Joyce & Showers, 2002; Allen & LeBlanc, 2005), prescriptive coaching (Newman & Cunningham, 2009), differentiated coaching (Kise, 2006), content-focused coaching (West & Staub, 2003), and instructional coaching (Knight, 2004, 2005, & 2006).

The TRC Program implementation is based on the most recent work of Jim Knight (2007) who espouses a *partnership coaching* model. The TRC Facilitator works in partnership with the classroom teacher to enhance teaching and learning by integrating the technology with the teachers' instructional strategies and choices. A meta-analysis conducted in 2003 reveals that combining teaching and learning with technology has a positive effect on student outcomes. The meta-analysis evaluated 42 studies involving 7,000 students. When compared to traditional instruction, technology integration resulted in positive effects for the cognitive and affective domains (Waxman, 2003). Research has also shown positive effects of high versus low technology integration on vocabulary, reading, and writing scores (Knezek & Christensen, 2002).

Enhanced Instruction

Technology has the potential to be a powerful teaching and learning instrument when integrated appropriately. Research supports that student achievement can increase when practicing authentic inquiry and higher-order thinking and when technology is present in the teaching environment the benefits are enhanced (Edutopia, 2009). Of course, the act of integrating technology in isolation does not necessarily result in the acquisition of higher-order thinking skills or improved student achievement. These positive results depend on how the technology is used and the role the teacher plays in the classroom. Collaboration is a key factor in the acquisition of higher order thinking skills (Brabec, Fisher & Pitler, 2004; Lemke & Coughlin, 1998; Wegerif, 2002).

When focused on higher-order thinking skills, integrating technology into teaching appears to have a particularly significant effect. Hopson (1998) evaluated the effects of placing students in a technology enriched learning environment on the development of higher order thinking skills in fifth grade students. The result of his study, which employed the CAQ (Computer Attitude Questionnaire) and Ross Test of Higher Cognitive Processes, indicated that the technology enriched the environment positively and significantly affected the use of the higher order thinking skills and evaluation in students (Hopson, 1998).

The Technological Pedagogical Content Knowledge (TPCK) framework identifies critical qualities of knowledge required by teachers for instructional technology integration, while focusing on teacher knowledge. At the heart of the TPCK framework, is the complex interplay of three primary forms of knowledge: Content (the actual subject matter), Pedagogy (methods of teaching and learning), and Technology (ranging from chalkboards to digital computers). (Mishra & Koehler, 2006) When using this framework, a synergy is developed between the relationships of technology, content and pedagogy. TRC Facilitators support classroom teachers by blending these three powerful components.

The National Educational Technology Standards for Teachers (NETS•T), revised in 2008, guide teachers to change the way they teach, the way they work, and the way they learn in an increasingly connected global and digital society. (ISTE, 2008) ISTE recognized that new demands are being placed on educators through the rapid advances in technology. These standards provide a framework for educators to use as they transition schools from Industrial Age to Digital Age places of learning and include the following standards for teachers:

- Facilitate and Inspire Student Learning and Creativity
- Design and Develop Digital-Age Learning Experiences and Assessment
- Model Digital-Age Work and Learning
- Promote and Model Digital Citizenship and Responsibility
- Engage in Professional Growth and Leadership

Performance indicators, rubrics and scenarios describe benchmarks for the use of technology as a tool for teaching and learning.

Along with the National Educational Technology Standards for Teachers, ISTE created technology standards for students (NETS•S), which were revised in 2007. The goal of the NETS•S is to help students prepare to work, live, and contribute to the social and civic fabric of their communities. These standards set the expectation for students to apply the basics in authentic, integrated ways to solve problems, complete projects, and creatively extend their abilities. The student standards include:

- Creativity and Innovation
- Communication and Collaboration
- Research and Information Fluency
- Critical Thinking, Problem Solving, and Decision Making
- Digital Citizenship
- Technology Operations and Concepts

These standards for students and teachers, along with the indicators, rubrics, scenarios, and student profiles, provide a roadmap for teachers to integrate technology to enhance instruction.

Theory and research suggest that classroom teachers who have access to technology resources and are in their effective use succeed. With technology access and job-embedded professional development provided by an on-site facilitator, teachers should improve instruction, which should lead to positive student outcomes outlined in the next section. This pilot study hopes to describe differences in pedagogy and student engagement when comparing both TRC and typical high-quality classrooms and to examine TRC teachers' change in use of technology, classroom management, pedagogy (including a focus on higher order thinking skills), and student engagement.

Methods

Participants

Participants were recruited to be involved in the study through the TRC project. Six TRC teachers were available for involvement in this project and three teachers who were uninvolved in the project were also recruited to serve as comparison classrooms. All TRC teachers and two of three teachers from the non-TRC classrooms were female. There were an average of 17.31 students in the classrooms, with a range of 13 to 21, and on average there were approximately 1.3 adults in the class besides the teacher, with a range from 0 to 4.

Observation Protocol Development

The TRC observation protocol was designed to provide a comprehensive picture of what is happening in a classroom during the observation period. The observation sheet included behaviors that fell into six distinct categories to record:

1. Technologies used by the teacher
2. Technologies used by students
3. Student groupings for classroom work such as independent , pairs, small groups, mixed groups/independent; as well as whole class with attention to teacher, to another student, or to media; and non-instructional transition activities,
4. Teacher engagement to include whole class lecturing or discussion, individual or group help, observing students with no interaction, and non-instructional transition or other activities,
5. Number of students off-task including zero, 1-3, 4-6, 7-10, or more than 10
6. Level of Bloom's Taxonomy to include Receipt of Knowledge, Applied Procedural, Knowledge Representation, and Knowledge Construction

Portions of the observation sheet were based on an observation protocol originally designed by Intel in cooperation with Rockman *ET AL.* (2007). The observation protocol is included in Appendix A, and the definitions for observation categories are included in Appendix B.

Momentary time sampling was the method used to conduct the observations, and observations occurred at 20 second intervals. Momentary time sampling has been shown to be an effective and accurate observation tool when short intervals are used and when the behavior is of substantial duration (Harrop & Daniels, 1986; Saudargas & Zanolli, 1990). In this case, the behaviors being observed in the classroom were not short or discrete behaviors occurring infrequently, they were general activities that would happen over a relatively long period of time during the classroom activities. The observers watched a single timer on a computer screen, and recorded the behaviors that were occurring at the end of a 20 second interval, i.e. when the timer reached 20 seconds. The observations were broken up so two of the six categories were scored every 20 seconds, which allowed all six categories to be scored each minute. Observation periods were designed to last for one hour, but some class periods ended earlier than scheduled, which made the observation period shorter that originally anticipated. The observation periods lasted an average of 54.97 minutes, with the shortest observation lasting 20 minutes and the longest being 60 minutes. At the end of the observation period, the totals for each observation category were added together to provide the proportion of intervals each category was scored during the observation period. The results are presented as the total proportion of intervals in which each of the categories was scored during the observation period.

Reliability for Observations

Two observers were trained on the observation form by watching videotapes of classrooms and observing in actual classroom periods until they achieved a reliability estimate of 80% for all categories. After the observers reached this level of reliability, they began to observe in the classrooms that were part of the project. Reliability information was collected for 44% of the observations (four of the nine classrooms at each observation interval, or 16 of 36 observations).

Reliability was calculated using the average frequency ratio of all categories and the correlation between observers. These two different methods were used to account for the strengths and weaknesses of each observer. The average frequency ratio is calculated by using the totals for each observation category and each observer, dividing the lower frequency by the higher frequency, and then taking the average ratio of agreement across all categories for each classroom. One of the problems with this method is when only a few intervals have been scored for a category; the level of agreement may appear low. For example, if one observer reports seeing a behavior two times, but the other reports a behavior occuring three times, this provides a low level of agreement (approximately 67%) even though there were many intervals in which the observers agreed the category was *not* appropriate to be scored. This can artificially decrease the overall level of agreement between observers. Additionally, there are observation periods in which a category was never recorded by either observer, and it would be reported that the observers agreed 100% of the time, which can artificially increase the overall rating.

The second way in which reliability was calculated was to correlate the numbers reported by each rater from each category using a Pearson correlation coefficient. While this provides a coefficient that shows the strength of the relationship between the raters, the correlation can also be artificially high if one rater is systematically lower or higher than the other rater (Kazdin, 1982). Additionally, when categories have not been scored during the observation period (thus, the raters scores are both zero), the level of agreement may also be inflated.

Table 1 reports the amount of agreement using the two forms of reliability for each of the four observation periods and the average level of agreement for all four of the observation periods. Overall, it appears that the level of agreement between observers was similar between observations for the average frequency ratio, although the average frequency ratio did increase when looking at the correlation coefficient for each observation. Overall, these levels of agreement are acceptable in accordance with previous studies and with acceptable levels of agreement.

Results

Results from the TRC and Non-TRC classrooms were collapsed together to create composite proportions for each type of classroom. To achieve this proportion, the number of total intervals in which observations took place across for TRC and Non-TRC classrooms were summed, and then the total number of intervals in which each category was scored was summed. The sums of the categories were divided by the total number of observation intervals and then multiplied by 100 to obtain a percentage. The resulting number is the percentage of intervals in which each category was scored for all TRC and Non-TRC classrooms across all four observations. A *z*-test for significant differences between proportions was conducted using the raw scores to determine which categories had significantly higher proportions. Table 1 provides the proportion of total intervals in which each category was scored, and the significant differences are flagged accordingly.

Technology Use

As it can be seen from this table, there are large differences between the TRC and non-TRC classrooms. For technology use, the TRC classrooms used technology significantly more often, with teachers and students using technology 49% and 68% of the time, respectively, while in non-TRC classrooms technology was only used by teachers and students 6% and 5% of the time, respectively. This indicates that there was substantially more technology use in the TRC classrooms.

Grouping Strategy

When looking at classroom grouping and classroom activities, observers in TRC classrooms were more likely to see students working Independently, in Pairs, or in Mixed Groups. On the other hand, non-TRC classrooms were more likely to be scored as Attention to Teacher or Attention to Student. The Attention to Student category was often scored while the teacher was lecturing and the teacher asked a question to the class, which a student would answer, so it makes sense that these two proportions would vary together. Based on these observations, TRC classrooms were more likely to have students engaging in individual work or group work, and were less likely to have the students paying attention to the teacher during lectures. This provides some evidence that in classrooms where technology use is occurring more often, students are more likely to be engaged in individual or group projects, and they are less likely to be engaged in whole class activities where the entire class is paying attention to the teacher or another student.

Teacher Engagement

Teacher behaviors also differed between TRC and non-TRC classrooms. Teachers in the Non-TRC classrooms were more likely to be engaged in Lecture and Discussion with students, which is commensurate with the Grouping Strategies data. Because those classes were also more likely to be engaged in whole class activities, students were more likely to be paying attention to the teacher or other students. However, teachers in TRC classrooms were more likely to be engaged in helping individuals or groups. This also is in line with the grouping strategies mentioned earlier: when the students are engaged in individual and group projects the teacher is more likely to be working one-on-one with an individual student or group. The amount of Teacher Lecture and Discussion were both more likely to occur in non-TRC classrooms. These two categories appeared to go together because the teacher was often lecturing and engaging in discussion during whole class activities. Additionally, there were no differences in the amount of time the teacher spent observing students, transitioning, or engaging in some other activity. This is important because it shows that teachers in both TRC and non-TRC classrooms are equal in the amount of time they require from the teacher to transition or complete tasks that are unrelated to the class activity that is occurring.

Student Engagement

On-task behavior differed between the classrooms as well. The TRC classrooms were more likely to have on-task behavior scored as 0 students off-task, whereas non-TRC classrooms were more likely to have students scored as 1-3 students off-task and 4-6 students off-task. While these proportions indicate that students in the TRC classrooms appeared to be on-task more often, these results should be interpreted with caution because reliability was difficult to achieve and sustain in these categories. It was difficult to determine who was on or off task by looking across the entire classroom. Relatively obvious off-task behavior had to be occurring in order for this category to be scored, however, this may help provide some preliminary information on how technology use may improve student on-task behavior in the classroom.

Bloom's Taxonomy

Finally, there were also differences between the classrooms on level of Bloom's taxonomy and the cognitive abilities that were required for the tasks used during class activities. The non-TRC classrooms were more likely to be engaged in Receipt of Knowledge, which are lower level tasks where they are only receiving knowledge from the teacher. Both types of classrooms were equally as likely to be engaged in Applied Procedural tasks, and this was by far the most common type of task seen in the classrooms. The categories of Knowledge Representation and Knowledge Construction were not scored often, but these two categories were more likely to be scored in TRC classrooms as opposed to Non-TRC classrooms.

Discussion

Overall, these observations do provide some preliminary evidence that classrooms with and without a wide array of technology that is available and used do tend to differ in many ways. When the technology was available, it was very likely to be used, and students were more likely to be engaged in individual or group projects, while students in classrooms without rich technology were more likely to be engaged in whole-class activities where they are paying attention to the teacher or another student. In line with this, teachers in classrooms with the rich technology were more likely to lecture and engage in discussion with students, but teachers with technology who have students working on individual or group projects were more likely to be helping them on their projects. Additionally, teachers in classrooms where there was more technology did not appear to spend more time transitioning or engaging in unrelated behaviors that teachers in classrooms without the technology. While the results should be interpreted with caution, students appeared to be more on task in TRC classrooms, and the level of Bloom's taxonomy was more likely to be higher. Teachers in Non-TRC classrooms were more likely to engage in lower level activities, and while they were not scored for a large percentage of time, TRC classrooms were more likely to be engaged in higher level cognitive abilities, such as Knowledge Representation or Knowledge Construction.

Limitations

While these data provide some preliminary evidence that there are some differences between these two types of classrooms, there are several limitations that need to be addressed. First, only nine classrooms were used in this analysis, six of which were TRC classrooms and three of which were Non-TRC classrooms. Because of the small sample, it is possible that these classes are not representative of typical TRC and Non-TRC classrooms. Second, the small sample may not have been as much of a limitation if more observations were able to occur. Gathering more data from each classroom across time would have provided a more comprehensive picture of the classrooms, but the current situation and a sample of convenience only allowed for four observation periods to occur over the school year. It is possible that these observation periods were not typical of the classrooms, and the occasional presence of the observers may have also been a distraction.

A third limitation was in the reliability of the observations. While the levels of reliability were acceptable across observations, they were generally on the low end of acceptability. It is possible that there may be some systematic differences between raters, and the numbers reported here may be biased in one way or another. Better reliability figures would help provide stronger evidence that the behaviors observed in the classrooms were the actual behaviors that occurred. Finally, the observations for this study were not conducted by blind observers. It is possible that because the observers knew the purpose of the study and which classrooms were TRC and Non-TRC classrooms that their ratings were biased. Even though reliability was acceptable, it does not rule out this possibility.

Conclusions

This brief study provides some evidence that including technology in a classroom, training teachers how to use the technology, and providing support for technology use may change many aspects of learning. While this study is small in scope, it does provide some important evidence that the use of technology in classrooms helps provide students with more opportunities to work together on projects that promote higher level thinking. More research is needed, especially research on student outcomes or other possible benefits from this program.

^ALTEC is a research and development group at the University of Kansas Center for Research on Learning. Established in 1995, ALTEC supports the instructional integration of technology into K12 classes through research, resource design and development, and professional development.

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Appendix A

TRC Research pre-observation assessment

Observer ______________________________________

Date______________________________________

School______________________________________

Teacher ______________________________________

Observation start ______ stop ______

Number of Students in Class______

Number of adults in addition to teacher ______

Subject (s) ____

Configuration of desks/table
______ tables and chairs
______ desks in rows
______ clusters of 3 to 5 desks per group
______ other ____

Equipment in the Classroom
______ Computers 1:1 or 1:2
______ Interactive white board
______ One or two classroom computers
______ Electronic Projector
______ Overhead projector
______ Data display projector
______ Response system
______ Camera
______ GPS
______ Handheld computer(s) (calculators or palms, etc)
______ Science probe
______ Printer
______ Scanner
______ Wii
______ TV
______ Audio player
______ Telephone

Notes:

ALTEC Classroom Observation Form

Time Interval	1	2	3	4	5	6	7	8	9	10	TIME
Teacher Technology											
1. Computer	○	○	○	○	○	○	○	○	○	○	**:20**
2. Power point/present.	○	○	○	○	○	○	○	○	○	○	
3. Web site	○	○	○	○	○	○	○	○	○	○	
4. Projector	○	○	○	○	○	○	○	○	○	○	
5. Interactive whiteboard	○	○	○	○	○	○	○	○	○	○	
Other (number)											
Student Technology											
1. Computer	○	○	○	○	○	○	○	○	○	○	**:20**
2. Web site	○	○	○	○	○	○	○	○	○	○	
3. Power point/present.	○	○	○	○	○	○	○	○	○	○	
Other (number)											
Grouping Strategy											
1. Independent work	○	○	○	○	○	○	○	○	○	○	**:40**
2. Pairs of students	○	○	○	○	○	○	○	○	○	○	
3. Small groups	○	○	○	○	○	○	○	○	○	○	
4. Mixed group/indep	○	○	○	○	○	○	○	○	○	○	
5. Whole class											
a. Attn. to teacher	○	○	○	○	○	○	○	○	○	○	
b. Attn. to student(s)	○	○	○	○	○	○	○	○	○	○	
c. Attn. to media	○	○	○	○	○	○	○	○	○	○	
6. Transition	○	○	○	○	○	○	○	○	○	○	
Teacher Engagement											
1. Active with students											**:40**
a. Lecturing	○	○	○	○	○	○	○	○	○	○	
b. Discussion	○	○	○	○	○	○	○	○	○	○	
c. Indiv./Group help	○	○	○	○	○	○	○	○	○	○	
2. Observing students	○	○	○	○	○	○	○	○	○	○	
3. Transition	○	○	○	○	○	○	○	○	○	○	
4. Other	○	○	○	○	○	○	○	○	○	○	
Student Engagement											
1. 0 students off task	○	○	○	○	○	○	○	○	○	○	**:60**
2. 1-3 students off task	○	○	○	○	○	○	○	○	○	○	
3. 4-6 students off task	○	○	○	○	○	○	○	○	○	○	
4. 7-10 students off task	○	○	○	○	○	○	○	○	○	○	
5. >10 students off task	○	○	○	○	○	○	○	○	○	○	
Cognitive Abilities											
1. Receipt of Know.	○	○	○	○	○	○	○	○	○	○	**:60**
2. Applied Procedural	○	○	○	○	○	○	○	○	○	○	
3. Know. Representation	○	○	○	○	○	○	○	○	○	○	
4. Know. Construction	○	○	○	○	○	○	○	○	○	○	
5. Other (describe)	○	○	○	○	○	○	○	○	○	○	

Appendix B

ALTEC Classroom Observation: Procedures and Definitions

Procedures for scoring – This procedure uses momentary time sampling in order to gain a general picture of the classroom during the target lesson. When observing a classroom, the observer must look up every 20 seconds and fill in what they were to observe during the interval. Two observations are to be made during each interval, and these are indicated on the sheet.

Definitions:

Teacher/Student Technology Used – Indicate any technologies that were used at the time of the observation. For students, even if only one student is using the technology, it should be included to gain an understanding of all technologies that are in use during a class period. For teachers, any time the teacher is actively using a technology or if they are presenting material using the technology (even if they were not actively manipulating it) technology should be scored. For example, if the teacher is presenting information on an "Elmo", this should be scored the entire time it is on and material is presented on it, even if the teacher is walking around helping students. The material that is presented should be relevant to the activity currently occurring in the class.

Grouping Strategy – Indicate how students are working at the time of the observations. Choose only one category that is indicated and best fits the definition of what is going on in the classroom.

1. Independent work – when ALL students are working on an assignment or project that is to be completed independently by the student. NOT if the student is working independently on part of a group project.
2. Pairs of students – when students are working together in pairs on an assignment that is to be completed jointly. NOT if the students are working in pairs as part of a group project.
3. Small groups – when students are working in groups larger than two to complete an assignment or project. All students should be involved in a group. If some are working independently on behalf of the group, then it would not be considered small groups.
4. Mixed groups – This category should be scored when the students are in a mixture of different groupings. For example, if some students are working in small groups while others are working individually, this category should be scored.
5. Whole class – when the entire class is focused on one person or media.
    a. Attn. to teacher – when the class is listening to the teacher giving instructions, lecturing, or engaging in some activity that requires the attention of the class.
    b. Attn to student(s) – when students are presenting work to the class or taking part in a discussion with the teacher. This should only be scored when the students are actually talking. For example, if the students are presenting information and the teacher begins talking during the scoring interval, the

attention to teacher should be scored. Also, if the teacher is engaging in discussion and a student is talking, this category should also be scored.

c. Attn. to media – when the students are watching a video or engaging in any activity that requires them to focus on a media object as the primary activity. If a teacher is using the technology as part of a lesson and they are talking or leading the class discussion, "Attention to Teacher" should be indicated even if the students appear to be paying attention to the media or technology. "Attention to media" should be indicated if the students are primarily paying attention to media to receive information about the lesson and the teacher has minimal involvement.

Student Engagement – At the beginning of the interval, count the number of students who appear to be off-task, or are not engaged in the activity. This can be done by quickly glancing over the room and seeing if students are obviously not involved in the activity. Off-task behavior is defined as: a) not oriented toward teacher or task while listening to instructions, b) not following instructions appropriately, c) not oriented toward the task. It should be fairly obvious that the student is not engaged in the classroom activity in order for this to be scored. For example, if the teacher is lecturing and a student is not looking directly at the teacher, but also not engaged in any other activities, this would still be considered on-task. Off-task behavior needs to be quite obvious in order for a student to be considered off-task.

Teacher Engagement – Indicate what activity in which the teacher is engaged in each interval

1. Active with students - they are actively engaged with students in one of the following manners:
    a. Lecturing – the teacher is talking to the class and is either presenting material to be learned or giving instructions about a task
    b. Discussion – the teacher is actively engaged in a discussion where students are contributing substantially to the task or lesson. In order for this to be scored when the teacher is talking, the teacher must be responding directly to a student's response during the moment the interval is scored. This interval is also scored if the teacher is silent and is listening to a student respond to a question.
    c. Individual/group help – the teacher is actively engaged in assisting a group or individual on a task they are completing. For this category they must either be actively listening to a question from a student or talking to the student/group
2. Observing students – when the teacher is walking around the class and observing the class as a whole while they are engaged in an activity. They should NOT be engaged with any particular student or group in order to score this interval.
3. Transition – the teacher organizing or helping students organize for the next task.
4. Unrelated activity – the teacher is doing something that is not related to the task at hand, such as sitting at their desk, talking on the phone, or out of the room. This category should also be checked when a teacher is not visible during video observations.

Cognitive Activity (from INTEL Classroom observation, Rockman *ET AL*)

1. Receipt of Knowledge – (includes Bloom's knowledge and comprehension) May include listening, repetition, answering simple/closed-ended questions, or reading. Knowledge gained can be found in external sources; no original or creative thinking involved

a. Students listen to a lecture from the teacher
b. Students watch an audio-visual presentation
c. Students sitting and listening to instructions

2. Applied Procedural Knowledge – (includes Bloom's Application) Involves following step-by-step procedures for completing a task or activity or arriving at a solution. The procedural steps can be provided by the teacher or found in the student guide. Any time the student is working on some type of assignment in the classroom, it will be at least applied procedural. See definitions for higher order thinking below to determine if what they are doing meets the requirements of those definitions.

a. Students enter data into a spreadsheet
b. Students use a worksheet to conduct Web Quest
c. Students completing a task in which they are applying some type of knowledge or skill they have learned after instructions are given

3. Knowledge Representation – (Includes Bloom's Analysis) Students may present and explain their original work. May also include students explaining their understanding of concepts in a way that helps others understand. This can be scored when a student is talking in class about how they arrived at a particular answer or what steps they took to figure out a problem. They must be representing the information in some fashion, and this requires greater creative or original thinking than applied procedural, where they are most likely only applying knowledge in a systematic fashion. Here, they are explaining or describing *why* they took the steps or used the methods they did.

a. Students make a graph from data they have entered on a spreadsheet.
b. Students summarize an article they have read online.

4. Knowledge Construction – (Includes Bloom's Synthesis and Evaluation) Students are involved in activities or tasks that call for original or creative thinking to produce a product, arrive at a solution, or develop an understanding that they would not find elsewhere. This can also include activities in which students are creating new or original ways to explain or present information, or if they are taking things they learned in class and synthesizing them in some manner that is original or creative.

a. Students interpret a graph they have made from data collected or taken from another source in order to explain the greater meaning of the graph.
b. Students explain why there may be differences in information they have read online (i.e. different sources of bias).
c. Students are using media to portray information in a new or original way.

Bloom's taxonomy – Knowledge, Comprehension, Application, Analysis, Synthesis, Evaluation

Table 1. Average agreement for all observations.

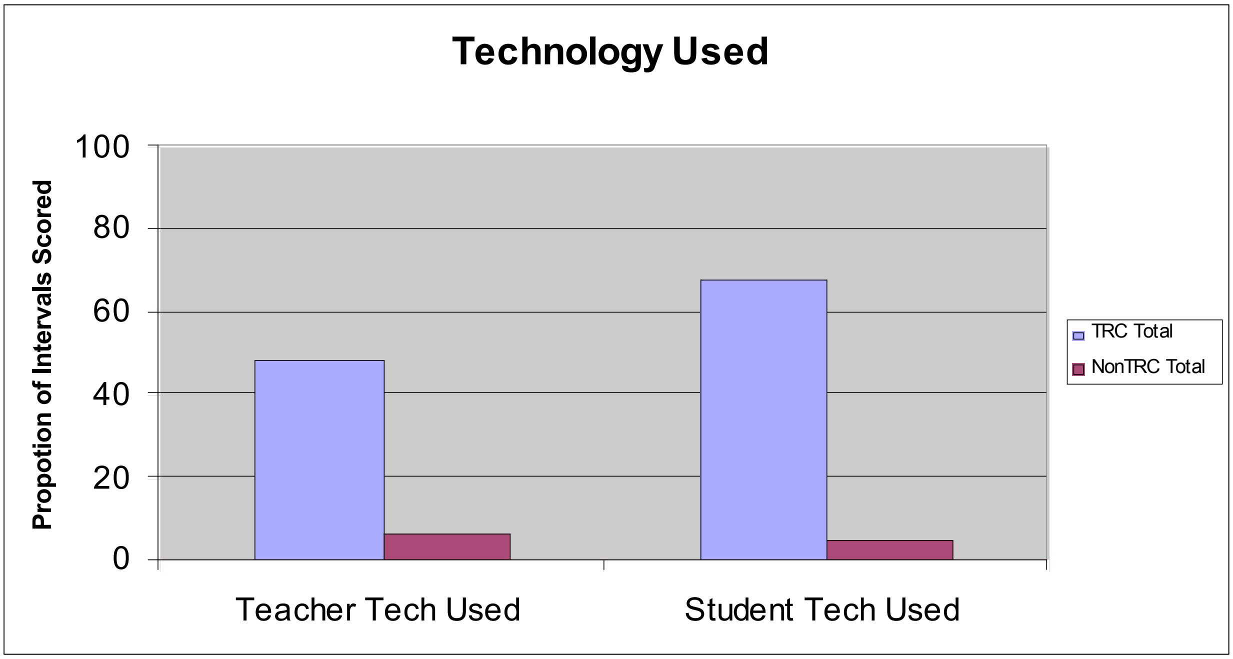
Method	*Observation 1*	*Observation 2*	*Observation 3*	*Observation 4*	**Total Average**
Average Frequency Ratio	80.41%	80.79%	82.81%	78.63%	80.68%
Correlation	.849	.964	.984	.938	.934

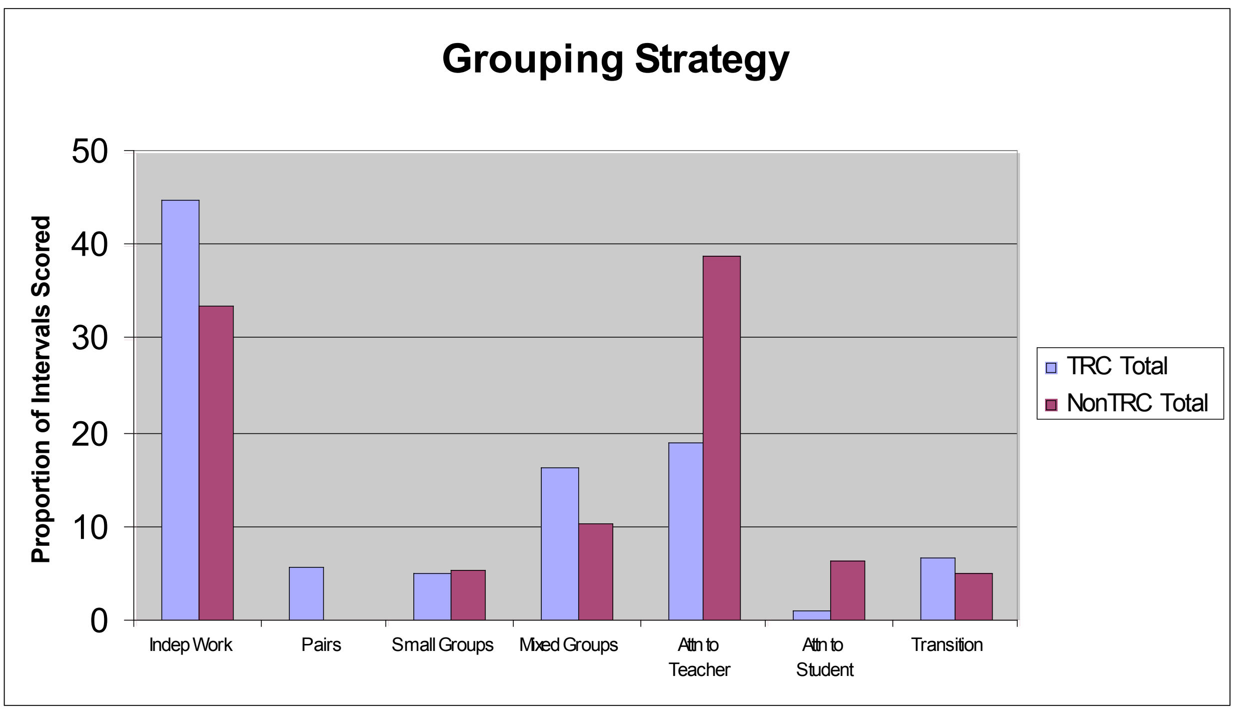
Table 2. Total proportions of intervals scored over all observations.

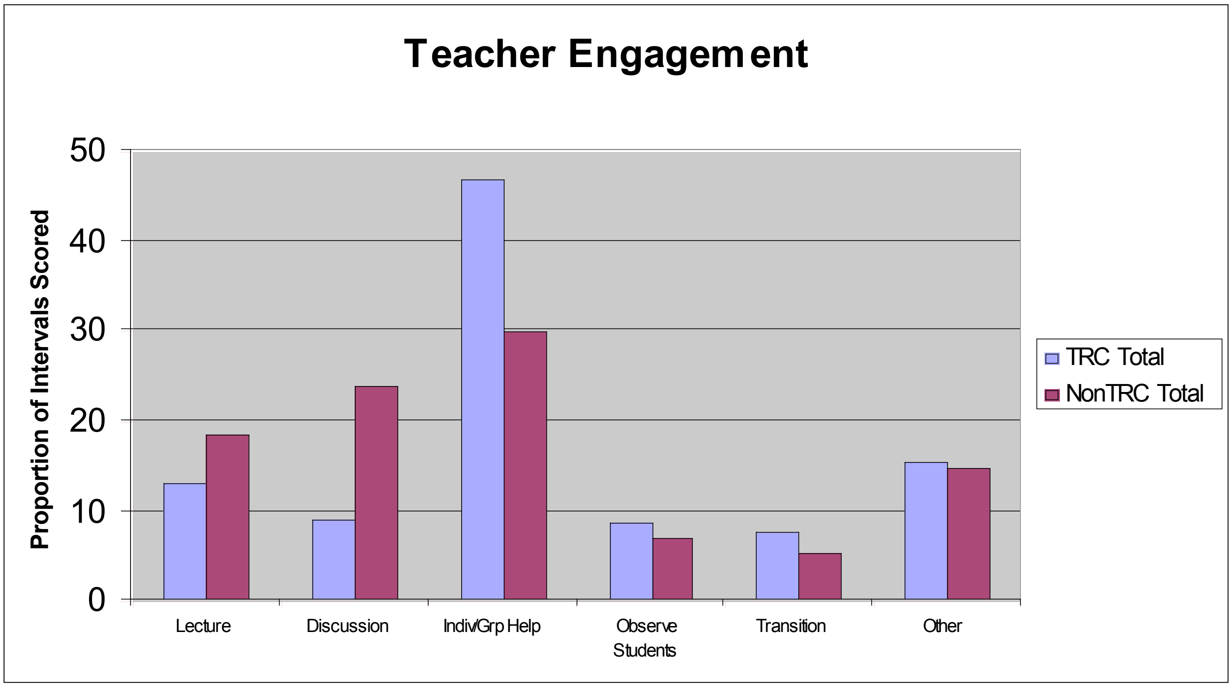
Category	*Total TRC Proportion*	*Total Non-TRC Proportion*
Teacher using Technology	*48.50***	6.26
Students using Technology	*68.28***	4.93
Independent Work	*44.96***	33.73
Pairs	*5.85***	0.00
Small Groups	5.15	5.37
Mixed Groups	*16.32***	10.30
Attention to Teacher	19.09	*38.81***
Attention to Students	1.15	*6.42***
Student Transition	6.70	5.22
Teacher Lecture	12.93	*18.36**
Discussion	9.08	*24.03***
Individual or Group Help	*46.96***	30.00
Observing Students	8.70	7.16
Teacher Transition	7.70	5.37
Unrelated Activity	15.32	14.63
0 Off Task	*75.06***	60.00
1-3 Off Task	24.02	*34.93***
4-6 Off Task	0.85	*3.43***
Receipt of Knowledge	12.63	*22.99***
Applied Procedural	60.51	60.75
Knowledge Representation	*7.24***	3.88
Knowledge Construction	*9.85***	0.60
Other	9.93	11.64

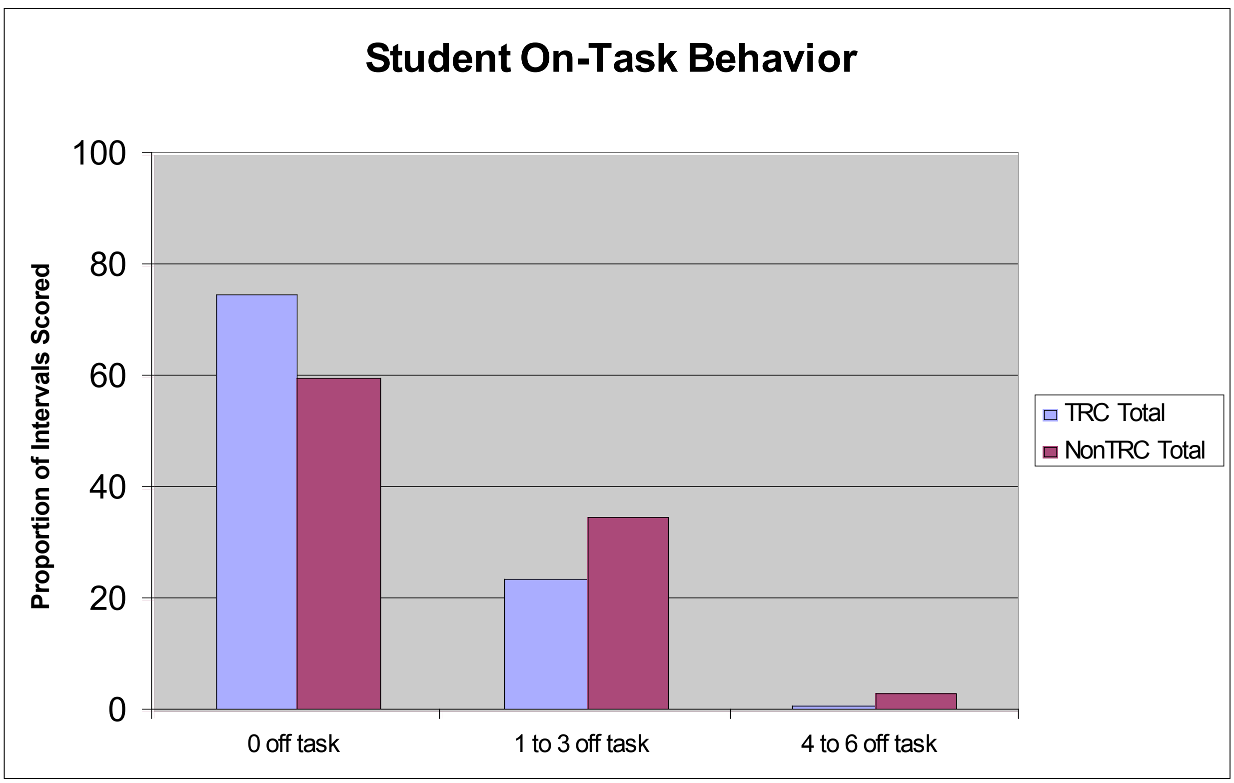
*Indicates proportion is significantly higher, $p < .01$
**Indicates proportion is significantly higher, $p < .001$

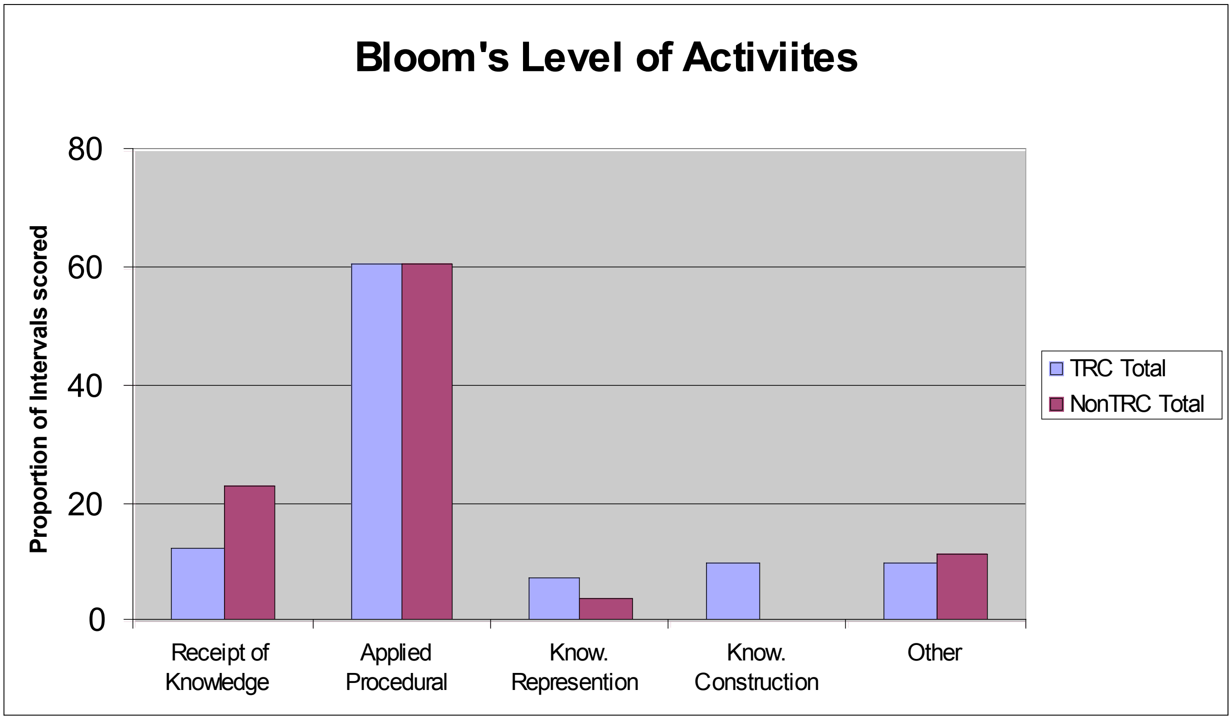
Graphs:


Technology Used
Propotion of Intervals Scored
100
80
60
40
20
0
Teacher Tech Used
Student Tech Used
TRC Total
NonTRC Total


Grouping Strategy
Proportion of Intervals Scored
50
40
30
20
10
0
Indep Work
Pairs
Small Groups
Mixed Groups
Attn to Teacher
Attn to Student
Transition
TRC Total
NonTRC Total


Teacher Engagement
Proportion of Intervals Scored
50
40
30
20
10
0
Lecture
Discussion
Indiv/Grp Help
Observe Students
Transition
Other
TRC Total
NonTRC Total


Student On-Task Behavior
Proportion of Intervals Scored
100
80
60
40
20
0
0 off task
1 to 3 off task
4 to 6 off task
TRC Total
NonTRC Total


Bloom's Level of Activiites
Proportion of Intervals scored
80
60
40
20
0
Receipt of Knowledge
Applied Procedural
Know. Represention
Know. Construction
Other
TRC Total
NonTRC Total