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The Steps to Building a Thinking Classroom

Final Project

Summer 2020

University of Montana Graduate Studies

Introduction

Being an educator is similar to being a fashion designer. If you are unwilling to keep up with the trends that are happening around you, your business will drown. Maybe, two decades down the road you will see old trends start to filter back through but nonetheless there are still changes. In education this same concept happens as teachers decide whether to adapt their teaching practice to meet the needs of the evolving world. Many of us are constantly continuing to educate ourselves simply to stay in the "know" about what methods people are using to teach. We are in this profession to educate a younger generation that will soon be making the big decisions. To best prepare them we have to seek new ways and be confident enough to try them. A concept I came across is the golden ticket. The level of learning that happens in this classroom is beyond what has happened before. This classroom looks like hard work and a lot of collaboration at all times. This classroom rumbles math talk, and that talk is coming from young students not the teacher. This classroom challenges students daily to think outside of the box and push themselves to be better thinkers. This classroom exists, and is something that everyone should aspire to create. I aspired to create this classroom with a group of 16 7th graders. How I plan to get there is an interesting story, one I will try to tell in the following research.

Literature Review

Over 10 years ago, a man named Peter Liljedahl set out to create a classroom that would break typical classroom norms. During his studies he observed many different mathematics classrooms and found that they were all missing the same thing, thinking. He observed that the typical classroom norms created the exact opposite of mathematical thinkers and he started to refer to these classrooms as non-thinking classrooms. These observations were his motivation to create what he came to call a *thinking classroom- "a classroom that is not only conducive to thinking but also occasions thinking, a space that is inhabited by thinking individuals as well as individuals thinking collectively, learning together, and constructing knowledge and understanding through activity and discussion" (Liljedahl, 2016)*

Liljedahls research went on to provide a list of 11 elements of a thinking classroom and those are:

1. The type of tasks used, and when and how they are used;
2. the way in which tasks are given to students;
3. how groups are formed;
4. student work space while they work on tasks;
5. room organization, both in general and when students work on tasks;
6. how questions are answered when students are working on tasks;
7. the ways in which hints and extensions are used while students work on tasks;
8. the autonomy students have while working on tasks;
9. when and how a teacher levels their classroom during or after tasks;
10. the ways in which students record notes;
11. and assessment, both in general and when students work on tasks.

Using these 11 elements, he attempted to fix a class that he considered non-thinking. Using these elements he could focus on specific changes that needed to be made. His research found that in making the changes, small changes did little to nothing to the overall norms of the class. Rather, large and more substantial shifts were needed. He goes on further to explain this by giving an example of a large shift that would mean making a change that was opposite of what procedure was already in place. If students were used to sitting, then they would be asked to stand. The goal was a complete shift in the behaviors and norms. He goes on to provide the audience with a tiered table that recommends the steps that should be taken to transition into a thinking classroom.

<table>
<tr><th>Stage One</th><th>Stage Two</th><th>Stage Three</th></tr>
<tr><td>• begin lessons with tasks
• form visibly random groups
• use vertical non-permanent surfaces</td><td>• use oral instructions
• defront the classroom
• answer only keep thinking questions
• build autonomy</td><td>• level to the bottom
• use hints and extensions to manage flow
• use assessment as communication
• use mindful notes</td></tr>
<tr><td colspan="3">bluntness</td></tr>
<tr><td colspan="3">difficulty of implementation</td></tr>
</table>

Collaborative learning is a major factor in setting up a classroom such as a *thinking classroom. Collaborative learning (CL) can be defined as a set of teaching and learning strategies promoting student collaboration in small groups (two to five students) in order to optimise their own and each other's learning (Johnson & Johnson, 1999).* Ha Le, Jeroen Janssen and Theo Wubbels conducted a study in 2017 that portrayed some of the difficulties in successfully implementing collaborative learning in the classroom. Their research demonstrated that collaborative learning can enhance a students learning outcome, but they have also found that the implementation of collaborative learning is not always adequate. Their study focuses on both the struggles of the teacher and the learners who are trying to incorporate this style of learning into the classroom. They found that the teachers struggle when it comes to designing and executing a collaborative learning activity. They often struggle to manage off-task behavior, materials, assigning roles, work time and establishing teamwork beliefs. Whereas students struggle to have the knowledge to speak up, lack the confidence or are constantly being spoken over and it diminishes the group's efforts.

After interviewing many participants and carrying out their study they concluded that when students are unskilled in collaboration, they are unable to contribute to the task at hand. Rebecca Alber paints this scenario for us, “several children gathered at a table engaged in a high-level task, discussing, possibly debating an issue, making shared decisions, and designing a product that demonstrates all this deeper learning.” (Alber, 2017) But the reality of this scenario is that right out the gate this intensified collaboration does not happen. But getting there takes scaffolding. She goes on to tell the readers that simply by placing the students in groups is also not going to create sophisticated collaborators. There are steps that must be taken to get them there. Her list of teachable moments includes:

1. Establishing Group Agreements
2. Teach them how to listen
3. Teach them how to ask good questions
4. Teach them how to negotiate
5. Model what we expect
6. Group brain power

Together, the works of Rebecca Alber and Ha Le, Jeroen Janssen and Theo Wubbels, suggest that collaboration is important to higher level learning. However, the other connection is that they both agree that collaborative skills must be taught.

Methodology

The study conducted in my 2019-2020 7th grade math class was done in two parts. Through the action research process of plan, act and reflect/revise I was able to recognize that a shift in the study was necessary in order to obtain results and move toward reaching the end goal of transforming my classroom into a thinking classroom.

Initial Approach- “Will slowly integrating the components of a thinking classroom lead to a successful transition to the new way of thinking and learning?”

During the months of September, 2019 and December 2019 I engaged a group of 16 7th grade students in a study that was designed to develop their critical thinking and problem solving skills by adopting the methods used in Peter Liljedahls *thinking classroom.* I introduced new components of the model every two weeks and two weeks was considered a cycle. Each cycle added a new component and built upon the last. The measurements used in this study were based on teacher observation. Things that I was looking for were questions asked, off task behavior, completion of a problem and an attempt. All of the observations are collected and displayed in a table. The purpose of this study was to slowly integrate components of a thinking classroom into daily routines in order to build the full effect.

The approach I used was based on a two week cycle. Every two weeks I would introduce a new concept that would build upon the last.

Cycle 1:

Plan: I will introduce visually random grouping to students by greeting them at the door at the beginning of class with a popsicle stick. The popsicle stick will have a number on it that corresponds to a number at a table. I will make sure to let students know that they are not to trade or sit anywhere else, tomorrow is a new day and they will get to try their luck at another table at that time.

Act: Greet students at the beginning of every class period with a random seat assignment. Collect popsicle sticks after the bell so they are accounted for and ready to go for the next session.

Reflect/Revise: Issues I saw were that students, although told not to, were trying to move seats to be near their friends. I started to say the numbers out loud so students knew I was aware of where they were supposed to be. I also noticed a bunch of behavior issues between students who do not tend to behave appropriately when around each other. I feel it is best to remain consistent with the plan of implementing visually random groups because without consistency students will not learn the expectation. In continuing without the intervention of removing students I hope they will learn to cope with their differences and maintain appropriate behavior in hopes that tomorrow will be different.

Cycle 2:

Plan: I will continue to implement visually random groups by greeting the students at the door. Two days a week, Tuesday and Thursday I will introduce a non-curricular problem solving task from students to be completed in their groups.

Act: On tuesday and thursday upon entry into the classroom I placed a problem solving task at each working station for students to work on. I monitored students by walking around the room, asking driving questions and answering questions to the best of my ability without giving away too much information.

Reflect/Revise: This phase is going to During this cycle I noticed students were not cooperating in their groups. I wondered how I could get them to communicate with each other while engaging in the mathematical task. I gave problems that were unrelated to math, and it was still not interesting enough to hook them. Feedback from students was that it was too difficult and they did not have a clear solution path, therefore I started giving out curricular tasks that reflected current mathematical topics. For example, building a table of proportional values and writing a story to go with the table.

Cycle 3:

Plan: Continue adding on to visually random grouping as well as curricular problem solving tasks by introducing vertical non-permanent spaces. Go expectations during this time and allow students to work on their Tuesday and Thursday problems using the vertical space.

Act: Assign students to their work space, give them one marker, remind them of the rules and read the problem 3 times. Remind students to write down any information they seem is important.

Reflect/Revise: I saw students sitting at their work stations rather than standing. I had to remove furniture from those locations to encourage students to stand. This then led to students wandering from station to station and that was my next battle. Should students be required to not take a participation grade for the day if they do not stay put? Students were also having a hard time remembering and documenting the problem when an oral presentation was given. To resolve this issue, I printed the problems and taped them to the board. I still went through one read with the students so they could hear it before working collaboratively with their groups. One big question with this cycle, is how to manage students and get them to engage in the work?

<u>Cycle 4:</u>

Plan: Continue working with all components mentioned before.

Act: Students will work with a randomly assigned group at a non-permanent vertical space on a curricular problem solving task.

Reflect/Revise: Students are simply not getting anything done or out of this. I am going to keep trying to get them to a place where they are compliant and doing math.

<u>Cycle 5:</u>

Plan: Remove the vertical non-permanent spaces as an option, but continue twice a week to utilize randomly assigned groups while working on a curricular problem solving task.

Act: Every Tuesday and Thursday greet students at the door to have them choose their stick that corresponds to where they will sit for the day. Send their attention to Seesaw where the group warmup will be posted.

Reflect/Revise: This phase lasted through the month of December and I still see little engagement between groups of students. They are not collaborating effectively and it appears only one student is doing the work and gaining any knowledge from the exercise. Utilizing a group warmup is part of the routine now, but it is not effective. How can I improve this practice?

Secondary Approach- “Will focusing on developing unafraid, confident and meaningful communication skills smooth the transition from a traditional classroom to a collaborative problem solving based curriculum, like that of a thinking classroom?”

During the months of January, 2020 through March, 2020 I engaged a group of 16 7th grade students in a study that was designed to encourage them to be unafraid to take risks mathematically, become more confident in their abilities and learn to communicate effectively with their peers. The study used a variety of methods including interactive educational and non-educational card games to encourage communication as well as open-ended problem solving tasks to develop mathematical bravery and confidence. The measurements used in this study were intended to be based upon teacher observation and a final survey regarding their overall opinion of their confidence in their problem solving skills when both alone and in a group. However, with an abrupt end to a school year, the final survey was not conducted as I lost touch with many of the students involved in the survey. The observations included a daily checklist involving questions asked, answers shared out, general conversation. The purpose of this study was to build a skill set that would later be used to foster a thinking classroom.

The approach I used was on a four day rotation schedule, and two four day rotations makes one cycle. Each cycle lasts two weeks. Monday and Wednesday were scheduled communication building activities whereas Tuesday and Thursday were problem solving days.

Cycle 1:

Plan: After returning from Christmas break, I am going to continue utilizing visually random groups but address the issues with students not being able to manage their behavior when around each other. There are 5 who cannot be with each other, so to split them up, they will each become a team captain for that given table number. Alongside the captain status they will have duties. Cycle 1 will consist of playing a communication called "would you rather" for a quick 10 minutes at the beginning of the class period. The "would you rather" questions are already created and ready to be passed out.

Act: Greet students at the door and hand them a popsicle stick corresponding to their seat. The students who need to be separated should be given their new spots and sit there every day. Hand out the would you rather cards after demonstrating a successful round of the game to the class. Give them 10 minutes to play.

Cycle 2:

Plan: As visually random groups were already a norm for the class, I am going to continue to utilize them. On Monday and Wednesday I will place cards at each table and as students find their table number and the bell rings, I will introduce a game. Each cycle I will introduce one game to be played and will continue to add on to their options throughout the study. On Tuesday and Thursday I will draw cards or roll a di to choose the numbers students will be using to make 1-20. For both warmup activities students will have 10 minutes daily.

Act:

Monday/Wednesday-Greet students at the door to give them their random seating placement for the day. Introduce the game Inverse Go Fish and explain this will be the game they play for the next two weeks. (4 days in total). Monitor students while they play listening for overall communication as well as math talk.

Tuesday/Thursday- Greet students at the door to give them their random seating placement for the day. Roll the die, write the four numbers rolled on the board and direct students to Seesaw to document their work in using the four numbers to make 1-20. Walk around the room and interact with students looking for engagement, mathematical questions and overall attempt.

Reflect/Revise:

During cycle 1, I noticed that splitting the students up and calling them captains worked out well. It took them a few days to get used to their new role and norm, but they did. This seemed to help some of the behavior issues that were going on. Questions for next cycle: How did the game work? Will it continue to work? Are students fizzing out? What is the engagement level of making 20? Will this last? Modifications for the next cycle will be to add a game, and give students choice.

<u>Cycle 3:</u>

Plan: Continue utilizing visually random grouping. On Monday and Wednesday I will place cards at each table and as students find their table number and the bell rings, I will introduce a game. Each cycle I will introduce one game to be played and will continue to add on to their options throughout the study. During this cycle they will have two choices for games. On Tuesday and Thursday I will draw cards or roll a di to choose the numbers students will be using to make 1-20. For both warmup activities students will have 10 minutes daily.

Act:

Monday/Wednesday-Greet students at the door to give them their random seating placement for the day. Introduce the game Integer War and explain this is an optional game over the next two weeks. (4 days in total). Monitor students while they play listening for overall communication as well as math talk.

Tuesday/Thursday- Greet students at the door to give them their random seating placement for the day. Roll the die, write the four numbers rolled on the board and direct students to Seesaw to document their work in using the four numbers to make 1-20. Walk around the room and interact with students looking for engagement, mathematical questions and overall attempt.

Reflect/Revise:

During cycle 3, I noticed that given students choice on their card game helped with their overall engagement. They enjoyed having choice and the ability to switch after 5 minutes of play. I am hearing a lot of conversation happening between students that is both friendly and mathematical. Students are beginning to be more comfortable talking about math and helping each other out. Next cycle I may try giving them the option to also play a fun non-mathematical game on these warm up days. Also, I notice students anxious to work with other students on the make 20 task. I will allow them to work with other people next cycle.

<u>Cycle 4:</u>

Plan: Continue utilizing visually random grouping. On Monday and Wednesday I will place cards at each table and as students find their table number and the bell rings, I will introduce a game. Each cycle I will introduce one game to be played and will continue to add on to their options throughout the study. During this cycle they will have three choices for games that are mathematical and the option to play a fun game after 5 minutes of math play. On Tuesday and Thursday I will draw cards or roll a di to choose the numbers students will be using to make 1-20. For both warmup activities students will have 10 minutes daily. This week I will also give them the option to work with someone to complete their make 20.

Act:

Monday/Wednesday-Greet students at the door to give them their random seating placement for the day. Introduce the game Integer Garbage and explain this is an optional game over the next two weeks. (4 days in total). Monitor students while they play listening for overall communication as well as math talk.

Tuesday/Thursday- Greet students at the door to give them their random seating placement for the day. Roll the die, write the four numbers rolled on the board and direct students to Seesaw to document their work in using the four numbers to make 1-20. Tell students they are able to work with a partner or their table group if they would like. Walk around the room and interact with students looking for engagement, mathematical questions and overall attempt. At the end of the 10 minutes, ask students to stand up, and go and give 3 numerical expressions and get 3 numerical expressions from their classmates.

Reflect/Revise:

At this point, are the card games working? Are students still engaged or are they bored? How did working with a group go? Observations were that students when told they could work with a group did not want to. They went silent when they had the option to talk, which is opposite of what happens when they are told to remain working as an individual. The students were hesitant to share their answers with each other, but I think they will continue to grow if the procedure remains constant.

Results

As before, this section will be broken down to display the data I was collecting during both the initial implementation of my research and the secondary.

Initial Implementation Data

All data shown below is the data collected during the first implementation of action research in the classroom. I collected data during each cycle of the experiment. Although, I was utilizing visually random groups every day of the week, for the research purposes, I only collected data on them the two days where collaborative problem solving was also involved. As you will see below each cycle I added new components to the classroom. As a result, the observation tables and remarks parallel.

Throughout this section you will see the letter “Y” used in place of the word yes, and the letter “N” in place of the word no. As I was collecting data, I would use a tally mark for each question asked by a student. I used the same process when tracking off-task behavior. Here you will see them listed as numbers that represent the total. To track students who attempted the problem, I reviewed their online portfolios and looked for a submission with some kind of attempt and solving the problem.

Cycle 1	09/17/19	09/17/19	09/24/19	09/26/19
Visually random groups used?	Y	Y	Y	Y
Student movement after	Y	Y	N	N

initial placement?				

Table 1.1 Initial Implementation Cycle 1

Cycle 2	10/01/19	10/03/19	10/08/19	10/10/19
Visually random groups used?	Y	Y	Y	Y
Student movement after initial placement?	Y	N	N	Y
Type of problem given	Non-Curricular	Non-Curricular	Non-Curricular	Non-Curricular
Student Questions	17	15	20	12
Attempted problem (out of 16)	14	11	13	13
Off-task behavior	31	20	25	22

Table 1.2 Initial Implementation Cycle 2

Cycle 3	10/15/19	10/22/19	10/24/19	10/29/19	10/31/19
Visually random groups used?	Y	Y	Y	Y	Y
Non-Permanent space utilized	Y	Y	Y	Y	Y
Student movement after initial placement?	Y	Y	Y	Y	Y
Type of problem given	Curricular	Curricular	Curricular	Curricular	Curricular

Student Questions	20	18	17	12	23
Attempted problem (out of 16)	12	13	13	13	12
Off-task behaviors	22	21	24	19	30

Table 1.3 Initial Implementation Cycle 3

Cycle 4	11/05/19	11/07/19	11/12/19	11/14/19
Visually random groups used?	Y	Y	Y	Y
Non-Permanent space utilized	Y	Y	Y	Y
Student movement after initial placement?	Y	Y	Y	Y
Type of problem given	Curricular	Curricular	Curricular	Curricular
Student Questions	25	30	17	24
Attempted problem (out of 16)	12	11	6	7
Off-task behaviors	23	27	20	25

Table 1.4 Initial Implementation Cycle 4

Cycle 5	11/19/19	11/21/19	11/26/19	12/03/19	12/05/19
Visually random groups used?	Y	Y	Y	Y	Y

Non-Permanent space utilized	N	N	N	N	N
Student movement after initial placement?	Y	N	N	Y	N
Type of problem given	Curricular	Curricular	Curricular	Curricular	Curricular
Student Questions	17	12	25	22	16
Attempted problem (out of 16)	8	12	6	8	8
Off-task behaviors	27	20	16	21	21

Table 1.5 Initial Implementation Cycle 5

The tables above depict the progression of 5 different cycles of introducing concepts and ideas of a thinking classroom into a 7th grade math class. This particular group of 7th graders consisted of 16 students. When analyzing the tables there are a few things worth noting.

1. Visually random groups were implemented throughout the duration of the study. During cycle one, two and five the students were in their groups at their tables. Of the 13 days observed in cycle one and two, 6 out of the 13 days students were non-compliant with staying in their groups. There was movement about the room that interrupted the concept of visually random grouping.
2. Visually random groups were still being implemented through cycles three and four but students were expected to remain in their groups at a vertical non-permanent learning space. Of the 9 days I observed students working at their non-vertical permanent learning spaces, 9 out of 9 days there was movement away from their assigned location. The

movement interrupted the concept of visually random grouping and working at their assigned space.

3. When considering the data that shows the number of attempted assignments over the 22 day period, there was not one day where all 16 students attempted the problem. The pattern also shows that the number of attempts was higher in the beginning of the study and started to drop towards the end. The highest number of attempts was 14 and the lowest number was 6.
4. The number of questions asked by students during the study ranged from 12-30 questions. Some days the number of questions was below the number of students involved whereas other days that number was higher.
5. The number of off-task behaviors observed during the study was always greater than or equal to the number of participants. The lowest number of observed off task behaviors was 16 and the highest being 31.
6. Out of the 18 days students were working on a mathematical task, non-curricular tasks were given 4 times whereas curricular tasks were given the other 14 days.

Secondary Implementation

The data shown below was collected during the revised secondary implementation of this study. The methods were similar in that I collected data based on observations throughout the different cycles. The behaviors I was documenting were the use of a visually random group, whether or not there was movement after the randomly assigned group, engagement in the activity, off task behavior as well as any communication. After cycle one, I added two components based on submissions of attempted tasks as well as any math talks I overheard. Cycle one demonstrates a phase of the study where card games were used every day to have groups of students practice effective communication. Cycles two through five are all two weeks long and have a total of 4 days designated for card games and 4 days designated for a curricular math task.

Throughout this section you will see the letter “Y” used in place of the word yes, and the letter “N” in place of the word no. As I was collecting data, I would use a tally mark for each question asked by a student. I used the same process when tracking off-task behavior. Here you will see them listed as numbers that represent the total. To track students who attempted the problem, I reviewed their online portfolios and looked for a submission with some kind of attempt and solving the problem. I have highlighted in the tables the days where a math task was used rather than a card game to differentiate the data.

Cycle 1	1/13/20`	1/14/20	1/15/20	1/16/20	1/21/20	2/22/20	1/23/20
Visually random groups used?	Y	Y	Y	Y	Y	Y	Y
Student Movement after assigned?	N	N	N	Y	N	N	N
Engagement? (4 groups)	4	4	4	4	3	4	4
Communication (4 groups)	4	4	4	4	4	4	4
Off-task behavior	15	11	14	9	6	7	7

Table 2.1 Secondary Implementation Cycle 1

Cycle 2-Week 1	1/27/20	1/28/20	1/29/20	1/30/20
Visually random groups used?	Y	Y	Y	Y
Student Movement after assigned?	N	N	N	Y
Engagement? (4 groups)	4	n/a	4	n/a
Communication (4 groups)	4	n/a	4	n/a
Communicating about math (16 students)	12	5	10	7
Attempted tasks	n/a	10	n/a	10
Off-task behavior	6	24	11	17

Table 2.2 Secondary Implementation Cycle 1 - Week 1

Cycle 2-Week 2	2/3/20	2/4/20	2/5/20	2/6/20
Visually random groups used?	Y	Y	Y	Y
Student Movement after assigned?	Y	N	N	Y
Engagement? (4 groups)	4	n/a	4	n/a
Communication (4 groups)	4	n/a	4	n/a

Communicating about math (16 students)	18	8	17	10
Attempted tasks	n/a	11	n/a	9
Off-task behavior	5	16	8	19

Table 2.3 Secondary Implementation Cycle 2 Week 2

Cycle 3-Week 1	2/10/20	2/11/20	2/12/20	2/13/20
Visually random groups used?	Y	Y	Y	Y
Student Movement after assigned?	Y	N	N	N
Engagement? (4 groups)	4	n/a	4	n/a
Communication (4 groups)	4	n/a	4	n/a
Communicating about math (16 students)	10	9	10	13
Attempted tasks	n/a	11	n/a	12
Off-task behavior	12	16	18	23

Table 2.4 Secondary Implementation Cycle 3 Week 1

Cycle 3-Week 2	2/17/20	2/18/20	2/19/20	2/20/20
Visually random groups used?	Y	Y	Y	Y

Student Movement after assigned?	Y	N	Y	Y
Engagement? (4 groups)	3	n/a	3	n/a
Communication (4 groups)	4	n/a	4	n/a
Communicating about math (16 students)	10	14	10	19
Attempted tasks	n/a	9	n/a	13
Off-task behavior	16	13	17	9

Table 2.5 - Secondary Implementation Cycle 3 Week 2

Cycle 4-Week 1	3/2/20	3/3/20	3/4/20	3/5/20
Visually random groups used?	Y	Y	Y	Y
Student Movement after assigned?	N	N	N	Y
Engagement? (4 groups)	3	n/a	3	n/a
Communication (4 groups)	3	n/a	3	n/a
Communicating about math (16 students)	13	30	8	42
Attempted tasks	n/a	16	n/a	16
Off-task behavior	20	12	11	17

Table 2.6 - Secondary Implementation Cycle 4 Week 1

The tables above depict the data that was collected over 27 school days this spring. The group studied was a group of 16 7th grade students, and a summary of the data is explained below.

1. In the study there were 17 days where a card/communication game was used. Whereas 10 days in the study were reserved for mathematical tasks.
2. Of the 27 days included in the study a visually random group was assigned all 27 of those days. Of the 27 days, there were 9 days where students tried to get up and move to a new seat after their randomly chosen one for the day. Looking at those 9 days closer, 5 of those occurrences happened on days where students were playing a card/communication game and only 4 were on days where there was a mathematical task.
3. I tracked group engagement on days where students were engaging in a card/communication game. There were 4 groups being observed and on 12 out of the 17 days, all 4 groups were engaged and actively participating. There were 5 days where I witnessed only 3 groups participating. While in those groups during the 17 days I witnessed conversation happening in all 4 groups for 15 days. There were just 2 days that I only saw 3 out of the 4 holding a conversation.
4. On The 10 days where a mathematical task was used students discussed math by questioning myself or a peer as little as 6 times but near the end asked up to 42.
5. There were 10 mathematical tasks assigned during this study and were only 2 out of the 10 days where all 16 students attempted the work. The smallest number of attempts was 9.
6. While tracking off-task behavior on days where a card/communication game was utilized the lowest number of off-task behaviors observed was 6 with the highest being 20. Whereas when a mathematical task was utilized the smallest number of off-task behaviors observed was 9 and the highest being 24.

Discussion and Recommendations

With the start of every school year comes rejuvenated teachers bringing fresh ideas and new goals for both themselves as professionals and their students. Like many, I spent last summer learning about different pedagogies and how to adapt them to best meet the needs of my students. One system that stood out to me, was Peter Liljedahl on “thinking classrooms”. Immediately after reading about the mathematics that were happening when this kind of model was implemented, I was sold. At the start of the school year, I was on board to create a full-blown system that would produce the same results that Liljedahl discusses in his case studies.

The very first thing I started to use in our room was visually random groups. Each morning, I would greet the students at the door and hand them a card that corresponded with a seat. I tried to stay true to groups of 2-3 students, with the occasional group of 4. The next step was to introduce problem solving tasks while having the students work in their groups at vertical non-permanent spaces. As the bell rang and students were already randomly grouped, I would assign them a whiteboard space. They would then go to their designated area to work on the problem. To introduce the problem, I would print the problem out for each group so they would have information to refer back to at any point. We would go through one reading of the problem together and then the students would be set free to work. As students were working, I would wander around the room monitoring what they were doing. In my observations I noticed many different things:

- I had many students wandering around the room trying to go find their friends/disrupting other groups

- students returning to their desks because “this is stupid”
- conversations unrelated to math
- students giving up
- groups unwilling to start
- students being too aggressive as a leader
- students not participating
- too much dependence on the teacher
- too much focus on the “right answer”

The list goes on and on, and truthfully there was not a lot of “doing math” that came from this scenario in my room. The data in tables 1.1, 1.2, 1.3, 1.4 and 1.5 portrayed the results of the numbers of the behaviors I was watching on a daily basis. Of course establishing norms and making them routine takes time, so I would teach and reteach the expectations of our group problem solving time. After months of no improvement, I reevaluated the situation and was looking for a quick fix. I was not willing to give up on trying to force my students into becoming collaborative problem solvers. I then focused my energy on their self-efficacy. I thought that I could start by making them believe they are problem solvers and it would fix my entire issue. A little more thought went into it, and I decided that maybe transforming my classroom into a thinking classroom was not going to happen because it is slightly unrealistic. The image of a thinking classroom in my mind versus what was happening made it seem impossible to accomplish.

It is very important for my readers to know and understand that my support for Peter Liljedahls model on *thinking classrooms* is greater than any support I have ever given in education models. Furthermore, my desire to run my classroom based on that model is equivalent to my passion for teaching. After the first go and coming to the conclusion that this model is just not right for my class, I really sat down over christmas break and thought long and hard about my students and what it was I was trying to get them to do. I had to start with the end goal and really break it down into its components. While beginning the action research with my students, my passion blinded me and I overlooked the fine details that must be tuned in order for a system like so to function smoothly. In short, the characteristics of a *thinking classroom* include random grouping, vertical non-permanent working spaces, good problems, good questions and answers and assessment. All of the aforementioned characteristics are doable, because they are artificial changes to the classroom. You can very easily adapt your physical space, and assign students a random seat at the door daily. Good problems for problem solving, are everywhere online and easily accessible. Teaching students to ask the right questions while training yourself to give the correct answer back is a bit more challenging, but still an easy fix. However, there are characteristics and abilities not listed above, that are crucial to the success of creating a thinking classroom. From my observations through this study, I have narrowed them down to being unafraid, having self-confidence and the ability to collaborate effectively through communication. Without these characteristics, the thinking classroom will not exist.

I spent much time trying to figure out how these characteristics develop together, and which needs to happen before the other. There is no clear formula, but I am going to discuss them in the order in which I think it happens. The very first characteristic is the ability to be unafraid. This word is extremely powerful in many realms of life, but covers the student, the teacher and the classroom environment all in one when used to anything scenario in education. This characteristic starts with the teacher when he/she is willing to make mistakes and own them.

There are many different ways this can be demonstrated. We are all human beings, so mistakes will happen naturally. We may call a student by the wrong name, write the wrong date on the board or complete a multiplication fact wrong. Students are always eager to point out when a teacher is wrong, and in this moment we get to shine. We get to stand up and own our mistakes and normalize that scenario. We also get to control how students respond to their peers' mistakes. Every opportunity like this, we are showing our students that mistakes are normal and it takes bravery or being unafraid to put themselves out there and try something. At the end of the day, even if it isn't 100% right, the effort was still there and they did something. Being unafraid describes a characteristic in a student and the general dynamic of the classroom culture. Nonetheless, no student can be a problem solver unless they are first unafraid to take a risk and try something.

As soon as a person is unafraid you will see their self-confidence in math start to rise. I know I did with some of my students who blatantly told me they hated math and were unwilling to engage whatsoever. Being unafraid gives them the power to start asking questions and opening them up to trying new things. The more they engage in math, the more communication and feedback they are receiving from both their peers and the teacher. This attention they are receiving and the relationship being built between the student, teacher and the mathematics all works together to build their inner self-confidence. This characteristic is where the power comes into play when asking students to problem solve. They are already unafraid to take a risk and try something mathematically, but now they are also confident enough to construct their own thoughts. These thoughts and questions are the foundation of a mathematical conversation that is required when you ask a group to sit down and solve a problem together. Without confidence, there is no discussion which in my experience leads to a one-man group operation. In that scenario, one student is learning a little. The others, not so much.

Finally, the most important and overlooked characteristic is the ability to communicate. We always ask our students to work together, to collaborate. But, what we never usually take time to do, is teach them how to communicate effectively. In a classroom setting asking students to collaborate is asking them to communicate with purpose. We live in a digital era, students can communicate through digital media with the entire world. What they struggle to do, is sit down and have a simple conversation let alone a meaningful one. There are many environmental factors that could result in this, but regardless it is our job to teach and develop the skill if we are asking them to use it on the regular. Personally in my current teaching setting the students are very familiar with speaking using profanity and are constantly making fun of each other. So imagine Ms. Bakke says to them, “In your groups, you have 15 minutes to read through and discuss a possible solution path to this problem.” Without going into a detailed description, it simply isn’t happening. Again, the tools required to be successful at communicating and collaborating are not there. In many school settings this may not be the case, but for some it most definitely is. I saved this characteristic for last implying that I believe it should be that last skill developed in the sequence. This is not entirely true, teaching students to communicate effectively should be practiced throughout the entire preparation process. However, asking them to collaborate on a mathematical task, is the last skill that comes after developing the three spoken of above.

Where my entire initial study went very wrong was again in the blindness I had towards considering these hidden characteristics of a working *thinking classroom.* It is easy to read about a model, and begin to implement it in the classroom. It is not easy to face reality and learn of obstacles you have to overcome first in order to get there. I wrote in my initial study that I was hoping to have this beautifully designed thinking classroom by Christmas Break of the 2019-2020 school year. But, in turn what I had was nothing but frustration and a drawing board to devise a new plan.

With the return of school in January, 2020 I had decided on the characteristics of a thinking classroom that my students were lacking and revamped my entire schedule. I knew the students needed to learn to take risks and confidently, as well as develop effective communication skills. We were never going to succeed in a group setting without them. At this point, I changed my schedule so that students were warming up two days a week for 10 minutes at the start of class playing simple card games. Some of them were math related like multiplication war or inverse pair Go Fish, and others were just for fun. I wanted to give the students the opportunity to practice their communication skills. I knew they were doing this because while wandering the room it was not quiet. My data also supports this claim, on many of the days all 4 groups observed were maintaining some sort of conversation. Refer back to tables 2.1-2.6 to see this data. Of course there was off topic chatter, but I was willing to accept that as long as they were being friendly and appropriate. I mentioned before that this skill is one to practice during the entire preparation period, and that is just what I did. Over the course of three months, I saw my students becoming more willing to communicate with each other and myself. Playing simple card games allowed them to develop that skill.

Another schedule change that was made was for the other two days a week, students were working on a math puzzle involving operations where they were encouraged to take risks.

During this time I would roll four dice and give the students four numbers on the board. They were to use those 4 numbers and any operations they were comfortable with to try and make the numbers 1-20. The rules at first were there are no rules. For example, if the 4 numbers were 1,2,3 and 4 and you were trying to make the number 5, you could say 1 + 4 = 5. Or, a student might have said (4x3)+(2x1) = 14. In my eyes, both scenarios were acceptable and students began taking mathematical risks. They were confident in their work and willing to shout out "I got 17!" (or whatever number it was) even when they realized while explaining their work they were wrong. All the while, I applauded their efforts and accepted the work they were doing. Right at the end, it had gotten to a point where this work was challenging and fun for them to engage in and they wanted to keep going. I saw improvements in their confidence and ability to take risks during this time.

While working on all three skills of being unafraid, confident and an effective communicator I saw so much progress that slowly started to integrate communication and collaboration with these warmups. After their 10 minutes of thinking time, I would then ask them to get up, find 3 people and give a numerical expression as well as get one from a classmate. They were to repeat this process with 3 different classmates. This was a bit rough right off the bat. Students would only find one person and not follow through with communicating with all 3. I also saw students only going to their friends rather than someone they are less comfortable with. As the teacher I managed to wander the room and encourage them to keep moving, find more, and eventually they started doing it. At this point I watched my students develop the foundational skills they needed in order to begin collaborating on mathematical problem solving tasks. In other words, they were ready to begin an initial step in transforming into a *thinking classroom.*

When I set out to implement a thinking classroom, I fell short. I walked through many miserable months filled with behavior issues and little to no engagement with mathematics. It is a result of my own neglect of what was actually happening in my classroom that led to a delayed start of an effective process with my students. I began to implement my secondary approach in January, 2020. Little did I know at that time, that I would be saying goodbye to my students and classroom a little over three months later when the Covid-19 pandemic hit and the world shut down. I felt robbed of the last couple months of school and opportunities to continue to develop our collaboration and communication skills. As you know by now, this was the final skill needed in order to move forward in having my students collaborate and communicate about mathematical problem solving tasks. While I cannot offer my readers positive and encouraging research data, what I can offer is a list of recommendations for other educators that will eliminate some of the overwhelming stress and chaos I felt while trying to create a thinking classroom. These recommendations were what I wish I would have done when beginning my research.

My very first recommendation is a bit of a cliche, but analyze your students behavior and get to know your class. Even as a cliche, sometimes we need a reminder of this. I consider myself a very personable teacher, and I build strong relationships with my students every year. When looking back at how my initial study unfolded in my room, it is clear that I did not know them at all. Had I taken just a couple of weeks to watch how they interacted with each other, I would have known that they were incapable of maintaining an appropriate conversation. I would not have even expected them to be anywhere near maintaining one that was about mathematical concepts. I would have also recognized that random grouping was not necessarily the right choice for this class given the behavior issues and conflicts that exist between members of the class. It is during this observation time, that you can start to devise a plan based on your observations and the needs of the students. Looking back, what I was expecting and asking of my students was like asking a baby to walk before it could even hold its own head up. By not following my own recommendation here, I lost 4 months of school trying anything to make the shoe fit. Had I taken time to analyze their behavior, I may have gotten to see my students effectively collaborate on a problem solving task before our school closed on Friday, March 13th and did not open again for the remainder of the school year.

Getting to know your students is the base of the entire project, and taking that time gives you an idea of what foundation has already been laid. I encourage all teachers to either start building the foundation from bottom up, or continuing from where they are already at. What I mean by this is taking the time to recognize if they are already unafraid, confident or effective communicators. Figuring out where to go next based on what is already there. Maybe the students need everything, like mine did. Or, maybe they are already able to sit down at a table and communicate effectively. Both of which have different paths they are going to take in order to reach the end goal of running a functioning thinking classroom. This was yet another step I failed to take. I would have immediately known my students had very little foundation and would need to start from the beginning. I may have gotten the opportunity to work on collaborative thinking tasks rather than collaboration skills. Someday, I will reach the end goal, but it may have happened sooner had I not wasted any time and figured out where to start.

Last, I would recommend teachers to take their time through this process. Every student is different as well as every class. Going from traditional teaching methods to a thinking classroom is a major shift in our students' educational life and it will take various amounts of time for those changes to occur. I started out with a vision on a timeframe and I kept pushing that timeframe. Meanwhile I was ignoring the fact that it was not working well. I had it in my mind that one day it would just click, and we would be rolling. Well after 4 months, the click never happened and we started over. I now know that this entire process may take my kids another school year in order to have made the change. I am willing to accept the long timeframe because I know in the end my students will be problem solvers. If you are controlling the time based around your personal agenda, the students are going to fall behind.

After a detailed description of my experiences and findings the time has come to speak on behalf of my initial research questions. I originally asked ”*Will slowly integrating the components of a thinking classroom lead to a successful transition to the new way of thinking and learning?”,* and fortunately I believe time still has yet to tell. My initial approach was not successful, but I feel in the future, this will be possible if I take the time to prepare the students for this transition. With failure, comes revision, and that leads to my second question, *"Will focusing on developing unafraid, confident and meaningful communication skills smooth the transition from a traditional classroom to a collaborative problem solving based curriculum, like that of a thinking classroom?"*, and I feel confident that had we had time to finish the school year like I had intended, we would have been there. My students and I would have been able to go back and slowly start to transition into a thinking classroom.

Fortunately for me, I will get to have this same group of students again returning in the fall. I will get that opportunity to continue where we left off and progress even further. What this research has taught me for my new incoming 7th graders, is to take it slow, meet them where they are at and start to build the foundation necessary in order to transition them into learners who are successful in a thinking classroom.

References

Alber, R. (2017, June 19). Deeper Learning: A Collaborative Classroom Is Key. Retrieved April 01, 2020, from https://www.edutopia.org/blog/deeper-learning-collaboration-key-rebecca-alber

Collaborative Learning: Center for Teaching Innovation. (n.d.). Retrieved April 20, 2020, from https://teaching.cornell.edu/teaching-resources/engaging-students/collaborative-learning

Gates, S. (2018, November 08). Benefits of Collaboration. Retrieved April 5, 2020, from http://neatoday.org/new-educators/benefits-of-collaboration/

Ha Le, Jeroen Janssen & Theo Wubbels (2018) Collaborative learning practices: teacher and student perceived obstacles to effective student collaboration, Cambridge Journal of Education, 48:1, 103-122, DOI: 10.1080/0305764X.2016.1259389

Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia - Social and Behavioral Sciences, 31*, 486-490. doi:10.1016/j.sbspro.2011.12.091

Liljedahl, P. (2016). Building Thinking Classrooms. Retrieved March 01, 2020, from http://peterliljedahl.com/wp-content/uploads/Building-Thinking-Classrooms-for-teachers.pdf