

You Choose! Student choice and its effect on students intrinsic motivation and engagement

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Abstract: Choice boards contain a collection of questions that students choose from in the order that they want to. Choice boards fulfill the autonomy piece of self determination theory that emphasizes the need for autonomy for students to thrive. This study measured whether implementing choice boards in a fifth grade math classroom affected students' intrinsic motivation and engagement. There were no significant changes in student motivation or engagement but there were smaller changes. Student engagement did increase while working on the choice board activities. These results confirmed previous findings that supporting autonomy in the classroom may increase students' intrinsic motivation and engagement.

Introduction and Justification

In classrooms across the country there are many students who are unmotivated and not engaged with their classwork. Every day is unpredictable and you never know whether your students will be motivated and on task or not each day. A lack of motivation and disengagement can be seen through many off task behaviors that students exhibit. Off task behaviors can include talking to a neighbor, sleeping, drawing, and walking around the room. These off task behaviors can lead to a loss of instructional time for students and teachers as well as negatively impact academic achievement (Godwin et al., 2016). One approach that could help lessen these off task behaviors and improve student engagement is through providing students with autonomy in the classroom. Autonomy can be defined as the ability to think, feel, and make decisions by oneself (Nunez & Leon, 2015). Students have a basic psychological need for autonomy and competence in the classroom and when that need is supported it can lead to higher engagement and better learning outcomes (Niemiec & Ryan, 2009).

One way is through providing students with choice in the classroom. Autonomy is proven to be best supported by providing choice and with the removal of external controls (Stefanou et al., 2004). An example of providing students with choice in the classroom is through the use of choice boards. A choice board contains numerous activities on it about the topic the students are learning about. The students are tasked with completing a few of the activities that they get to choose themselves to show what they have learned. Choice boards provide students with the autonomy that they psychologically need which could potentially lead to higher engagement and better learning outcomes. While the use of

choice boards in the classroom is not a new concept, there is not a lot of research on how they affect students' intrinsic motivation and engagement (Cook, 2020). I implemented the use of choice boards in the math classroom to provide students with the autonomy that they need.

Literature Review

Self-Determination Theory

The self-determination theory developed by Deci and Ryan (2020), argues that for healthy development individuals require support for three basic psychological needs of: autonomy, competence, and relatedness. Autonomy refers to an individual's inherent desire to feel volitional and to experience a sense of choice and psychological freedom when carrying out an activity (Van den Broeck et al., 2010). Competence refers to an individual's inherent desire to feel effective in interacting with their environment (Van de Broeck et al., 2010). Relatedness refers to an individual's inherent need to feel connected to others and be a member of a group where they are loved and cared for (Van de Broeck et al., 2010). According to Deci and Ryan (2020), for students to function optimally these three needs must be satisfied. The satisfaction of these three basic needs can result in increased intrinsic motivation (Ryan & Deci, 2000).

Intrinsic Motivation

There has been a long trend of children's intrinsic motivation decreasing steadily from third grade through high school (Cordova & Lepper, 1996). Intrinsic motivation is where someone such as a student does a behavior because the activity itself is interesting and spontaneously satisfying (Deci & Ryan, 2008). When people are intrinsically motivated they perform activities because of the positive feelings that result from the activities themselves (Deci & Ryan, 2008). Developmentalists found that from birth, children are active, inquisitive, curious, and playful in the absence of rewards which is the beginning of intrinsic motivation (Ryan & Deci, 2000). When people are intrinsically motivated they feel a sense of autonomy because their basic need for autonomy is satisfied (Deci & Ryan, 2008). One hypothesis is that more autonomous forms of motivation will lead to higher levels of student engagement (Ryan & Deci, 2020).

Extrinsic motivation such as threats of punishment, deadlines, and surveillance have been found to decrease intrinsic motivation (Deci & Ryan, 2008). When people are offered a full sense of choice and endorsement of an activity their intrinsic motivation is enhanced (Deci & Ryan, 2008). Cordova and Lepper (1996) conducted a study of fourth and fifth grade elementary school students where some were provided a choice and others were not. They found that when students were exposed to autonomous activities such as choosing their own assignments, they displayed higher levels of intrinsic motivation (Cordova & Lepper, 1996).

Autonomy

Nunez and Leon (2015) define autonomy as a form of voluntary action, stemming from a person's interest and with no external pressure. There are three different types of autonomy support that can be used in the classroom: organizational, procedural, and cognitive (Nunez & Leon, 2015; Stefanou et al., 2004). Organizational autonomy support refers to practices such as choosing group members, due dates, and evaluation procedures (Stefanou et al., 2004). Procedural autonomy support includes practices where students

can choose what materials to use in their schoolwork or how to display their work (Stefanou et al., 2004). Lastly, cognitive autonomy support refers to practices where students can find multiple solutions to problems, debate ideas freely, and have time to make decisions (Stefanou et al., 2004). All three different types of autonomy support have different benefits on students in the classroom. Organizational autonomy support can help students feel more comfortable with the way the classroom works, procedural autonomy can help to foster initial learning engagement, and cognitive autonomy support encourages a deeper investment in learning activities (Nunez & Leon, 2015).

Teachers cannot directly give students an experience of autonomy, but they can encourage and support the experience of autonomy (Reeve & Jang, 2006). Students have a basic psychological need for autonomy and when they are supported it can lead to higher engagement and better learning outcomes (Niemic & Ryan, 2009). Autonomy support in the classroom has also been linked to higher achievement and positive attitudes towards learning and on-task behavior (Stefanou et al., 2004). Autonomy supportive teachers listen to students more often and they allow students to handle and manipulate instructional materials more often (Stefanou et al., 2004). Teachers can support student autonomy in the classroom in many ways but one of the most popular is providing meaningful choices to students (Thompson & Beymer, 2015). Meaningful choices can be defined as choices that are simple but personal to the student and make the student want to select one option over the other (Parker et al., 2017).

Choice Activities

Brooks and Young (2011) conducted a study of college students and found that when meaningful choices were offered, students' intrinsic motivation increased. Scott and Glaze (2017), conducted a study at a Montessori school and found that when students were provided a choice in their homework there was an increase in competence and intrinsic motivation among the students. These studies show how choice in the classroom can have positive effects on students but they must be enacted in certain ways. For choices to be beneficial in the classroom students must feel the value in the task they are completing and be interested in the activity (Thompson & Beyer, 2015). A detrimental effect of providing too much choice in the classroom could cause students to experience choice overload if there are too many options for students to choose from (Thompson & Beyer, 2015). Providing smaller sets of choice can help students and take away from choice overload (Thompson & Beyer, 2015).

A few ways teachers can provide choice to students in the classroom can be through the material they study, assignments they complete, who they work with, as well as many other ways (Parker et al., 2017). Cook (2020) provided students with choice boards in their eighth grade math classroom over a two week period and students chose which activities on the board they wanted to complete (Cook, 2020). This is an example of a choice board which is one of the most popular ways that teachers can provide choice in the classroom (Brennan, 2021). Choice boards help teachers establish differentiation in the classroom as there are numerous activities for students to complete in an order that they prefer (Brennan, 2021). The options on the choice board can suit different students' interests, learning preferences, and different stages of readiness (Brennan, 2021).

Engagement

There are many different definitions of engagement in the classroom. Marks (2000) defines engagement as the amount of physical and psychological energy the student devotes to the academic experience. Reeve (2012) explains engagement as the extent of a student's active involvement in a learning activity. The opposite of engagement is when students are involved in off-task behaviors and activities. These off-task behaviors can lead to a loss of instructional time and can negatively impact academic performance (Godwin et al., 2016). Research has estimated that students spend between 10 and 50 percent of their time in classrooms engaging in off-task behaviors such as walking around the room and talking to other students (Godwin et al., 2016). The ultimate goal for teachers is that their students are engaged and on task in their classrooms.

There are three types of engagement that are present in the classroom, behavioral, emotional, and cognitive (Marks, 2000; Reeve, 2012). Behavioral engagement encompasses students' effort, persistence, participation, and following rules (Davis et al., 2012). Emotional engagement can be defined as students' feelings of interest, happiness, anxiety, and anger during achievement related activities (Davis et al., 2012). Lastly, cognitive engagement refers to how students feel about themselves and their work, their skills, and the strategies that they employ to master their work (Davis et al., 2012). Greater engagement can lead to higher grades and better performance in school (Marks, 2000). One way that engagement can be increased is through the use of structure and student autonomy, such as when teachers implement autonomy supporting behaviors students tend to show higher levels of engagement (Marks, 2000).

Purpose Statement and Research Questions

The purpose of this study was to implement choice activities in a fifth grade math classroom and analyze the effects that they have on students' intrinsic motivation and engagement..

1. How does promoting autonomy through student choice affect students' intrinsic motivation in the classroom?
2. How does promoting autonomy through student choice affect students' engagement in the classroom?

Methods

Description of Sample/ Context

This study was conducted in a rural elementary school in Southern Maryland. Participants were 12 fifth grade students (three girls, nine boys) in a math class. Students were racially diverse; five were Black and seven were white. There was one student with an individualized education plan (IEP) who participated in the study. The class had a wide range of students who were performing at different levels based on their math scores and english language arts scores.

Intervention

The intervention and action piece of my study was based on the idea that providing choice in the classroom can increase intrinsic motivation and engagement (Deci & Ryan, 2008; Ryan & Deci, 2020). I created two different choice boards that the students would

work on for one week at a time. Each choice board contained nine different activities that the students could choose to complete. The students completed the choice board during the rotation time in math where students work in small groups on different assignments for ten minutes at a time. At the end of the week the goal was for students to complete at least four to five of the choices given to them on the board. Students were instructed to look at all of the options and choose which activities they would like to complete. Most of the activities or problems on the board were about concepts that the students had already learned about but a few had to do with items that they were learning about or have not learned yet. The appendix contains the two choice boards that were given to the students.

Type of Methods

This study is a mixed-methods study comprising collecting quantitative and qualitative data. First, I collected quantitative data through the use of an intrinsic motivation scale survey that was completed before and after the intervention. The second source of data that I collected was qualitative data consisting of a short answer survey that students filled out. Students completed this short answer survey at the end of the intervention.

Data Collection

The two sources of data used in my intervention were an intrinsic motivation scale survey, and student responses to a short answer survey. These two data sources were used to determine if providing students with a choice affects their intrinsic motivation and engagement. Before any data was collected consent was received from all parents of the students to allow their student to complete the surveys. The first piece of data collected was the intrinsic motivation scale survey. The students completed the survey after they came back from winter break before the intervention was implemented, and after the intervention was completed. The second piece of data collected was a short answer survey from all 12 students. This survey contained three questions about how students felt about the intervention and how it affected them. The survey was collected after the intervention was completed.

Table 1:

Research Questions and Data Sources

	Data source 1	Data source 2
How does promoting autonomy through student choice affect students' intrinsic motivation in the classroom?	Intrinsic Motivation Scale Survey (Before and after intervention)	
How does promoting autonomy through student choice affect students' engagement in the	Intrinsic Motivation Scale Survey (Before and after intervention)	Student Questionnaire (After intervention)

classroom?

Data Analysis

A paired t-test was conducted to analyze the student responses from the intrinsic motivation scale survey. They were used to see if the students' responses changed between the pre and post survey and their significance. To analyze the qualitative student responses I looked for recurring words and themes that students used to explain how they felt about the intervention.

Results

How does promoting autonomy through student choice affect students' intrinsic motivation in the classroom?

Paired two tailed t-test Comparing Intrinsic Motivation Pre and Post Intervention

	<i>Pre-Intervention Mean (SD)</i>	<i>Post-Intervention Mean (SD)</i>	<i>p-value</i>	<i>Effect Size (d)</i>
Intrinsic Motivation Questions (N=12)	3.33 (1.24)	3.69 (0.93)	0.07	0.36

After running the paired two tailed t-test I found that there was not a statistically significant increase in students' intrinsic motivation as the p-value is 0.07. While this is not statistically significant it approaches significance. There were three questions that were used to measure intrinsic motivation on this survey. The first question the average went from 2.67 on the pretest to 3.46 on the posttest. The second question the average went from a 3.50 on the pretest to a 3.46 on the posttest. And lastly on the third question the average went from a 3.83 on the pretest to a 4.17 on the posttest. For the first and third question the average went up which shows that the intervention may have had a small effect and caused a change. The second question's average went down, but not by much. Even though the results were not statistically significant there is some evidence through looking at the means that the intervention was a little bit effective and changed students intrinsic motivation marginally.

How does promoting autonomy through student choice affect students' engagement in the classroom?

Paired two tailed t-test Comparing Engagement Pre and Post Intervention

	<i>Pre-Intervention Mean (SD)</i>	<i>Post-Intervention Mean (SD)</i>	<i>p-value</i>	<i>Effect Size (d)</i>
Engagement Questions (N=12)	2.92 (1.57)	3.21 (1.36)	0.09	0.29

After running the paired two-tailed t-test for the engagement questions I found that there was not a statistically significant increase in students' engagement as the p-value is 0.09. While this value does not show statistical significance it is on the borderline of being a significant trend. Even though the p-value does not show a significant increase it is encouraging that the averages increased from the pre to post test. There were three questions that measured engagement on the survey given to students. The first question the average went from a 2.42 on the pretest to a 2.50 on the posttest. The second question the average increased from a 2.67 on the pretest to a 3.33 on the posttest. The third and last question for this section the average increased from a 3.67 on the pretest to a 3.79 on the posttest. The averages increased on each question but they did not increase enough to show significance. This shows that students' engagement did increase a small amount from the pre to posttest based on the averages.

The open ended questionnaire was the second data source that measured student engagement. Since it was an open ended questionnaire students responded with a variety of answers but there were many common themes that repeated throughout the responses. The first question asked students about how they felt while completing the choice board. Over half of the students reported that they felt "good" while completing the choice board. Three out of the 12 students reported that it was "fine". These responses were mostly positive and showed that the students felt good about the choice board activity. The second question asked students what they liked about the choice board. Five out of the twelve students responded that they "liked the challenge" or the "different types of questions" on the choice board. Four out of the twelve students reported that they liked "being able to choose" the problems that they completed on the choice board. All of these responses to the second question were positive and really highlighted how students liked being offered to choose which problems they completed on the choice board. The third question asked students what they disliked about the choice board. Five out of the 12 students responded that they disliked "nothing" about the choice board. Five out of the 12 students responded that some of the questions were "hard and challenging". These responses showed that students did not dislike much about the choice board and some thought it was challenging. This may be due to the fact that the board was designed to have questions with varying degrees of difficulty for the students to choose from.

While students were working on the choice boards I was able to answer any questions that students had and observe them working on their choice boards. For a majority of the days students were very quiet and focused on completing their math work which was not always the case before the intervention. Students seemed to really enjoy

working on their choice boards and completing the different math activities. Even though the goal was for students to complete about four to five of the choices, many students wanted to keep working and completed more than the required amount. On one of the first days of the intervention, one student who particularly struggled with math and behavior asked if they could have extra time and keep working on the choice board since they were enjoying it so much. Students were up out of their seats less often, had less questions, and were more quiet throughout the intervention.

Discussion of Results

The data sources used in this project did not reveal significant changes in students' intrinsic motivation and engagement after analyzing pre and post intervention data. Previous research showed that when students are offered autonomy or choices, then intrinsic motivation will increase (Deci & Ryan, 2008). This was not statistically proven through the study but the increase of averages on the survey shows some evidence that this theory can be applied and used in the classroom. Research also showed that when students' need for autonomy is supported then greater levels of engagement can be seen in the classroom (Niemiec & Ryan, 2009; Marks, 2000). This theory was also not supported by statistically significant data but there was evidence from the student questionnaire and observations that support this theory. Many students indicated on the questionnaire that they enjoyed being offered choices which promoted autonomy. These same students were very engaged with the choice board through observations.

Conclusions and Implications

The purpose of this study was to examine whether implementing choice boards in the math classroom would affect students' intrinsic motivation and engagement. To align with Deci Ryan's (2020) self determination theory, students' basic need for autonomy was supported through the implementation of choice activities in the classroom. No data showed statistically significant changes in students' intrinsic motivation and engagement through the use of choice in the classroom. Even though the data did not show statistically significant changes, most of the survey questions student averages increased from the pre to post survey. There were smaller pieces of evidence that show how students enjoyed the intervention and were more engaged than other math lessons they participated in. Common themes from the student questionnaire revealed that students enjoyed the choices offered and liked the choice board. Teacher observations showed that students were very engaged with the choice board, even more than usual.

Limitations

The very small sample size of 12 students was a major limiting factor in this study. A larger sample size would have provided more data and opportunities for the results to be significant. Another limiting factor was the three week time period that the intervention was implemented for. The three week time period of participation does not allow very much time for any statistically significant changes in student engagement and motivation to be made. There were also numerous interruptions that inhibited proper collection of data such as a school fire drill and band/orchestra rehearsals that my students were a part of. These interruptions caused students to miss out on time where they could have been participating in the intervention. My mentor teacher was also out for a few days during the

intervention so there was a substitute in the room with me which caused different student behaviors that were normally not a problem. All of these limitations inhibited the ability to obtain consistent data and provide accurate results of the effects of the intervention.

Implications

Despite the numerous limitations from this study there are a few takeaways from this study that can be used to further develop and add to these theories. This study was completed over a three week period and there was a small increase in intrinsic motivation and engagement seen throughout the study. This shows that choice activities and supporting autonomy in the classroom does have benefits to students. Future researchers can take this preliminary study and implement choice and autonomy over longer periods of time in the classroom to see the effects. One of the driving factors of this study was the lack of research of choice boards in the math classroom and how they affect students' intrinsic motivation and engagement. This preliminary study adds to the few research studies and confirms that choice activities can play a part in increasing students' intrinsic motivation and engagement in the mathematics classroom.

Autonomy supportive practices in the classroom such as implementing choice boards has the potential to increase student intrinsic motivation and engagement (Deci & Ryan, 2008; Marks, 2000). The results of this study show that this claim is correct and there is data that shows promising results and correlations between the two. Students were more engaged and motivated to participate in the choice board activity than many other activities completed in the math classroom. Teachers can use choice boards in their classroom and may find that their students are more intrinsically motivated and engaged with their work.

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Appendix A

Student Questionnaire

Directions: The following questions are about your experience with the choice board activity. Please answer them as best you can. If you have any questions, raise your hand and I will come help you.

1. How did you feel while completing the choice board?

2. What did you like about the choice board?

3. What did you dislike about the choice board?

Appendix B

Intrinsic Motivation Scale Survey

Directions - Read the statement and circle the number that best describes how you feel about the statement

1. I enjoy math

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2. I put a lot of effort into math

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3. Math activities are fun to do

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4. I feel relaxed when working on math problems

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5. When in math class I believe I am provided with choice

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6. I believe math is useful to me

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix C

Math Choice Board #1

Directions: Choose an activity to complete. Once the activity is completed cross it off and move on to another activity. Please **SHOW YOUR WORK** on a separate sheet of paper for all activities.

Decimal Round Up Round the following decimal numbers to the nearest tenth, hundredth, and thousandth. (3 answers for each number) 4.5687 and 52.2436	Write It Out Write word problems that represent the following math equations and solve them. $168 \div 12 = ___$ $176 \div 8 = ___$	Magic Number! Time yourself for 2 minutes and write as many equations as you can that equal 42 . Use PEMDAS and make sure to solve them!
Money Matters Josh opened his wallet and found 15 quarters, 8 dimes, 12 nickels, and 42 pennies. How much money does Josh have in total?	Strategy Solver Solve the following equation $36 \times 48 = ___$. You can choose whichever strategy you want to solve it.	How Old Are You? There are 365 days in one year. Use what you know about your own age and multiplication to find out how many days old you are. Next, figure out how many days old Mr. Morin is. Hint, he is 23 years old.
Conversion Craziess Mr. Morin went for a bike ride and traveled 15,000 meters. How far did he go in kilometers, centimeters, and millimeters.	P.E.M.D.A.S.! Solve the following equations. Remember the order of operations. $(80 \div 4) + (7 \times 8) = ___$ $10^3 - (15 - 8) = ___$ $(8 \times 2) \times (15 \times 3) = ___$	Fraction Fun Solve the following fraction problems. $2/10 + 3/6 =$ $8/12 - 2/8 =$ $3/4 + 2/7 =$

Appendix D

Math Choice Board #2

Directions: Choose an activity to complete. Once the activity is completed cross it off and move on to another activity. Please **SHOW YOUR WORK** on a separate sheet of paper for all activities.

Area and Perimeter What is the area and perimeter of a rectangle that has a width of 24 and a length of 12?	Decimal Comparison Use $<$, $>$, or $=$ to finish the problems $0.3 \underline{\hspace{1cm}} 3.0$ $4.80 \underline{\hspace{1cm}} 4.08$ $0.07 \underline{\hspace{1cm}} 0.70$	Money Matters Tom opened his wallet and found 8 quarters, 4 dimes, 12 nickels, and 32 pennies. How much money does Josh have in total?
P.E.M.D.A.S.! Solve the following equations. Remember the order of operations. $(80 \div 4) + (7 \times 8) = \underline{\hspace{1cm}}$ $10^3 - (15 - 8) = \underline{\hspace{1cm}}$ $(8 \times 2) \times (15 \times 3) = \underline{\hspace{1cm}}$	Write It Out Write word problems that represent the following math equations and solve them. $156 \div 12 = \underline{\hspace{1cm}}$ $220 \div 20 = \underline{\hspace{1cm}}$	Magic Number! Time yourself for 2 minutes and write as many equations as you can that equal 64 . Use PEMDAS and make sure to solve them!
Decimal Round Up Round the following decimal numbers to the nearest tenth, hundredth, and thousandth. (3 answers for each number) 7.8346 and 42.3467	Conversion Crazyiness Mr. Morin went for a swim and traveled 10,000 meters. How far did he go in kilometers, centimeters, and millimeters.	Strategy Solver Solve the following equation $52 \times 16 = \underline{\hspace{1cm}}$. You can choose whichever strategy you want to solve it.

