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Action Research: Hand Signals' Impact on Student Mindset and Performance

Katelyn Niehaus
katelyn@bgsu.edu

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ACTION RESEARCH: HAND SIGNALS' IMPACT ON STUDENT MINDSET AND
PERFORMANCE

KATELYN NIEHAUS

HONORS PROJECT

Submitted to the Honors College at Bowling Green State University in partial fulfillment of the
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Christina Miller, Ph.D., Teaching Professor, Department of Mathematics and Statistics, Advisor

John Fischer, Ph.D., Emeritus Professor, School of Teaching and Learning, Advisor

Abstract

Hand signal use as a form of alternate mode of communication in the classroom offers potential for developing a growth mindset in students and, by this, improving student performance. This paper explores the work already done on various response systems. Research shows response systems typically accomplish their intended goal, and may help students to develop a growth mindset. Additionally, development of a growth mindset is associated with improvement in student performance. The action research discussed in this paper shows there may be an increase in growth mindset as a result of hand signal use in the classroom.

Introduction

Student participation, feedback, and collaboration are all important aspects of an effective classroom. In a traditional classroom, the primary mode for these facets is verbal. Students talk to give answers or discussion points, to ask questions or show their understanding, and to work with peers on a project or to ask peers for clarification. However, there may be a student who is less likely to use verbal communication. This student may be less apt to participate, give feedback, and/or collaborate, meaning that they may miss out on important skill development associated with these tasks, as well as receive less attention from the teacher.

Just as there are many learning styles, there can be multiple means of expression when dealing with participation, feedback, and collaboration in a classroom. One such mode is nonverbal signs, not just facial expressions that an attentive teacher would observe and respond to naturally, but hand signals having designated meanings for student use. For example, students could put their hand in a “Y” shape and shake it between themselves and another student to show

agreement or support. In fact, this particular hand signal was used in many of my math education classes at Bowling Green State University, and, upon taking an American Sign Language (ASL) course, I discovered this is the sign for “SAME.” Having hand signals in a classroom could not only help those students who are less likely to use verbal communication to become more active, but could also offer another avenue of expression to students to try out and become proficient at, as well as become another way for teachers to receive feedback from their students to enhance their instruction.

Having the hand signal previously described in my math education classes available to use was beneficial to me for several reasons. First, I tend to be a less verbal student in the classroom unless I feel I have something truly important to add or until I get comfortable. With the availability of this hand signal, I felt like I was able to participate in a way that was known and accepted by my classmates and teacher, without having to voice my thoughts or feelings. Additionally, when I said an idea or had a question, I felt supported when my classmates used that signal to show they agreed with me or had the same question. For me, this created a positive setting that I was more willing to speak out into in the future. I felt increased confidence and was more willing to take risks in this setting. Because of these factors, I feel that my learning also improved in this setting.

Due to my personal experience with using a hand signal in a classroom, I began to wonder what other hand signals were in use or could be used in a classroom, as well as the effects of these on various types of students. Additionally, because of the confidence I gained, the increased willingness I had to take risks, and the perceived increase in learning from using

hand signals, I found myself asking about the effects of hand signals in two areas: student mindset and performance.

If the use of hand signals in classrooms does improve student mindset and performance, then this additional mode of expression could be a tool for educators. It could benefit not only those students who are less likely to use verbal communication, but all students by offering the aforementioned benefits.

Literature Review

There is limited research looking specifically at hand signal use for student communication in the middle grades. Recent research from the 2000's and 2010's on the effectiveness of various response systems in the classroom has been conducted, with many of the hand signal response systems in this research focusing on classroom management techniques. The results of this research generally finds response systems to be effective in improving the numerous areas investigated; however, I will be researching the impact of hand signals on student mindset, which there has been limited research on. However, there has been much research done on the connection between student mindset and performance, especially since the release of *Mindset: The new psychology of success* by Carol Dweck in 2016. Thus, looking at the impact of hand signal use in the classroom on student mindset could also draw a link between hand signal use and student performance.

Response systems in the classroom based on the research available (Brophy, 1986; Wu, Wu, & Li, 2019; Witt, 2017; Nagro, et. al., 2018) vary significantly in their purpose and implementation. Mobile technology, hand signals, response cards, and sound cues have all been

used as response systems in classrooms. Purposes for these systems also vary, as some response systems focus more on classroom management, some have the goal of gaining feedback from students, and others intend to provide an alternate mode of student communication. The research proposed in this paper aims to provide a response system via hand signals for an alternate mode of student communication. While the mode and function of response systems may differ from that which is focused on in this research, much can still be learned from the impact of these diverse response systems.

One purpose of response systems is to implement a system of classroom management, defined as “the ability to establish, maintain, and restore (when necessary) the classroom as an effective environment for teaching and learning” (Brophy, 1986, p. 182). A study by Heimlich (2010) looked at the use of hand signals, gestures, and sound cues to improve classroom management and decrease the amount of interruptions during class time (p. 15). This study used hand signals for quieting down the students, transitioning, bathroom trips, pencil sharpener trips, and water fountain trips. The action research found that these nonverbal signals decreased student interruptions and transition time, as well as minimized the effect of student interruptions, which allowed for continued momentum in teaching (p. 52).

Another response system that involves classroom management is the mobile technology of ZUVIO, an interactive teaching tool, focused on in the Wu, Wu, & Li study (2019). While this particular response system focused mostly on collecting student feedback, it also aimed to refocus students on the lecture and motivate students to be involved (p. 12). Basically, by having a system in place for student feedback, it also helped to manage students because there was the

expectation of student involvement. The results found that this was effective in increasing student attention, exemplifying its usefulness as a classroom management technique (p. 15).

Feedback was another major purpose of the classroom response systems found. Feedback is communication that tells about the learner's performance, often relative to a standard, and can help the learner to correct, affirm, and rethink what they know (Witt, 2017, p. 287). As mentioned, the main goal of ZUVIO was to gain feedback from students. Feedback in this particular response system could be received in many forms from the students' mobile devices with the ZUVIO application, including answers to multiple-choice, true or false, ranking, voting, and short answer questions (Wu, Wu & Li, 2019, p. 12). Students found that this system "promoted an active and interesting learning climate" due to being able to give and receive feedback in this mode. This, in turn, enhanced their conceptual understanding and cognitive development (p. 15).

Feedback can also be gained from the use of hand signals. In an article examining the use of whole-group response systems in inclusive classrooms, an example was given where students would use hand signals to give feedback on comprehension. Students would hold up one to four fingers, depending on their level of comprehension (one finger representing "I did not get it" and four fingers representing "I got it, and I can explain it to the class") (Nagro, et. al., 2018, p. 244). This feedback allows the teacher to tailor their lesson to student needs, helps students who may be typically left behind to be included, and holds students accountable for their learning by making them reflect on their comprehension (p. 244).

Providing an alternate form of communication besides verbal communication is another purpose for classroom response systems. An example of using hand signals as an alternate form of communication was given in the aforementioned article, which looked at various modes and purposes for classroom response systems in the context of inclusive classrooms. In this example, a student could hold up one finger for wanting to add on to the idea currently being discussed, and hold up two fingers to indicate the desire to contribute a new idea to the conversation (Nagro, et. al., 2018, p. 244). The implementation of this hand signal allows the teacher to pick if they want to continue discussing the current idea or move on to a new one, making transitions smoother. The authors pointed out that this is a form of scaffolding, which can improve the comprehension of students with learning disabilities, as this targets both cognitive and metacognitive development (p. 245).

Another mode of response system given in this article that provided an alternate form of communication was response cards. Response cards can take on several different formats. They are cards that could have true/false, multiple choice answer letters, or more content-specific words on them (Nagro, et. al., 2018, p. 246). Students can hold up these cards to answer questions when prompted, offering a nonverbal form of communication. These response cards can help to create a positive learning environment where all students are encouraged to participate (p. 246).

As shown, classroom response systems can take on many modes and purposes. The response system that is to be studied in the research described in the methodology section of this paper has the mode of hand signals and the purpose of giving students an alternate form of communication. The effects of this response system can be predicted based on the effects of the

response systems found in the research analyzed previously. For example, it is possible that implementing this response system will allow for smoother class discussion, less breaks in teaching momentum, increased student attention, the creation of an active and positive learning environment, and increased student comprehension, as the findings of the research analyzed supported these as effects of various response systems. The effect that is focused on in this research is the creation of an active and positive learning environment, particularly one that stimulates a growth mindset.

A growth mindset is a mindset “based on the belief that your basic qualities are things you can cultivate through your efforts, your strategies, and help from others” (Dweck, 2016, p. 7). Having a positive and active learning environment where students are encouraged and willing to share their ideas, to take risks, to collaborate, and to learn, stimulates a growth mindset. A growth mindset is the opposite of a fixed mindset, which is “believing that your qualities are carved in stone” (p. 6). Having a growth or fixed mindset impacts student performance.

The idea that mindset can impact student performance is shown by a study evaluating the impact of a growth mindset intervention for ninth graders. This study exemplified not only that this intervention was successful at helping students to develop a growth mindset, but also that this growth mindset had an impact. The study found that students were more willing to take risks in their academics and that there was a statistically significant improvement in students’ grade point average (GPA), as well as in their math GPA specifically (Zhu, et. al., 2019, p. iii). This shows that the development of a growth mindset can improve academic performance as measured by GPA.

When looking at the content areas of math and science, much research has been done on the impact of growth mindset. For example, one study looked at the relationship between grit, mindset, and grades for 117 students in grades 5-12 at private schools. This research found a positive correlation between growth mindset and better science grades, as well that a fixed mindset was the strongest predictor of math grades; a negative correlation was found between a fixed mindset and better math grades (Khan, 2018, p ii). The idea that a student having a fixed mindset, rather than a growth mindset, was the strongest predictor of math grades is interesting, as it shows it is likely many people still believe math ability is fixed, and this mindset hurts student performance significantly. It is significant then, that changing a student's mindset from fixed to growth, will likely improve their performance in the subject areas of both math and science.

As shown by these studies, a growth mindset can positively impact student performance. These studies exemplify that this holds true for the middle grades, and for the content areas of math and science. If it is found that the use of hand signals in the classroom helps to develop a growth mindset in students, then it can reasonably be thought that the students' performance will improve as well.

Student response is an important part of the classroom, and it can take on many types and modes, as shown by the previous studies. Additionally, response systems tend to improve the areas they were intended to enhance, including creating a more positive learning environment likely to foster growth mindsets. Furthermore, it has been demonstrated that developing a growth mindset in students improves their performance (Zhu, et. al., 2019, p. iii). With this knowledge,

using hand signals as a response system in the classroom holds high potential for developing growth mindsets and improving student performance.

Methodology

For this action research project, students were given four hand signals to use throughout the time of this research, which was approximately 4 weeks. One represented “I agree/same,” and was a “Y” handshape that shakes between the user and the person the user is agreeing with. The second sign represented “I want to add on/build on,” and was an addition sign made with the user’s two index fingers. The third sign represented “I have a question,” and was made by bending the index finger into a hook shape. The fourth sign represented “I have a different idea/answer,” and was made by the user putting their two index fingers together in the shape of an “X” and then moving their fingers up and apart. All of these hand signals are based on American Sign Language. Data was collected to measure student development of growth mindset. This data came from journal entries, mindset surveys, and observation of student involvement and contribution. This data was collected at the beginning and end of the research period to measure any changes in student mindset.

For the collection of data through journal entries, students were given prompts about which to write. The prompts were 1) Do you feel that this class is one where you can share your thoughts? Do you feel judged when doing so? 2) Are you able to improve your intelligence, or is it something you’re born with? Why? 3) How do you feel when doing work that is hard for you, but that you learn from? The first two questions were changed for the journal entries done at the end of the research period to help with clarity. At the end of the research period, the first two

prompts read 1) a. Do you feel that this class is one where you can share your thoughts? 1) b. Do you feel judged when doing so? 2) Are you able to improve your intelligence? Why? The teacher reviewed these journal entries and labeled the responses on a range from “very fixed mindset” (1) to “very growth mindset” (5). Responses from the beginning and ending journal entries were compared to determine changes in student mindset.

Students were also given a mindset survey (see Appendix A) with eight questions about topics regarding mindset. Students were asked to circle an answer in the range from “disagree a lot” to “agree a lot.” Students received a score based on their answers that tells the teacher what they generally believe. These scores were compared to look at changes in student mindset.

Finally, during two days throughout the research, the number of contributions from all students were counted, as well as observations documented about involvement. Observations were individually counted and documented for three focus students, who vary in their mindsets based on the first journal entry and mindset survey. More contributions show that students are more willing to take risks with sharing their ideas in class, likely demonstrating a growth mindset. Additionally, if students involve themselves in challenging questions or discussion, this shows their willingness to take risks and challenge themselves, exemplifying a growth mindset. These contributions and types of involvement were compared to examine changes in student mindset.

The mindset survey, journal entries, and observations provided a solid set of data for the teacher to evaluate students’ mindsets, as well as students’ changes in mindsets, especially in relation to the implementation and use of hand signals.

Data and Analysis

There were 12 students who wrote journal entries and took the mindset survey on the first data collection day at the beginning of the research period, and 16 students who underwent the same data collection process on the second data collection day at the end of the research period. Additionally, for the first observation period, there were 12 students present; for the second observation period, there were 14 students present. Both observations took place during a 35-minute science class.

Overall, the average mindset survey and journal entry score increased slightly from the beginning data collection to the ending data collection. An increased score indicates a shift from a fixed mindset to a growth mindset. For the mindset survey, scores of 8-24 reflect a fixed mindset, scores of 25-32 reflect a mindset that is in between fixed and growth, and scores of 33-48 represent a growth mindset. For the journal entry, a score of 1 or 2 reflects a fixed mindset, a score of 3 represents a mindset in between fixed and growth, and a score of 4 or 5 reflects a growth mindset.

When including all students, the mindset survey score increased from 29.3 to 31.1 on a 48 point scale, and the journal entry score increased from 3.1 to 3.3 on a 5 point scale. These averages include all of the students, even those who did not take the beginning data collection. If only including the students who participated in the data collection both times, the scores for both the mindset survey and journal entries still increased slightly. The mindset survey score increased from 29.3 to 32 on a 48 point scale, and the journal entry score increased from 3.1 to 3.4 on a 5

point scale. These numbers show the overall trend of students moving from a fixed mindset to a growth mindset.

However, when looking at individual student changes, only six students' mindset survey scores increased from the first data collection to the second, and 5 students' scores decreased. This suggests students whose scores increased did so by a decent amount in order for the average score to increase. For the journal entries, 5 students' scores increased from the first data collection to the second, 5 students' scores stayed the same, and 1 student's score decreased. The figures below show the data from the first and second collections. Figure 2 is color coded to show how the students' scores changed on the mindset survey and the journal entry. Green indicates an increase in the students' score, yellow represents the same score, and red represents a decrease.

| Student Name | Mindset Survey Score | Journal Entry Score (1=very fixed, 5=very growth) | Range | Number of students with score in range |
|--------------|----------------------|---|-------------|--|
| TP | 34 | | 2 8-16 | 1 |
| MC | 34 | | 4 17-24 | 0 |
| DM | 26 | | 3 25-32 | 7 |
| SL | 28 | | 2 33-40 | 4 |
| DB | 32 | | 5 41-48 | 0 |
| AT | 37 | | 2 | |
| ZB | 27 | | 3 | |
| SH | 28 | | 3 | |
| TK | 28 | | 4 | |
| DW | 27 | | 2 | |
| RS | 16 | | 4 | |
| AC | 35 | | 3 | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Average | 29.33333333 | | 3.083333333 | |

Figure 1: Data from first collection

| Student Name | Mindset Survey Score | Journal Entry Score (1=very fixed, 5=very growth) | Range | Number of students with score in range |
|--------------|----------------------|---|-------------|--|
| TP | 35 | | 2 8-16 | 0 |
| MC | 27 | | 5 17-24 | 3 |
| DM | | | 25-32 | 7 |
| SL | 35 | | 3 33-40 | 3 |
| DB | 29 | | 4 41-48 | 2 |
| AT | 42 | | 3 | |
| ZB | 19 | | 3 | |
| SH | 19 | | 3 | |
| TK | 37 | | 5 | |
| DW | 48 | | 3 | |
| RS | 29 | | 3 | |
| AC | 32 | | 3 | |
| TE | 32 | | 2 | |
| EC | 24 | | 3 | |
| CJ | 28 | | 3 | |
| JS | 30 | | 4 | |
| Average | 31.06666667 | | 3.266666667 | |

Figure 1: Data from second collection

For the mindset survey, a predetermined set of ranges were given on the back of the survey with descriptors of a person's mindset whose score would likely fall in that range (see Appendix A). Figure 3 shows the number of students in these ranges during the first and second data collections. From this graph it can be seen that one student was in the lowest range during the first data collection, and none were in that range in the second data collection. Additionally, no students were in the highest range during the first data collection, and 2 students were in the highest range during the second data collection.

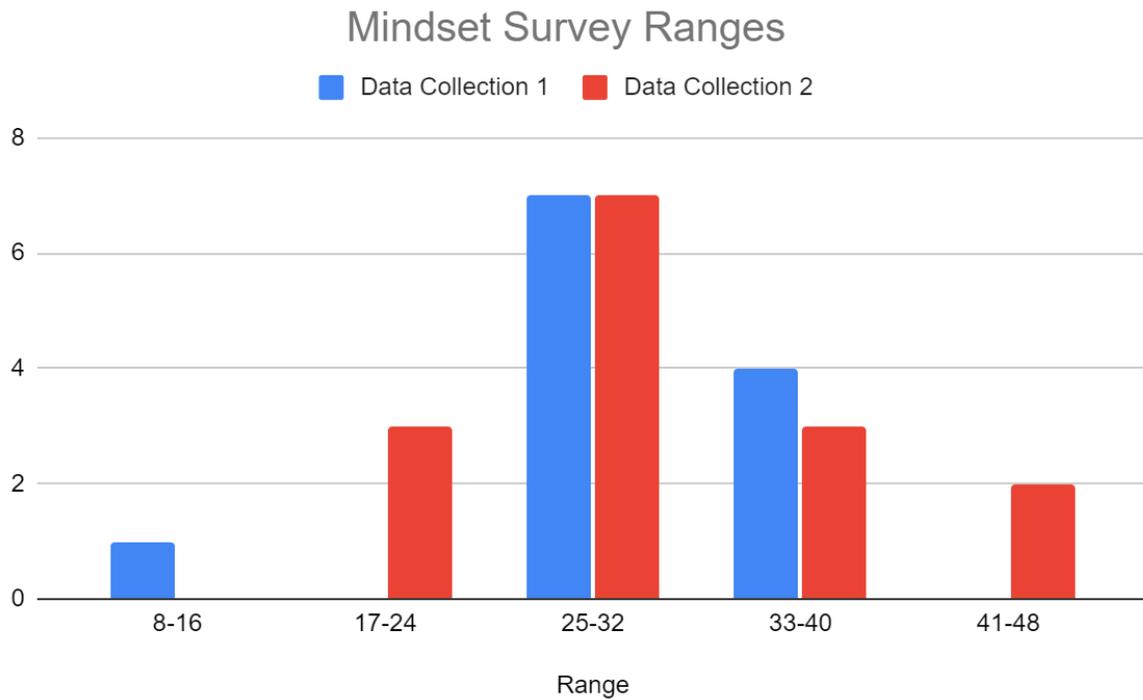


Figure 3: Mindset survey score ranges for first and second data collections

As mentioned previously for the journal entry, a score of 1 or 2 reflects a fixed mindset, a score of 3 represents a mindset in between fixed and growth, and a score of 4 or 5 reflects a growth mindset. Examples of journal entries receiving each score are below. Figure 4 shows the journal entry scores for the first and second data collections. As shown, the scores increased slightly for the second data collection.

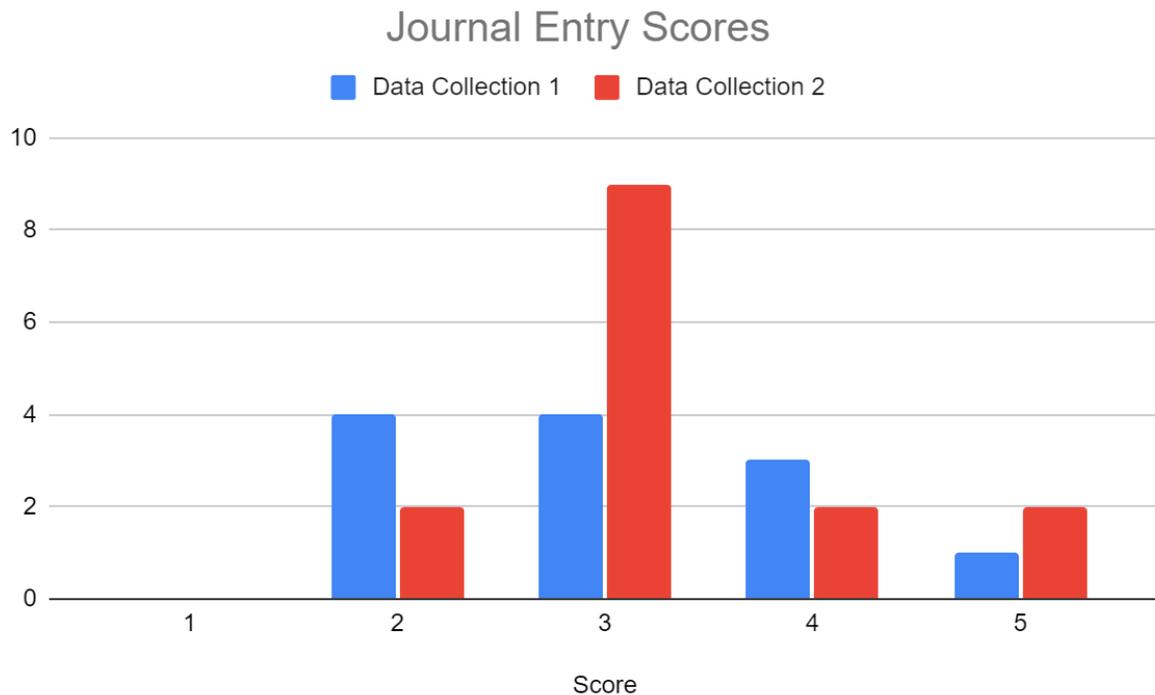


Figure 4: Journal entry scores for first and second data collections

Below are some examples of entries from scores 2-5 (there were no students who scored a 1):

Journal questions for reference:

- 1) a. *Do you feel that this class is one where you can share your thoughts?*
- b. *Do you feel judged when doing so?*
- 2) *Are you able to improve your intelligence? Why?*
- 3) *How do you feel when doing work that is hard for you, but that you learn from?*

Score of 2:

- 1) a. No, because there's a lot of jokers in the class.
- b. Yes, because they think a lot of stuff is funny.

- 2) Yes, because I pay attention a lot.
- 3) Good and frustrating because it's hard sometimes.

Score of 3:

- 1) a. Sometimes
b. Sometimes
- 2) Yes, because you can improve anything.
- 3) I feel okay.

Score of 4:

- 1) a. No
b. Yes
- 2) Yes, because you can always improve on something.
- 3) I feel happy about that.

Score of 5:

- 1) a. I feel that I can share my thoughts sometimes.
b. No, not really.
- 2) Yes, because I try my best to learn new things.
- 3) I feel good because even though it was hard for me I still didn't give up.

Student contributions were also observed by my Coordinating Mentor Teacher (CMT) twice throughout the research period: once at the beginning and once at the end. Contributions were recorded for the whole class, as well as counted individually for three focus students. Contributions were counted by type, including the use of hand signals as well as verbal contributions. See Appendix B for the observation sheet. Overall, student contributions increased from the first observation day to the second observation day. On the first observation day, there were 14 contributions made. On the second observation day, there were 28 contributions made.

The breakdown of the types of contributions is shown in Figure 5. This shows an increase in all types of contributions.

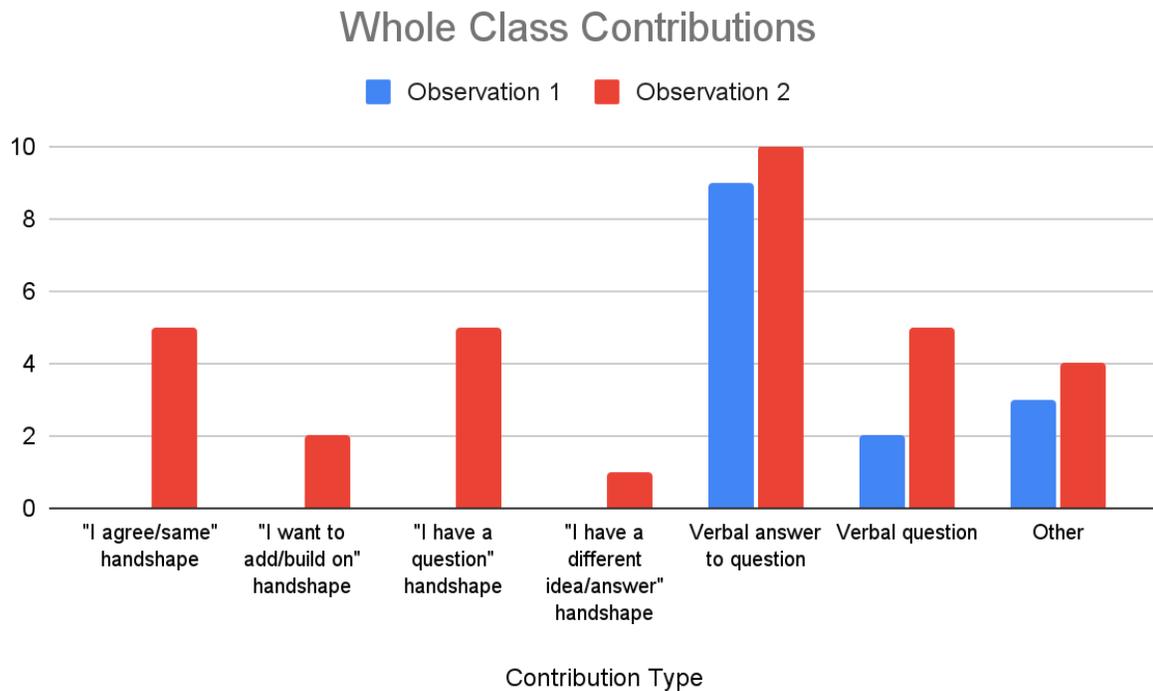


Figure 5: Whole class contributions on the first and second observation days.

The three focus students were chosen after the first data collection. These students' initials are highlighted in Figures 1 and 2. One student was chosen who had a growth mindset according to the data, and two students were chosen who had conflicting mindsets. These two students' mindset surveys indicated that they had a growth mindset, but their journal entries indicated that they had a fixed mindset. These students were also chosen by recommendation from the teacher for different types of students in terms of normal participation amounts. These students' contributions were counted individually during the observation days. Their

contributions are shown in Figure 6. All three focus students increased their contribution amounts from the first observation day to the second.

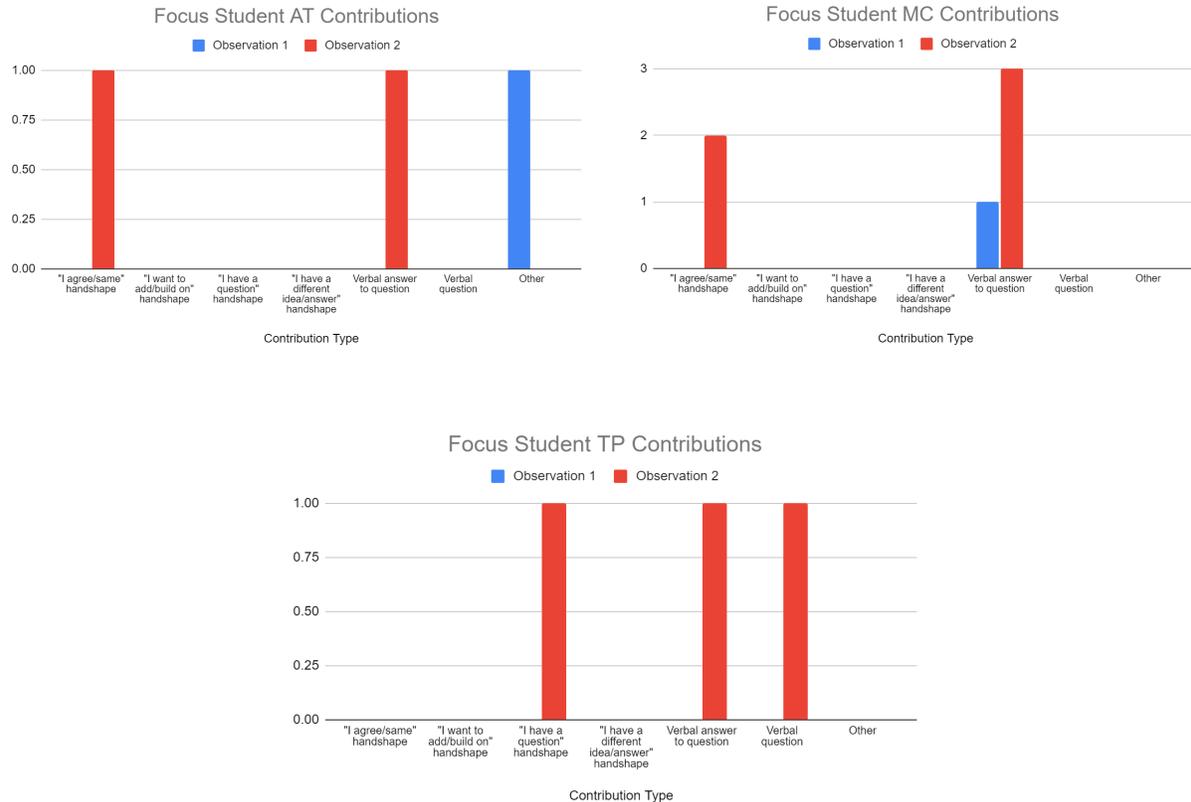


Figure 6: Focus student contributions on the first and second observation days.

The increases in contributions from the whole class as well as the focus students suggests a change in students from a fixed mindset to a growth mindset, as students are more willing to take the risk of making a contribution in class, in which the student could be wrong.

All in all, the mindset survey, journal entries, and contribution observations show a slight trend of the class moving more towards a growth mindset. However, individual student shifts

were more complicated to interpret, as the different data sources sometimes conflicted as to which mindset a student more likely had.

Conclusions, Implementations, and Limitations

Overall, I believe that this research shows promise for hand signal use in the classroom. The mindset survey, journal entry, and observation of contributions all showed a slight trend towards a growth mindset for the class after the use of hand signals for several weeks. There were some discrepancies in the trends for individual students from different data sources, but most students trended towards a growth mindset in each of the data sources. This was consistent with the ideas found from other research and discussed in my literature review. For example, the trend towards a growth mindset could be attributed to a more positive classroom environment due to this response system, as described in the study by Nagro, et. al. (2018, p. 246).

There are some limitations to this research, as well as some things that I would change if I were to do this research again. One such limitation is that it is hard to tell if the slight trend towards growth mindset was directly related to the use of hand signals. It could have been related to taking a mindset survey and thinking about some of the items mentioned in the survey in between the data collections, as there are some indications (Walter & Cohen, 2011) that even doing a survey or simple intervention can have an impact on mindset. The short time frame between when these data collections may have led students to see what desired answers would be, as they would have been more likely to remember the first data collection and see the connection. This slight trend may have also been due to becoming more comfortable with having me as a teacher, or as a result of my teaching style. It is very hard to isolate what may have

caused this slight trend in growth mindset, as there are so many factors at play in a classroom. In the future, I would have more time for students to get used to my teaching, then introduce the hand signals to hopefully see a more direct correlation, as well as allow for more time between my data collections.

Another item I would change about this research if I were to do it again is how I modeled the hand signals. I did not model them as often as I would have liked to, and I think that this led to students not using them as often as I had hoped. In the future, I would remind students about the hand signals at the beginning of every class, and then model them myself throughout the lesson. I did have a poster to remind students of the hand signals, and I would continue to use and reference this in the future. This was an important realization for myself that I can apply to all procedures that I want to become routines in my classroom.

Due to the results of this study, I would like to implement hand signals into my future classroom. This will hopefully help my future students to develop a growth mindset, as well as will serve as a useful tool for myself as a teacher in assessing the types of contributions that students are wanting to make, and having more control over discussions due to this. I will also implement growth mindset surveys and journals into my future classroom, and I will talk with my students about the importance of a growth mindset, as I can see the value of doing so simply from giving these surveys and journal prompts during this research. I will also continue to look into response systems that will work the best for my future students.

Annotated Bibliography

Wu, Y.-C. J., Wu, T., & Li, Y. (2019). Impact of using classroom response systems on students' entrepreneurship learning experience. *Computers in Human Behavior*, *92*, 634–645.

<https://doi-org.ezproxy.bgsu.edu/10.1016/j.chb.2017.08.013>

This study focuses on Classroom Response Systems (CRS) and mobile devices' impact on students in an entrepreneurial education course. ZUVIO was used as a feedback system, with students responding to multiple-choice, true or false, ranking, voting, and short answer questions. The students also received feedback on their answers. It was found that the use of this response system created a positive learning environment, as well as increased student attention levels.

Nagro, S. A., Hooks, S. D., Fraser, D. W., & Cornelius, K. E. (2018). Whole-Group Response Strategies to Promote Student Engagement in Inclusive Classrooms. *Teaching Exceptional Children*, *50*(4), 243–249. <https://doi-org.ezproxy.bgsu.edu/10.1177/0040059916640749>

This article explores whole-group response strategies in an inclusive classroom with students with disabilities. Various response systems were explored, including those for feedback, using hand signals, and those for an alternative to verbal communication, using response cards and hand signals. The authors reasoned that the use of these response systems can help the teacher tailor their lesson to meet student needs, can help students typically left behind, can hold students accountable for their learning, can allow for smoother discussion and scaffolding, and can create a positive learning environment.

Heimlich, M, (2010). A nonverbal signal system: minimizing the effects of student interruptions, maximizing instructional time, and sustaining momentum while teaching. *Theses and Dissertations*. 54. <https://rdw.rowan.edu/etd/54>

This study focuses on hand signals, gestures, and sound cues to nonverbally manage various aspects of the classroom. The research found these nonverbal signals decreased student interruptions and transition time, as well as minimized the effect of student interruptions, which allowed for continued momentum in teaching.

Khan, N. (2018). The impact of mindset and grit on academic success in math and science [ProQuest Information & Learning]. *In Dissertation Abstracts International Section A: Humanities and Social Sciences* (Vol. 79, Issue 11–A(E)).

This article looked at the correlations between mindset, grit, and academic success, particularly in the content areas of math and science. The main purpose was to see if the measurement tools of mindset and grit are independent or related. However, Khan also found there was a positive correlation between growth mindset and science grades, that a fixed mindset was the strongest predictor of math grades, and that a growth mindset was the strongest predictor of grit.

Zhu, P., Garcia, I., Boxer, K., Wadhera, S., Alonzo, E., & MDRC. (2019). Using a Growth Mindset Intervention to Help Ninth-Graders: An Independent Evaluation of the National Study of Learning Mindsets. In *MDRC*. MDRC.

This research explored the effectiveness of a growth mindset intervention used with ninth graders. The results showed the intervention did in fact change students' mindsets. It also

improved students' willingness to take on challenging academic tasks and improved student performance as measured by grade point average. Interestingly, this study also found certain groups of students and schools may have benefited more than others, including students with relatively low academic performance, schools in the middle in academic performance, and schools where students are more challenged.

Dweck, C. S. (2016). *Mindset: The new psychology of success*. New York: Random House.

Dweck's book describes what mindset is, why it is important, and how it can be applied to education. Notably, it defines a growth mindset as being "based on the belief that your basic qualities are things you can cultivate through your efforts, your strategies, and help from others" and a fixed mindset as "believing that your qualities are carved in stone" (6-7).

Brophy, J. (1986). Classroom Management Techniques. In *Education and Urban Society*. 18 (2), 182-194.

This article describes classroom management and how to implement an effective classroom management system. Particularly, it looks at how to maintain student attention and task engagement, as well as what to do when individualized student treatment is necessary.

Witt, P. (Ed.). (2017). *Communication and Learning*. Berlin: De Gruyter Mouton.

This book covers a vast amount of concepts in the areas of communication and learning, especially how communication impacts learning. It looks at spoken and unspoken

communication, and the impacts various forms of this can have on teaching and learning. It talks about the importance of feedback as well.

Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, 331(6023), 1447–1451.

<https://doi.org/10.1126/science.1198364>

This article looks at the impact of an intervention on students' sense of belonging. This study focuses on students transitioning to college and finds that intervention, even when unnoticed by the student, can have an impact on their sense of belonging.

Appendix A

| <i>Circle the word(s) that indicate how much you agree with each statement.</i> | | | | | | | SCORE |
|---|----------------|----------|-------------------|----------------|-------|-------------|-------|
| 1. No matter how much intelligence you have, you can always change it a good deal. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 2. You can learn new things, but you cannot really change your basic level of intelligence. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 3. I like my work best when it makes me think hard. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 4. I like my work best when I can do it really well without too much trouble. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 5. I like work that I'll learn from even if I make a lot of mistakes. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 6. I like my work best when I can do it perfectly without any mistakes. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 7. When something is hard, it just makes me want to work more on it, not less. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| 8. To tell the truth, when I work hard, it makes me feel as though I'm not very smart. | Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot | |
| Your Overall Mindset Score: | | | | | | | |

Mindset Quiz Scoring Guide

For questions with odd numbers (1, 3, 5, 7) use the following scores:

| | | | | | |
|----------------|----------|-------------------|----------------|-------|-------------|
| Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot |
| 1 | 2 | 3 | 4 | 5 | 6 |

For questions with even numbers (2, 4, 6, 8) use the following scores:

| | | | | | |
|----------------|----------|-------------------|----------------|-------|-------------|
| Disagree a lot | Disagree | Disagree a little | Agree a little | Agree | Agree a lot |
| 6 | 5 | 4 | 3 | 2 | 1 |

Total up your score for each question to arrive at your overall mindset score. Use the table below to interpret your score:

| If your overall mindset score falls into this range: | Then you usually believe the following things: |
|--|---|
| 8–16 | You strongly believe that your intelligence is fixed—it doesn't change much. If you can't perform perfectly you would rather not do something. You think smart people don't have to work hard. |
| 17–24 | You lean toward thinking that your intelligence doesn't change much. You prefer not to make mistakes if you can help it, and you also don't really like to put in a lot of work. You may think that learning should be easy. |
| 25–32 | You're not sure whether you can change your intelligence. You care about your performance, and you also want to learn, but you don't really want to have to work too hard for it. |
| 33–40 | You believe that your intelligence is something that you can increase. You care about learning, and you're willing to work hard. You want to do well, but you think it's more important to learn than to always perform well. |
| 41–48 | You feel very sure that you can increase your intelligence by learning, and you like a challenge. You believe that the best way to learn is to work hard, and you believe that making mistakes is an inevitable part of the learning process. |

Appendix B

Observation Sheet

Date: _____ Name of Observer: _____

Whole/majority of class contribution:

| Contribution Tally | Types of Contributions | Additional Notes |
|--------------------|--|------------------|
| | "I agree/same" handshape | |
| | "I want to add/build on" handshape | |
| | "I have a question" handshape | |
| | "I have a different idea/answer" handshape | |
| | Verbal answer to question | |
| | Verbal question | |
| | Other | |

Individual: Student Name: _____

| Contribution Tally | Types of Contributions | Additional Notes |
|--------------------|--|------------------|
| | "I agree/same" handshape | |
| | "I want to add/build on" handshape | |
| | "I have a question" handshape | |
| | "I have a different idea/answer" handshape | |
| | Verbal answer to question | |
| | Verbal question | |
| | Other | |

Individual: Student Name: _____

| Contribution Tally | Types of Contributions | Additional Notes |
|--------------------|--|------------------|
| | "I agree/same" handshape | |
| | "I want to add/build on" handshape | |
| | "I have a question" handshape | |
| | "I have a different idea/answer" handshape | |
| | Verbal answer to question | |
| | Verbal question | |
| | Other | |

Individual: Student Name: _____

| Contribution Tally | Types of Contributions | Additional Notes |
|--------------------|--|------------------|
| | "I agree/same" handshape | |
| | "I want to add/build on" handshape | |
| | "I have a question" handshape | |
| | "I have a different idea/answer" handshape | |
| | Verbal answer to question | |
| | Verbal question | |
| | Other | |