Spring 2023

The Modern High School Learning Environment: A Study of Differentiated Learning and Flexible Grouping Strategies

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Capstone Project: An Action Research Project

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Abstract

This research project explores the effects of differentiated learning and flexible grouping on students' learning in high school mathematics. Specifically, the research demonstrates the effects of flexible grouping in a team-taught environment on students' engagement and achievement. In this research study, students from two sections of team-taught Algebra 1 were used to determine changes in levels of engagement and achievement. First, students were grouped into a remediation group or an independent learning group based on their level of proficiency on an initial formative assessment. Students received instruction, practiced the necessary skills, and were assessed to conclude the study. Additionally, the researcher tracked the practice completion percentage for each group to determine if engagement levels were affected by the learning environment. Overall, flexible grouping strategies positively affected engagement levels and assessment scores for the low-ability learners in the remediation group. The engagement levels and assessment scores for students in the independent learning group were less significant than the results observed in the remediation group. Therefore, flexible grouping strategies play a significant role in teaching and learning for low-ability students. This research project aims to equip teachers with the knowledge and confidence to implement these strategies to provide authentic and engaging learning environments for all students.

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Amid the evolution of the 21st-century classroom and learning environment, high school teachers throughout the United States are still searching for the most efficient instructional practices to meet the unique needs of their students. Unfortunately, since the turn of the century, best practices are no longer significant enough to sustain students' attention while ensuring an authentic and engaging learning environment. The current journey through the digital revolution and a worldwide pandemic allows educators to determine the new best practice in education.

Teachers are encountering students and learning environments unforeseeable not too long ago. The number of students with learning difficulties and the diversity of learning needs teachers have to cope with in a regular education classroom are increasing. Thus, how can educators transform their pedagogical practices to contribute to developing the learning environment they provide for their diverse students? (Dube et al., 2013). From a high school math standpoint, students' value of mathematics (-0.10) and their beliefs surrounding their ability to learn in math class (-0.12) have declined from 2015-2019. (Nilsen et al., 2022). What would a current study, post-pandemic, reveal about the same variables? Based on the 2022 National Assessment of Educational Progress (NAEP), eighth-grade mathematics average scores decreased by eight points since the last assessment period in 2019 (NAEP, 2022). The problem is current students are performing at underwhelming rates mathematically, and there needs to be more engagement and motivation among high school students. Some lack of engagement stems from distractors (i.e., cell phones), while some are a lingering effect from learning, or the lack thereof, that occurred during the pandemic. All other subjects have surpassed pre-pandemic achievement levels (measured by the ACT) within the school district, while math has remained

stagnant. There needs to be more recent literature regarding differentiated instruction and flexible grouping strategies implemented in a secondary math setting with many special education students.

The action research aims to answer the following questions: Does using flexible grouping and differentiated instruction affect student achievement and understanding in high school mathematics? As a result of flexible grouping and differentiated instruction, will students' engagement level regarding completing in-class practice and homework increase? Once the action research is complete, the goal is to be equipped with new knowledge to make evidence-based instructional decisions to support the longevity of desirable achievement and engagement levels.

Research and resources for the action research study were compiled from DeWitt Library at Northwestern College. Most studies included were current within the last ten years and published in an educational or medical peer-reviewed journal. In addition, prior studies researching the effects of differentiated instruction and flexible grouping, students' lack of homework/practice engagement, students' motivation, and COVID-19 on learning and mental health were reviewed. Eventually, 20 sources were selected based on relevance and support given to the present study. Studies were used to understand what is currently known about the study and identify existing gaps considering learning and teaching in a post-pandemic environment.

While many instructional strategies are desirable, differentiation through flexible grouping strategies positively and consistently affects the mathematical achievement and engagement of high school students with diverse learning needs. For example, data has shown, on average, students are more likely to perform better at the end of a mathematical unit than at

the beginning once exposed to flexible grouping. Additionally, students were shown to be more engaged and completed a higher percentage of practice assignments in and out of class.

As a result of the thorough literature review, four common themes emerged. The first was the effectiveness of differentiated instruction and flexible grouping strategies in various classroom environments. Also, as homework and practice completion is a concern, what barriers prevent students from completing their homework or practice in and out of class? The final two common themes helped paint a clearer picture of the students in the current study. Considering the current state of students' motivation, engagement, and mindset was desirable as students are motivated and engaged much differently than previous generations. It is essential to be knowledgeable about best practices for motivating and engaging students and promoting a growth mindset. Finally, what did educators learn from COVID-19? The pandemic shined a bright light on shortcomings in prioritizing adolescent mental health. Students in classrooms are struggling with unprecedented encounters. Educators have the professional responsibility to be aware of the makeup of their students, making the final two themes critical to the literature review and the current study.

Review of the Literature

Research of Differentiated Instruction and Flexible Grouping

Teachers have the opportunity to manipulate their classroom environment on a frequent basis to meet the needs of their students. A study completed by Guay et al. (2017) shows the positive effect of implementing differentiated instruction. Guay et al. surveyed elementary students and teachers in a differentiated learning environment. Consequently, the researchers found differentiated instruction positively impacted student motivation, with an effect size of 0.35. Lai et al. (2020) report similar findings as they studied differentiated learning in a sixth-

grade math classroom. Students responded to a survey on a scale of 0 to 100, with 100 corresponding to something a student felt confident completing. Like Guay et al. (2017), Lai et al. (2020) show differentiation increases mathematics learning motivation (12.22) after a year of differentiated learning. Perceived competence in mathematics was more pronounced (0.41) in a differentiated learning environment (Guay et al., 2017), and mathematics self-efficacy (8.62) improved, as well (Lai et al., 2020). Guay et al. (2017) observed the infrequent use of differentiated learning hurt student motivation (-0.26). Lai et al. (2020) note mathematics problem-solving skills (4.00) also increase after yearlong exposure to differentiation. Lai et al. (2020) comment the participants "felt more comfortable before taking a mathematics test and were able to remember what they had studied". In other words, differentiated instruction helps students retain information throughout the learning process. Guay et al. (2017) note, "To be autonomously motivated, students need to pursue optimal challenges that are suited to their abilities". Educators must provide meaningful enrichment and remediation opportunities focused on individual student learning needs. As a result of purposeful differentiation students' motivation and belief in mathematical abilities will improve.

Pozas et al. (2020) surveyed a small group of teachers on using differentiated instruction strategies in educationally diverse classrooms. On a scale of 1 to 5, with 5 corresponding to implementing completely, teachers were most likely to implement heterogeneous ability grouping (3.57). Teachers utilized project-based learning the least (2.23), with homogenous ability grouping (2.37) being the second least. Based on interviews with six English language teachers using differentiated instruction, Idrus et al. (2021) establish differentiated instruction as a fundamental approach to teaching students with diverse needs. One teacher commented, "I feel that differentiated instruction is very effective in catering to the needs of pupils and it can

mediate my teaching based on what they need." While another stated, "When I try to reach students, I can understand their problem better." Nevertheless, another teacher conceded, "Whether or not the students answer with a 'Yes' it is undeniably harder to scan whether they truly understand their task/lesson for the day or not if you try to assess a large group of 25-35 students at a time" (Idrus et al., 2021). Broken down only by math teachers yielded a similar result, with heterogenous ability grouping preferred significantly more than homogenous ability grouping (Pozas et al., 2020). The challenge teachers might encounter while implementing new strategies is time. Idrus et al. (2021) note two of the six teachers in their study shared there needs to be more time to prepare everything they wanted to prepare. While challenges persist throughout differentiated instruction, it is crucial for teachers still see value in its implementation in diverse learning environments. Pozas et al. (2020) concluded the frequency of teachers implementing homogenous ability grouping is less than recommended for dealing with diverse students. Rather than grouping students heterogeneously in a math setting, the potential for research on homogenously grouping students becomes visible.

McKeen (2019) researched flexible grouping strategies exclusively in the elementary math setting. The researcher sought to find the effectiveness of a year's learning in flexible groups. Achievement test scores were compared to the previous year when flexible groups were not implemented. McKeen (2019) observed mean CRCT increases in first grade (7%), second grade (5%), and fourth grade (4%). The variance was reduced in first through third grade, while the variance in fourth grade remained nearly the same. McKeen concludes constructing homogenous ability groups can contribute much to the learning environment. Grouping by ability "can allow teachers to continually assess the student's performance in and outside the classroom and to spend more directed time with students in small groups" (McKeen, 2019).

Pozas et al. (2020) concluded homogenous ability grouping was underutilized in the math setting, and here McKeen shows its potential effect on young students. Like McKeen (2019), Benders and Craft (2016) were able to study the effectiveness of flexible small groups on first graders' math achievement. Twenty-five first-grade students were grouped homogenously based on their level of math content knowledge from recent MAP testing data. Students rotated between three groups: a teacher-led group, a cooperative learning group, and an independent learning group for each day of a first-grade math unit. The average score of the eleven students below mastery level on the pre-test increased from 24.5% to 90.9% on the post-test. Benders and Craft (2016) note "not all students respond in the same way to instruction and that the growth experience may depend on the amounts and types of mathematics instruction their teacher provides". In other words, teachers can vary the amount and instruction method to meet students' needs. Elementary teachers' flexible grouping and differentiated learning implementation have been researched heavily. Overall, the effects of either strategy are positive in the elementary setting.

Briggs (2020) compares flexible grouping strategies in a college-level physics class. The researcher grouped students into groups of three. Heterogenous groups consisted of one student from each level (high, medium, and low) measured by GPA in pre-requisite courses. Homogeneous groups consisted of three students, all from the same level. The researcher observed increases in all levels of students, but the most sizeable increases came from students in homogenous groups. High-level students increased by 48%, middle-level students by 36%, and low-level students by 48% from pre-test to post-test in groups with similar-level peers. Comparatively, high-level students increased by 45%, middle-level students by 28%, and low-level students by 29% in heterogenous ability groups. A sizeable difference occurred with the

low-level learners leading Briggs (2020) to conclude homogenous grouping is highly effective in meeting the learning needs of low-level learners. Dube et al. (2013) also confirm the effectiveness of homogenous grouping at the elementary level. Pre-test results made it possible to group students into five different subgroups. Students having the lowest competency level were grouped into subgroup 1. Dube et al. (2013) discovered the students in subgroup 1 saw the most sizeable increase in post-test scores (20.2%). Again, this confirms homogenously grouping students effectively meets the needs of the lowest level of learners. However, Dube et al. (2013) concede subgroup 5, the highest level of learners, experienced regression throughout the learning process. Average scores amongst these students decreased by 5.3%. These are promising conclusions that bring merit to the current research study's approach.

Research has shown the positive effects of differentiated instruction and flexible grouping strategies (Guay et al., 2017; Lai et al., 2020; McKeen, 2019; Benders & Craft, 2016; Briggs, 2020; Dube et al., 2013), especially in the elementary setting. However, much is left to wonder about the effectiveness of either instructional strategy in a diverse high school math setting. Will comparable results be observed if differentiated and flexible groupings are implemented in a high school math setting? Pozas et al. (2020) note the frequency of teachers implementing homogenous ability grouping is less than recommended for dealing with diverse students. There exists a potential avenue for current research to occur. If the frequency of homogenous ability flexible groups increases, might there be significant increases in low-level student achievement? Low-level learners might become more confident and believe in their abilities after being exposed to individualized teacher instruction in a homogenous ability group. Additionally, while homogenous flexible learning groups are effective for low-level learners, their effectiveness in high-level learners remains to be seen. Educators must find a happy

medium to complement both types of learners rather than putting one group at risk for regression.

Incomplete Homework

To effectively complete the study, it is necessary to consider current research and make a note of barriers preventing students from completing their homework. As a result, three potential barriers emerged: distractors, stress/mental well-being, and time. Galloway et al. (2013) worked with 4,317 high school students to establish non-academic factors affecting timely homework completion. The authors found that students reported spending approximately 3 hours per night on homework. Additionally, 11th-grade students reported spending the most time on homework per night, while 9th and 12th-grade students spent the least time. Finally, female students reported more homework time than their male counterparts (Galloway et al., 2013). Xu (2012) also confirms the effect size of being a male on homework completion is -0.22 compared to females. Therefore, an analysis of the three barriers to homework incompletion is necessary.

Mrazek et al. (2021) conducted action research on teenagers' phone use during homework time. The age of digital multi-tasking is in full force. One hundred and fifty-nine high school students completed a survey where the researchers asked respondents to consider their cell phone usage while working on homework. Of the students surveyed, 58.5% reported mind-wandering "often" or "very often", and 40% of them use their phone "often" or "very often". Less than half of the students (43%) use their phones habitually without thinking (Mrazek et al., 2021). Besides cell phone usage, Xu (2010) notes other distractors adolescents encounter. Students note spending 78 minutes playing organized sports and 120 minutes watching television on an average weekday. Those students spending more time watching television (0.15), engaged in extracurricular activities (0.10), playing organized sports (0.06), and working at paid jobs (0.05)

were all more likely to be distracted while doing homework (Xu, 2010). Interestingly, males reported significantly lower levels of homework distraction after controlling for other variables (-0.30) (Xu, 2010). To close, Mrzaek et al. (2021) comment if students spend 3 hours per weeknight on homework for the entirety of the school year, they will spend approximately 540 hours on homework per year. Their findings suggest students are distracted 37.8% of the time, meaning 204 hours are spent working on homework while distracted. In other words, distractors are a common and frequent barrier preventing students from completing homework throughout the school year.

In studying the non-academic effects of homework, Galloway et al. (2013) discovered stress and mental health are impacted. The researchers discovered 72% of students reported being "often" or "always" stressed over schoolwork. A similar percentage of students (82%) reported experiencing physical symptoms (headaches, stomach problems, sleep troubles) from the stress of schoolwork. Approximately 68% of students note the work they are expected to complete "often" or "always" limits them from getting the recommended amount of sleep. One student responded, "There's never a time to rest. There's always something more you should be doing. If I go to bed before 1:30 I feel like I'm slacking off, or just screwing myself over for an even later night later in the week" (Galloway et al., 2013). As a result of workload and high expectations, students expressed: "I don't feel healthy;" "I generally feel lousy;" and "It can feel like you are drowning". (Galloway et al., 2013). Educators have reached a point where they must consider the value of assigning homework. Is the homework assignment necessary for student success and understanding, or can the same learning result from a different opportunity?

High school students are often pulled in many different directions and expected to prioritize their time efficiently to find success. Galloway et al. (2013) report 63% of students

believe their school workload "often" or "always" makes it hard to spend time with family and friends. Furthermore, the researchers confirm 61% of students were forced to quit an activity they enjoyed because of their schoolwork. For example, one student reported, "There is hardly any time for me to enjoy being a kid when I have to go to school all day and then go home and do homework all night" (Galloway et al., 2013). Another student commented, "All of the homework and studying that I have each and every night take away from everything I used to do and the activities that I like to do and that keep me healthy" (Galloway et al., 2013). In closing, Galloway et al. (2013) state the students' inability to balance the overload of homework and extracurricular activities is often exposed. Thus, educators must consider the value of homework as it might limit students' ability to cultivate skills outside of school.

Observed declines in homework completion can be attributed to distractions, the stress of overwhelming workloads and the amount of time students spend doing homework and not things they enjoy. Is homework a necessity? Are there other convenient alternatives to assess student learning just as effectively? Educators must work to create meaningful, authentic learning opportunities for students inside the classroom. Xu (2013) comments "it would be beneficial for teachers to make homework more interesting, relevant, and engaging for students so they are more likely to take the initiative to monitor their homework motivation in the process". Students are more likely to engage in an activity when it is exciting or appealing. Rather than assigning homework for students to complete outside of school, there might be power in assigning practice for students to complete in class. What happens when teachers allow students to complete meaningful practice in class? Are they going to be more willing or more motivated to work? When combined with flexible grouping strategies, teachers might leverage students' strengths by allowing them to collaborate to complete practice and construct new knowledge. In-class

individual and small group practice still accomplishes the task of assessing student understanding of content while also allowing them to cultivate lifelong skills in collaboration and responsibility.

Student Motivation, Mindset, and Engagement

Motivation, mindset, and levels of engagement are crucial components of adolescent makeup teachers need to be aware of. Current high school-aged students are much different from earlier generations of students. Therefore, high school math teachers must find innovative ways to motivate and engage the current generation of students while also promoting a positive mindset. Degol et al. (2018) researched to determine the impact of having a growth mindset in mathematics. Within their study students responded to survey questions on a scale of 1 to 5, with a response of 5 corresponding to strongly agree. The researchers found a student's mindset is an influential part of math success. Females are more likely to have a fixed mindset because "they did not see doing well in math and science as compatible with their goals, values, and identity" (Fredricks et al., 2017). The stereotype in which females are not sought-after candidates for occupations in STEM fields still exists. Degol et al. (2018) confirm females with a fixed mindset had lower expectancy beliefs (-2.935) than males with a fixed mindset. Meanwhile, females and males with a growth mindset had comparable expectancy beliefs (Degol et al., 2018). In other words, Degol et al. (2018) show having a growth mindset leads students to believe more in their abilities. Keklik and Keklik (2013) build off a similar idea in their study of high school students and connect mindset and motivation. They observed students who had high levels of mathematics self-efficacy not only had growth mindsets but were more motivated (0.959). Meanwhile, Degol et al. (2018) found females and males with fixed mindsets had comparable grades (-0.064). However, "females with a growth mindset had higher grades than males with a growth mindset" (Degol et al., 2018). Mindset is a small component of adolescent makeup.

Degol et al. (2018), Keklik and Keklik (2013), and Fredricks et al. (2017) observed the importance of a growth mindset in mathematics. A growth mindset influences self-efficacy/expectancy beliefs and mathematics achievement.

Research by Fredricks et al. (2017) into what affects student engagement is extensive. They focus the majority of their study specifically on what engages students. Many students (76%) believe their engagement is higher in student-centered, hands-on learning environments. Additionally, 62% of students felt more engaged when they could apply content to real life. One student noted, "Instead of being told about science, you were like 'oh, this is how it's working'". Meanwhile, another student commented, "It's more interesting to me if I can connect it to something in my life" (Fredricks et al., 2017). Also noteworthy, 89% of students believed they were more engaged when they could work with peers and discuss ideas. One student mentioned, "It's just hearing other people's opinions or how to do it helps spark something. It helps me process information better" (Fredricks et al., 2017). Differentiation and flexible grouping allow for collaboration amongst peers to occur. Students crave the opportunity to connect learning with their personal life and connection can occur in a differentiated learning environment. Teachers can work to make the content personal and meaningful to each student or small group of students. A profound conclusion was 68% of students disengaged during teacher-directed instructional (lecturing) environments (Fredricks et al., 2017). In other words, over half of the class is not engaged, participating, or paying attention to anything transpiring throughout the class period. Thus, over half the class is not constructing knowledge and preparing to achieve at high levels. Again, the makeup of current high school students is vastly different than what has been seen in the past. Looking ahead, Fredricks et al. (2017) point to many essential alterations to the learning environment that will positively impact engagement.

Mindset, engagement, and motivation are all moving parts interacting within each student. The interaction is more favorable in some students and more negative in others. Interestingly, research ties these together much tighter. Degol et al. (2018) concluded having a growth mindset in mathematics leads to higher expectancy beliefs. If students are open-minded to learning mathematics, eventually, they will begin to develop belief in their abilities. Fredricks et al. (2017) build off this by concluding that higher perceptions of ability lead to higher levels of engagement in the classroom. Additionally, Keklik and Keklik (2013) note higher self-efficacy leads to higher achievement. Tying these research studies together leads to a tiered approach to understanding students. Once a student develops a growth mindset, they are likely to believe in their abilities. Once they believe in their abilities, they will be more engaged in the classroom. Inevitably, engagement and belief in oneself lead to increased achievement. Each development step within each student is as important as the step before and after. While the students have changed over time, the importance of this principle has remained the same.

Another parallel can be drawn between the Fredricks et al. (2017) study and a study completed by Liu and Chang (2019). Both observe the importance of teacher investment in each student's learning journey. Teacher support and interaction were positively associated with behavioral, emotional, cognitive, and social engagement (Fredricks et al., 2017) and motivation in learning (Liu & Chang, 2019). Specifically, Liu and Chang (2019) note one unit increase in student-teacher interaction was associated with a 0.182 unit increase in math learning motivation. Teacher support and interaction were most important to respondents in the Fredricks et al. (2017) study. It is hard to deny teachers have the power to be the best motivators and engagers in the classroom.

What motivates students to be engaged and achieve at high levels is a bit of a mystery. Student motivation differs from day to day and potentially minute to minute. For females, self-efficacy was found to be a motivating factor that had a positive impact on math achievement (Keklik & Keklik, 2013). Meanwhile, task value and self-efficacy were motivating factors positively impacting math achievement in males (Keklik & Keklik, 2013). Interestingly, females do not appear to be motivated by task value. Whereas male students need to value the mathematical task and have a high self-efficacy, female students need to believe in their abilities, and they will be motivated. Liu and Chang (2019) also confirmed through their research that student motivation was positively associated with student achievement. The better the students perform, the more motivated students will be in the subject area.

Students are comprised of their mindset, motivation, and engagement all working together behind the scenes. The teacher's job is to provide students with the most authentic, engaging, and productive learning environment possible. Fredricks et al. (2017) noted 68% of students disengaged in a direct instruction classroom environment. Students crave the opportunity to take control of their learning with a little structure and guidance the teacher provides. In addition, students crave the opportunity to apply learning to contexts outside the classroom and collaborate with others throughout the process. Through flexible grouping and differentiation, teachers might be empowered to provide these opportunities for students.

COVID-19's Impact on Students

While countless experiences have shaped the modern student, none is more prevalent than the impact of the COVID-19 pandemic. As a result of the pandemic, a bright light was left shining on all the educational shortcomings and adolescent mental health. How long will we work to undo the pandemic's educational and mental health effects? Approximately 72.4% of

students fell into the mild-severe depression umbrella when surveyed in 2021 (AlAzzam et al., 2021). High school students are among the most vulnerable populations at risk of depression and anxiety due to the pandemic (AlAzzam et al., 2021). Students have limited coping skills to manage everyday life's overwhelming nature. The research documented contains students' honest evaluations of what they struggle with and what areas in life they need help. These come directly from the students sitting in classrooms nationwide. Students are significant enough and awareness of their needs and struggles is even more crucial than before. To provide the best learning opportunities for students, all those involved in education must value and embrace the "COVID effects".

In addition to the 72.4% of students mild-severely depressed, 16.7% reported severe anxiety, and 58.1% reported mild-moderate anxiety (AlAzzam et al., 2021). The reported anxiety mean for females (10.1) was higher than what was reported in males (7.6). (AlAzzam et al., 2021). Additionally, the reported depression average was much higher for females (12.4) compared to males (9.4) (AlAzzam et al., 2021). Consistently, 28.3% of girls and 17.6% of boys reported the pandemic negatively affected their mental health and well-being (Lane et al., 2021). From these two studies, it appears female students are more likely to experience feelings of depression and anxiety than male students. Feelings of anxiety (2.98) were the second most common reported emotional distress item behind the inability to focus (3.38) during the pandemic (Hsieh et al., 2021). Fascinatingly, the average depression and anxiety scores were much lower for students who worked throughout the pandemic (AlAzzam et al., 2021). In other words, being active and engaged throughout the pandemic seemed to diminish the negative effect of the pandemic on mental health.

Not only has mental health been affected by COVID-19, but so has students' physical health. Fromel et al. (2022) collected data before the pandemic's beginning and returned two years later to see how the pandemic affected physical health. Near the end of the pandemic, 30.8% of male students were overweight/obese (+6.5% from pre-pandemic) and 14.1% of females were overweight/obese (+1.2% from pre-pandemic). Reported well-being scores were also significantly diminished as 50% of males reported a "good" level of well-being (-15.6% from pre-pandemic), and 34.9% of females reported a "good" level of well-being (-8.9% from pre-pandemic) (Fromel et al., 2022). While a higher percentage of females were impacted from a mental health standpoint, males were primarily impacted from a physical health aspect. Physical health and well-being affect other areas in the students' lives, and it can be dangerous when combined with mental health struggles.

As the world continues to emerge from the pandemic, there will continue to be concerns as the "COVID students" progress throughout their education. Since the start of the 2020 school year, educators have strongly emphasized academic remediation. Lane et al. (2021) observed heightened levels of test-related anxiety and perfectionism, and they believe anxiety is due to the strong emphasis on remediation. However, it is crucial to tread lightly with the approach to remediation. While schools hope to recover to pre-pandemic levels of achievement, it will not be accomplished easily or quickly. Additionally, educators are concerned with the burden young people had to shoulder throughout the pandemic and potentially still have to shoulder. One teacher notes, "he was doing his hardest to try and get all of his work done…while also having to work a part-time job to help his family make ends meet" (O'Toole & Simovska, 2021). Some families have never fully recovered from the pandemic and still rely on the income of students working part-time jobs after school. The educational professionals O'Toole and Simovska

interviewed also expressed concern about the regression. In particular, many professionals noted the English language learning demographic as the most impacted (O'Toole & Simovska, 2021). High schoolers have found ways to cope with the struggles of the pandemic but also identified "needed resources". The most reported resources students wanted more access to was social support and school counseling (Yeh et al., 2022).

As the world continues to return to normalcy after the pandemic, its effect will have a stranglehold on education for the foreseeable future. Educators looking to jump to remediation need to remember to teach with grace and understanding. Instead, it might be wise to continue to look for new, innovative ways to inspire a new generation of learners. How can teachers provide authentic, active, and engaging learning environments for their students? The current research project addresses the question by establishing the impact of flexible grouping and differentiation on student achievement and engagement.

Methods

Participants

As a result of the present action research study, the following research questions will be addressed: Does the usage of flexible grouping strategies and differentiated instruction affect student achievement and understanding in high school mathematics? As a result of flexible grouping strategies and differentiated instruction, will students' levels of engagement, pertaining to students' completion of in-class practice and homework, increase? The research study will occur at Norfolk Senior High School. The current ethnic makeup of the student body is 61% white, 29% Hispanic, 5% two or more races, 2% Black, 2% Native American, and 1% Asian. Approximately 39% of students are enrolled in the free and reduced lunch program, while 16% of students are eligible for special education services and 5% of students are English Language

Learners. Subjects for the study will be the students in two sections of team-taught Algebra 1. Between the two class periods, there are 48 students (36 boys, 12 girls), while 20 are served through an IEP.

Throughout the action research study, the researcher will study the effect of the independent variable (flexible grouping and differentiated instruction) on student achievement and engagement. Students will be placed in one of two flexible groups based on their level of proficiency on a formative assessment after a few days of instruction in a new Target. Students who do not demonstrate proficiency on the formative assessment will be placed in the remediation group. Meanwhile, students demonstrating proficiency will be placed in an independent learning group.

The students in the remediation group will receive 15-20 minutes of direct instruction per day. Direct instruction will include time for introducing new content and reviewing and re-instructing past concepts. Following the first 20 minutes of class, the final 25 minutes will be utilized as practice time. Practice will consist of written work on worksheets or completing Delta Math assignments. These practice assignments will require students to complete at most ten problems, but students can complete more if necessary to develop a greater level of understanding. Completion of assignments might require work out of class. Worksheets must be returned the following class day to check for completion, while Delta Math tracks the completion of assignments through its interface. Data on students' completion of practice assignments on time will be tracked throughout the remainder of the Target.

The students in the independent learning group will be able to work independently or with peers in their small group each day. Students will be assigned researcher-made Playposit videos to watch to introduce new concepts or review previous content. Videos will be concise

and no longer than 10 minutes. Following the video, students will engage in the practice, as well. Consistent with the remediation group, students will complete practice on similar worksheets and Delta Math assignments. Students who finish early will have access to enrichment opportunities through Plus Math, Mathigon, and PhET Interactives. The exact process for collecting assignments and checking for completion will be utilized as before.

Throughout the learning Target, the researcher will be the one to provide direct instruction to the remediation group during the first 15-20 minutes of class each day. Meanwhile, the co-teacher will be available to assist with the remediation group, manage behavior, and keep students in either group on task. During practice, the researcher and the co-teacher will be available to offer support when necessary. Both individuals are well-equipped to provide adequate support and offer immediate feedback to students.

Data collection will occur across eleven days of a fifteen-day Target. The students will complete introductory, exploratory activities and receive direct instruction for the first three days of the Target. On the fourth day, students will review and complete a formative assessment. Next, the researcher will group students based on their proficiency level. Here students will spend days five through eight completing work in their small groups before taking another formative assessment to evaluate growth on day nine. As a result, the researcher can shuffle students from one group to the other if evidence has shown remediation is necessary. On days ten through thirteen students will again complete work in their small groups. The final two days will include a whole class review and a summative assessment to conclude the Target.

The instrument for gauging the effect of flexible grouping and differentiated learning on student achievement will be common assessments composed through the PLC process. Assessment data will be scored based on a PLC-composed proficiency scale and stored in the

district learning management system (Infinite Campus). Data will also be collected to determine whether students learning in a flexible grouped environment are more engaged and complete more practice assignments compared to a regular learning environment. Data will be stored in a Google Spreadsheet, and the researcher will transfer assessment data from the learning management system to the Google Spreadsheet. Organized storage will help with the analysis of the data to determine the effectiveness of the intervention. To analyze any effect on student achievement, the researcher will use a Chi-Square Test of Association as the assessment data will be proficiency ratings. In addition, the researcher will use a Dependent Samples T-Test to analyze the effect on practice completion. The researcher gained IRB approval because the intervention was a research-based instructional practice.

Data Collection

Data collection will occur over eleven days throughout a Target spanning fifteen days. Formative assessment data will be collected through quizzes designed through the PLC small group process. Students will be formatively assessed on days four and nine with a summative assessment to conclude the Target on day fifteen. Evidence of student learning will be evaluated with a proficiency scale designed through the PLC small group process. Students will be able to receive a 1, 2, 2.5, 3, or 4 on the formative assessments and summative assessments. These scores will be recorded in the Infinite Campus grade book, and the researcher will transfer the data to a spreadsheet. Analysis of the data will occur much more smoothly as a result. In addition, the researcher will analyze the assessment scores for growth to determine the effectiveness of flexible grouping and differentiated instruction on student achievement.

The researcher will collect data over eight days to study the effectiveness of flexible grouping and differentiated instruction on student engagement through practice completion. Each

day both groups of students will have a practice/homework assignment to complete. Students will be given time in class to complete the assignment. If the assignment is unfinished at the end of class, students are expected to complete it before class the following day. Students who complete the homework assignment before the next day of class will receive a 1 for completion. Students who do not complete the assignment on time will receive a 0. The data points will be recorded in a spreadsheet and an overall completion percentage will be calculated after the eight practice assignments are assigned. It is important to note students are not evaluated on the accuracy of their work but based on the assignments being completed on time. Students are expected to show work for their assignments. Any assignment submitted with just the student's answers will be scored as a 0. Showing work is how students justify their answers, and this helps the researcher quickly determine if students simply wrote answers, so it appeared their assignment was complete. The researcher will compile each student's practice completion percentage before the study and store the percentage in the spreadsheet. The researcher will compare the students' practice completion percentage throughout the study with their prior practice completion percentage. Doing so will allow the researcher to conclude whether the instructional strategies effectively engage students in practice completion.

Findings

Data Analysis

Student Engagement and Completion of Practice

Table 1

Practice Assignment Completion - Independent Learning Group

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Pre-Research %	37	0	81	87	69	100	31	75	75	100	0	37	100	100	100	100	75	100	0	56	75	75	50	100	75	19
Post-Research %	62.5	62.5	100	87.5	75	100	62.5	87.5	100	87.5	50	37.5	100	100	100	100	87.5	87.5	50	62.5	75	100	37.5	75	75	37.5
Observed Change	25.5	62.5	19	0.5	6	0	31.5	12.5	25	-12.5	50	0.5	0	0	0	0	12.5	-12.5	50	6.5	0	25	-12.5	-25	0	18.5

Practice assignment completion percentages for students in the independent learning group before the research study, after the research study, and the observed change before and after.

Table 1 shows the practice completion percentage pre-research and post-research for the students placed in the independent learning group. As a reminder, these students showed proficiency in using the current skills on a formative assessment. Over half of the students in the independent learning group (15/26, 58%) completed more practice assignments than before the research study. It is essential to note some students had sizeable improvements, while others had slight improvements. The remaining 11 subjects (42%) in the independent learning group completed less homework throughout the research study compared to before or remained at a percentage consistent with before. Interestingly, as shown in Table 1, the students completing less practice throughout the study were students who completed 100% of their work beforehand.

A dependent samples t-test was conducted to determine if there was a significant change in students' engagement and practice completion following instruction using flexible grouping. Initial completion percentages showed students in the independent learning group completed their practice assignments 66% of the time before the study ($M = 0.66$, $SD = 0.340$). After learning in a differentiated learning environment through flexible grouping, students completed their practice assignments on time 77% of the time ($M = 0.77$, $SD = 0.217$). This data is reflected in Table 2. Results of the dependent samples two-tailed t-test reveal there was not a statistically significant difference between the engagement/completion percentage before and after the intervention, $t(25) = -2.66$, $p = .01$. Thus, the usage of flexible grouping and

Table 2

Practice Completiong Percentage Mean and Standard Deviation

	Pre-Research		Post-Research	
	M	SD	M	SD
Independent Learning Group	0.66	0.3402879	0.77	0.2170608
Remediation Group	0.19	0.22618041	0.47	0.25054054

Practice completion percentage mean and standard deviation for both learning groups before and after research.

differentiated instruction strategies did not profoundly affect the students' practice completion who were placed in the independent learning group.

Meanwhile, Table 3 displays the practice completion percentage pre-research and post-research for the students in the remediation learning group. Nearly all students (20/22, 91%) completed more practice due to those learning in the flexibly grouped environment. Two students (9%) in the remediation group completed less or an identical percentage of practice as before the study. Half of the students (11/22, 50%) completed no practice assignments before the research study occurred and were amongst the students having the most significant increases in completion percentage.

Again, a dependent samples t-test was conducted to find if there was a notable change in students' engagement and practice completion following the instruction in a flexibly grouped classroom setting. Initial completion percentages revealed students in the remediation learning group completed their practice assignments 19% of the time before the research study ($M = 0.19$, $SD = 0.226$). Following nearly two weeks of remediation, reinstruction, and involvement in a flexibly grouped learning environment, students completed their practice assignments 47% of the time ($M = 0.47$, $SD = 0.251$). This data is also reflected in

Table 3

Practice Assignment Completion (Engagement Levels) - Remediation Group

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Pre-Research %	0	0	0	56	56	0	37	0	56	18	37	0	56	0	0	37	37	0	18	18	0	0
Post-Research %	37.5	50	62.5	75	75	25	50	12.5	75	12.5	37.5	12.5	75	25	0	62.5	87.5	50	50	37.5	37.5	75
Observed Change	37.5	50	62.5	19	19	25	13	12.5	19	-5.5	0.5	12.5	19	25	0	25.5	50.5	50	32	19.5	37.5	75

Practice assignment completion percentages for students in the remediation group before the research study, after the research study, and the observed change before and after.

Table 2. Results of the dependent samples two-tailed t-test reveal a significant difference between the engagement/completion percentage before and after the intervention, $t(21) = -6.22$, $p < .001$. Therefore, due to flexible grouping and differentiated instruction strategies, students in the remediation group were more likely to complete their practice assignments.

Math Achievement

Students who completed the research study in the independent learning group have their formative assessment #1 and summative assessment data shown in Table 4. Noteworthy, throughout the study, a second formative assessment was given to students. However, the researcher only used it to ensure students were not falling too far behind in either group. Also, utilizing the PLC small group composed proficiency scale led the research to score students based upon the following parameters: 1 – needs support, 2 – approaching, 3 – proficient, 4 – advanced. Thirty-eight percent (10/26) of students in the independent learning group improved from their first formative assessment to the summative assessment. Meanwhile, 31% (8/26) of students did not improve or regress throughout the study, and another 31% (8/26) regressed from the first formative assessment to the summative assessment.

The proficiency score occurrences for students in the independent learning group on both assessments are provided in Table 5. Subsequently, a chi-square test of association was

Table 4

Assessment Scores - Independent Learning Groups

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Formative Assessment #1	2.5	2	3	3	3	3	1	2.5	4	2	1	1	2.5	2.5	3	3	2.5	3	1	3	2.5	2.5	1	2	1	1
Summative Assessment	2	3	2.5	3	2.5	2.5	2.5	3	3	2.5	2	2	4	2.5	3	3	2.5	2.5	2	2.5	2	2.5	2	2	2.5	1
Observed Change	-0.5	1	-0.5	0	-0.5	-0.5	1.5	0.5	-1	0.5	1	1	1.5	0	0	0	0	-0.5	1	-0.5	-0.5	0	1	0	1.5	0

Assessment score data for all students in the independent learning group and the observed change.

Table 5

Assessment Scores

	Independent Learning Group					Remediation Group		
Proficiency Score	1	2	2.5	3	4	1	2	2.5
Formative Assessment #1	7	3	7	8	1	17	3	2
Summative Assessment	1	7	11	6	1	9	8	5

Occurance of proficiency scores before research (first formative assessment) and after research (summative assessment) for both learning groups.

conducted to determine if the independent learning group's proficiency scores were significantly different. The chi-square test of association revealed no statistically significant difference before and after the intervention, X^2 (4, N = 26) = 7.2746, p = .122. Therefore, as a result of the study, students who were proficient at the beginning of the study tended to stay around the same level of proficiency while learning in a flexibly grouped environment.

Table 6 displays the formative and summative assessment data for the students in the remediation group. As a reminder, these are primarily students who were not proficient on the formative assessment or who have identified math learning needs. Half of the

Table 6

Assessment Scores - Remediation Group

Student	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Formative Assessment #1	1	1	2	1	2	1	1	1	1	1	1	1	2.5	1	1	1	2.5	1	2	1	1	1
Summative Assessment	2	2	2.5	2	2.5	1	1	2	2.5	1	2	1	2	1	1	1	2	2	2.5	1	1	2.5
Observed Change	1	1	0.5	1	0.5	0	0	1	1.5	0	1	0	-0.5	0	0	0	-0.5	1	0.5	0	0	1.5

Assessment score data for all students in the remediation group and the observed change.

students in the remediation group improved their proficiency level from the beginning of the study to the end. Meanwhile, 41% (9/22) of students remained consistent throughout the study, and 9% (2/22) regressed below pre-research proficiency levels.

Again, the proficiency scale occurrences for students in the remediation learning group on both assessments are provided in Table 5. As before, a chi-square test of association was conducted to determine if the proficiency scores were statistically different following a brief learning period in a flexible grouped environment. As a result, the chi-square test of association showed there was a statistically significant difference in the proficiency scores, X^2 (2, N = 22) = 6.02, p = .049, significantly significant at $p < .05$. Therefore, flexible grouping and differentiated instruction are practical strategies to promote achievement growth in students who lack proficient knowledge of current content.

Discussion

Summary of Major Findings

To summarize the research study, the effectiveness of flexible grouping and differentiated instruction depends on the group of students. In the current research study, the usage of flexible grouping strategies was an intervention leading to statistically significant data within a small group of low-ability learners. Not only were these students in the remediation group more engaged in the work they completed, but they achieved more because of learning in a flexibly

grouped environment. Meanwhile, data shows flexible grouping led to growth in the independent learning group. The growth, however, is not statistically significant. The research study results are consistent with other research studies occurring over the last ten years. Flexible grouping is most effective for low-ability learners struggling with conceptual understanding. In their study, Dube et al. (2013) showed students in subgroup 1, the students with the lowest ability, experienced the most significant growth throughout the study. While other subgroups of students improved, it was nearly as significant as those within subgroup 1. Benders and Craft (2016) concluded following their research, not all students respond the same way to instruction and intervention. This is seen in the current research, as there was a variance in the observed growth between the remediation and independent learning groups. Similarly, Briggs (2020) observed low-level learners in a homogenous learning group experienced more growth than learners of a similar level in a heterogenous learning group. The current study also compares with Briggs (2020) as growth was observed across all types of learners, but the growth of the high-level learning group was not nearly as significant.

Across the board, flexible groups have a small to significant effect on students in the math environment. The study led to a higher completion percentage of homework and higher assessment scores. However, could an argument be made that doing the practice/homework impacted the student's ability and achievement on assessments? As seen above in Table 3, many of the students in the remediation learning group had completed little to no practice before the study. Learning mathematical concepts involves repetition and practice. If these students went from doing nothing in class to doing even 50% more, would this profoundly affect their ability to do well on assessments? In the end, further research must occur, but might the repetition from completed practice have clouded the effect of flexible grouping strategies?

Limitations of the Study

One of the study's limitations was the challenge faced in keeping two groups of students motivated to work. Even with two teachers in the room, it was challenging to answer questions, assist and support, and maintain a desirable level of motivation in students. Cell phones and Chromebooks were a foreseeable distraction leading up the research study. A cell phone/device policy should be enforced if the study is to be completed again. Additionally, GoGuardian could be utilized to limit the access to distractions students have on their Chromebooks while working on their Delta Math assignments.

Additionally, the study was completed with a small number of subjects in one math content area. Would similar results be observed in a different math class (Geometry, Algebra II) with a more significant number of students? What about classes that do not include special education students or students with learning difficulties identified in math? It is hard to generalize the study's findings across all high school math classes as the study subjects were in a freshman-level co-taught class.

The length of the study should be considered in generalizing the study's results. The research study was conducted for one Target. Would similar results be observed if the study was to occur over multiple Targets, a semester, or an entire school year? The Target may have been conceptually less challenging than other Targets throughout the Algebra 1 curriculum. This one Target might have been one students enjoyed more than others. Potentially, students might have been led to perform better on assessments and be more engaged in learning the material. Again, it is hard to generalize the study's results across all Algebra 1 Learning Targets.

Finally, while flexible grouping was effective in the independent learning group, the lack of growth should be considered a limitation. What could be done to maximize the learning

potential of those students in the independent learning group? For some, the research study was structured just well enough to maintain their level of achievement from the beginning to the end. However, some students could not handle the responsibility of learning in a self-paced environment. Some students could not maintain their attention on activities they viewed as mundane. What can be done to get the most out of these students and to challenge, stretch, and enrich their learning potential?

Further Study

Further research is necessary to generalize the findings of the current research study across all types of high school math learning environments. Most of these further research opportunities stem from the study's limitations identified above. For example, a longer study would be instrumental in determining the long-term effects of the interventions. Rather than completing a study for one Target, future research should be structured throughout the course of a semester or the entirety of a school year. The short-term effects of flexible grouping and differentiated instruction strategies were observed in the study, and it is left to wonder about the long-term effects. Additionally, future research should focus on a much wider variety of subjects. Rather than limiting the study to one small cohort of students in high school mathematics, including students in different math classes (i.e., Geometry, Algebra II, Pre-Calculus). Research in a higher-level math class, like Pre-Calculus, would also provide further insight into the effects of the interventions on high-level students. Since these students are in a high-level math class, are they also more internally motivated to complete practice and perform well on assessments?

In addition to the opportunities above, future research must ensure technological distractions are eliminated from the learning environment. Essentially during individual practice time, a policy throughout the research study must be implemented to eliminate the temptation for

students to be off-task. By eliminating distractions, the research will fully capture the effects of the flexible grouping strategies. In addition, motivation and changes in homework completion percentage will be accurate based on students working in a distraction-free environment.

A final opportunity for future research would be to study the correlation between homework/practice completion and assessment scores. Does regularly completing the practice assignments lead to more success on assessments? For example, some students will never complete any assigned practice but will still be successful on a summative assessment. Meanwhile, the opposite is also true: students who complete all the assigned practice will experience lower summative assessment scores. Since the research study viewed practice completion and summative assessment scores as two different components, what would the research say about their effects on one another?

Conclusion

Currently, teachers find themselves amidst a challenging and frustrating time in education. The modern student has significantly evolved in the last ten years, especially in the last few years. The research study aimed to account for the COVID-19 pandemic's effect on students' physical, mental, emotional, and social well-being in providing the best educational environment. AlAzzam et al. (2021) found nearly 75% of students were mild-severely depressed and 58% of students suffered from mild-moderate anxiety. The pandemic opened eyes to adolescent mental health. Students' mental health challenges will impact their engagement, motivation, and educational achievement. Additionally, students are impacted by technology on a minute-by-minute basis. Technology has become a colossal distractor inhibiting students' ability to focus and complete quality work on time. To try and tackle this challenge, the current research study looked at instructional strategies like flexible grouping and differentiated

instruction to meet the unique needs of students. Liu & Chang (2019) and Fredricks et al. (2017) confirmed students were more engaged when their levels of interaction with a teacher were elevated. Another significant problem is students are underperforming in mathematics across the country. Based on the 2022 National Assessment of Education Progress (NAEP), eighth-grade mathematics scores decreased by an average of eight points since the last assessment period four years ago (NAEP, 2022). Despite everything they have encountered throughout the last handful of years, current students are performing at underwhelming rates in mathematics.

As a result of the study, it was concluded that flexible grouping strategies have a statistically significant positive impact on low-level learners. The students in the remediation learning group experienced significant increases in practice completion and assessment scores throughout the study. Meanwhile, higher-level students in the independent learning group did not experience similar increases in practice completion and assessment scores. The study's results were like other studies of flexible grouping strategies and their effects on student achievement. Through their studies, Dube et al. (2013) and Briggs (2020) confirm flexible grouping strategies are particularly effective in low-level learners.

Moving forward, the current work and other pieces cited throughout the study should be impactful for educators. With this research and information in mind, teachers should be well-equipped to provide authentic and engaging learning environments for their students. For example, when instructing low-level students, research shows a classroom structured with flexible groups effectively meets these students' learning needs. Meanwhile, further research still needs to occur to determine the most effective instructional strategies for meeting the needs of high-level learners.

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