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Implementing and Managing Student Choice in Independent Online

Mathematics Learning:

What Motivates Students?

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Abstract

This teacher action research study investigated the effects of providing choice in independent online algebra learning on high school students' motivation and achievement in a three-station hybrid model. This study was conducted in a large urban high school in eastern Pennsylvania containing approximately 2,800 students. Participants included forty-five ninth grade Algebra 1 students. Data collection methods included student surveys, student work samples, formal and informal assessments, participant interviews, anecdotal notes, and teacher observation. Methods of data analysis included analytic and reflective memos, review of student work and survey results, coding of field log, and construction of bins and theme statements. Findings suggest that in order to increase students' motivation and achievement in independent online algebraic choice-based content, the teacher and students must engage in habitual reflection and class discussions with opportunities for all to provide input and suggestions for improving choice-based content. In addition, the teacher must provide students with ongoing support, feedback, and guidance, select content that elicits students' interests, frequently monitor student progress, consistently assess student understanding, set mutual goals with students, and effectively manage and format choices in an online setting.

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Researcher Stance

It has been quite a journey when considering my academic and professional career as an educator. As I remember, I never had academic struggles in elementary school. In fact, I got straight A's from fourth to sixth grade. I remember being extremely bored in school and conscious that I had exceeded my peers' level of academic performance, especially in my math classes. Instead of partaking in whole-class instruction, I was often allowed to play games on the computer. I definitely knew my stuff in elementary school, and I must give credit to my teachers, but, when looking back at the situation, it perplexes me that I was never challenged to continue my mathematical development. It seemed as though once I proved my understanding, I was put in a corner and forgotten about. Why, I wonder, did I never have the opportunity to complete extension work or to continue learning new mathematical content?

As I got into high school, I began losing interest in education altogether. Many environmental and biological factors contributed to this dilemma, but I cannot pinpoint exactly what caused my change in attitude. Despite my lack of interest, I was still able to graduate despite severely underperforming. I regret not challenging myself more, but I knew I had the capacity to pass exams even when I did not prepare for them. Little did I know that I was setting myself up for a rude awakening in college.

I graduated from high school in 2007 and enrolled in several basic classes at my local community college the following fall including Biology, and English. However, as I took my first assessment in Calculus, I remember a sense of hopelessness and confusion, which were new feelings for me in a math course. For the remainder of the semester I often stayed after class for extra help and made frequent visits to the tutoring department. I wound up passing the class with a C, but it was a struggle. As a result of this experience, I completely altered the way I approach school.

I transferred to Temple University in fall of 2010 and proudly graduated in 2012 with a GPA over 3.6. During my final year at Temple University, I was assigned to student teach at a struggling public high school in North Philadelphia. The school was dirty, falling apart, and lacked significant resources. Furthermore, too many teachers at this school displayed a level of indifference to students' wellbeing that shocked me as a pre-service teacher. Much of the traditional instruction that I observed was not effective, and when I tried to incorporate my own more constructivist approach, I was scolded for trying to change things. Two years after I graduated from Temple University, the school in which I student taught was shut down, and I knew the kids deserved better.

My experiences as a student and pre-service teacher helped me develop a fundamental belief about human beings and how they learn, needing to be motivated, supported, and challenged. I constantly reflect on my previous

schooling, which allows me to identify and help students who do not initially perform to their potential. I aim to motivate my students with emerging ideas and resources and also challenge my students at an appropriate level while supporting them along the way.

I began my teaching career at a large urban public high school in 2013. As I look back, I feel as though I did pretty well for a first year teacher. I stumbled a bit along the way, to be sure, but these ‘stumbles’ only made me a stronger educator. I can still recall in detail many of the things I did wrong or poorly, and I consciously seek to avoid making these mistakes again as I plan for future classes. I am still teaching at this school and I love it. I especially love the people I work with, as my colleagues offer continued support and advice. I wholeheartedly feel lucky to be at this school.

During the 2015 – 2016 school year, I was selected to pioneer a hybrid-teaching program, the goals of which were to raise students’ test scores, and ultimately, improve the manner in which students learn algebra by using a newly designed three-station hybrid model. Hybrid classes have certain characteristics that can be difficult to plan for and incorporate, such as collaborative learning activities and independent online learning. At times, the hybrid model was restrictive in nature, in that I felt pressured to include station-specific activities that were underdeveloped. For instance, a bulk of the issues I experienced running a hybrid class occurred with the planning and incorporation of

collaborative activities. Many of the collaborative activities I planned for ultimately failed to produce meaningful learning experiences. At times, I had intuitions that the activities were of poor quality, but I felt pressured to maintain the hybrid model. Finding time to locate meaningful activities proved to be a challenge as I ran the hybrid model. However, I have spent the last two years researching and developing better and more effective projects.

I have come a long way with planning collaborative algebra activities. However, my new goal is to improve students' quality of learning at the independent station. The independent station is where students utilize newly purchased Chromebooks and IXL software to practice and learn algebraic concepts. While IXL is a great tool, I have been guilty of overusing it in the past. I want students to experience more diversity in the activities they complete online, and I think they need a variety of activities in order to stay interested and engaged at this station. During my time as a hybrid teacher, I have seen students look bored and uninterested at the independent station. Hence, I felt compelled to find resources and strategies for improving my instruction. Anything less on my part would be a disservice to my students, and quite frankly, I take too much pride in my teaching not to improve instruction to meet my students' needs.

At the end of this research project, I hope to have developed an educational intervention to alleviate the problems my students face with independent online learning by providing students with choices in learning

activities at the independent station. I hope that by increasing motivation to learn at the independent station, students will, in turn, demonstrate more mastery of content and higher levels of achievement.

Students will play an important role throughout this research. While participation in this research is not mandatory, all students will be exposed to the same resources regardless of consent to participate. Students will be required to complete independent online assignments, per usual, with the added feature of having a choice. The data I collect during this study will largely shape how I continue or alter the approach to providing students choice in independent learning, as is clarified in my Trustworthiness Statement. This will take some considerable planning time and reflection, but it is an undeniably important aspect of my research project, and I need to do it right. After all, the main reason for completing this research is to strengthen my skills as an educator and give my students the best learning opportunities possible. Accordingly, I ask, “How can I use choice to increase my students’ motivation to complete independent online work?”

Literature Review

Introduction

We make choices everyday. We choose what we want to wear, which routes to travel, what we want to eat, and how to devote our time, just for starters. Choice can make us happy or overwhelm us. Choice can elicit liberation or paralysis. In education, research indicates that student choice can increase motivation and achievement when managed effectively or cause frustration and despair when managed poorly (Schwartz, 2009). A review of literature suggests that in order for student choice to be effective at increasing motivation and achievement in an independent online setting, choices must be meaningful, organized and accessible, and allow for teacher guidance and support as they are being implemented (Bonk & Lee, 2017; Kashden & Silvia, 2009; Kayalar, 2016; McCombs, 2012; Schwartz, 2009; Song & Bonk, 2016).

To understand why student choice is identified as an effective intervention strategy in this study, it is worth reviewing important historical developments including the rise of new learning formats such as hybrid learning models. (Horn & Staker, 2011). There are many strategies for increasing motivation and achievement in mathematics that help shape the design of choice-based curriculum (McCombs, 2012; Kilpatrick, Swafford, & Findell, 2001). More recently, there have been developments into the best practices for managing and monitoring students' interactions with independent online choice-based activities,

but documented research on the topic is essentially nonexistent (Song & Bonk, 2016).

Historical Background

New formats and ways of learning. In an increasingly technologically driven world, Curtis (2006) suggests that traditional instructional methods and strategies fail to meet the needs of contemporary students. With the emergence of new and affordable technological tools such as interactive software and learning management systems, educators search for ways to incorporate these tools into the curriculum in order to break away from outdated forms of instruction. Moreover, educators, policymakers and researchers alike look for ways to make use of these emerging technologies that can better prepare students for an increasingly global and complex world (McCombs & Vakili, 2005). Consequently, online learning has experienced tremendous growth recently in the United States (Horn & Staker, 2011; Allen & Seaman, 2010).

What started out initially in strictly distance-learning environments, online education and learning have come to take many forms. “Educators and entrepreneurs are increasingly creating blended-learning environments—where rather than doing the online learning at a distance, students learn online in an adult-supervised school environments for at least part of the time” (Horn & Staker, 2011, p.2). It is important to distinguish the difference between online learning (e-learning, distance learning) and hybrid learning (blended learning).

Online learning, e-learning and distance learning all refer to the same principles in which “at least 80 percent of the course content is delivered online” (Allen & Seaman, 2010, p.5). Further, “Online courses, distinct from hybrid courses, provide computer-based instruction to students geographically separated from their teacher” (Cavalluzzo et al., 2012, p.1). Conversely, in hybrid or blended courses, “students engage in a variety of face-to-face whole class, small-group, and individual activities to learn the targeted knowledge and skills of the course” (Cavalluzzo et al., 2012, p.1). Further, blended courses typically include 30 to 80 percent of the content delivered online while offering some element of student control (Allen & Seaman, 2010; Horn & Staker, 2011).

Contemporary hybrid courses are offered in a variety of formats and models. For instance, Horn and Staker (2011) outline six different models of hybrid learning, known as face-to-face driver, rotation, flex, online lab, self-blended, and online driver. Meanwhile, Stevenson and Zweier (2011) describe another hybrid model that focuses on five key components including online individualized remediation of prerequisite skills, interactive lectures using materials shared across all course sections, facilitated group work in a weekly supplemental contact hour, online homework with instant feedback, and common student assessment tools shared across all course sections.

Motivation and achievement. Regardless of learning modality, the importance of student motivation cannot be overlooked (McCombs, 2012). To

define motivation, this study refers to the work of Kayalar (2016), in which motivation is described as “the desire and energy to complete a task, achieve the target or reach a goal” (p. 868). According to Kayalar (2016), there are two types of motivation, namely intrinsic and extrinsic. Relating motivation to education, intrinsically motivated students take part in activities out of enjoyment and self-realized importance of the activity. Extrinsically motivated students, on the other hand, take part in activities because they desire something of value, such as a letter grade.

There are many factors affecting motivation, both intrinsic and extrinsic. According to Kayalar (2016) “factors such as relevance, control and choice, challenge, social interaction, anticipated sense of success, need, novelty, cognitive dissonance or discrepant events appear to influence motivation in learning” (p. 868). Meanwhile, McCombs and Vakili (2005) discuss additional factors affecting students’ motivation such as individual beliefs, emotional states, interests, goals, and habits of thinking. However, sometimes factors that impact student motivation are not as obvious, such as linguistic proficiency. For instance, Kebritchi, Hirumi, and Bai (2010) determined that students’ proficiency in the English language directly impacted their motivation to complete curricular tasks.

Specific to an algebra course, Bokhove (2014) defines success as a student’s development of algebraic expertise, or mathematical proficiency. Moreover, Kilpatrick, Swafford, and Findell (2001) suggest that mathematical

proficiency comprises five strands, namely conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Conceptual understanding is defined as “the comprehension of mathematical concepts, operations, and relations” (Bokhove, 2014, p. 116), and procedural fluency as the “skill in carrying out procedures flexibly, accurately, efficiently, and appropriately” (ibid.). Furthermore, “the five strands are interwoven and interdependent in the development of proficiency in mathematics” (Bokhove, 2014, p. 25). Stevenson and Zweier (2011) share a similar definition of student achievement in mathematics course, in which success in Kilpatrick, Swafford, and Findell’s (2001) five strands of mathematical proficiency can be referred to as content mastery. In less technical terms, some researchers observe a student’s overall course grade as a measure of success, while other researchers in mathematics education measure success using students’ scores on selected standardized tests (Amro, Mundy, & Kupczynski, 2015; Cavalluzzo et al., 2012). Generally, achievement or success in an academic sense is thought of as a student’s ability to meet outlined objectives or goals, or obtain a specified numerical or letter grade.

Despite a current lack of research on student choice in independent online learning, there exists substantial research into motivation, achievement, learning mathematics in an online setting, and student choice in general (Aichele et al., 2012; Curtis, 2006; Heppen, 2012; Weems, 2002). McCombs (2012) suggests that

student choice in independent online learning activities can increase motivation and achievement. However, identifying what makes choices effective and determining the best way to structure the student choice content requires a thorough review of previous research and case studies related to motivation, achievement, and online learning (McCombs, 2012; McCombs & Vakili, 2005; Kayalar, 2016; Kebritchi, Hirumi, & Bai, 2010; Hardway et al., 2017, Bonk & Lee, 2017).

Motivation and achievement in an online setting. In their study, Aichele et al. (2012) observed college algebra students' perspectives and attitudes about online learning. Aichele et al. (2012) reported that the use of technology and the structure of a course directly impacted perceptions of student participation. Students who responded positively expressed that technology enhanced their learning experiences, while students who responded negatively reported that technology could be detrimental to their learning experience. "With less direct access to teachers in the traditional sense, students must assume more responsibility for their own learning. As seen in the study, this trade-off was preferred by some while rejected by others" (p.60). Evidently, simply being aware that a course contains technological aspects immediately impacts one's attitude and motivation, whether positively or negatively.

Luckily, for those students whose attitudes and motivation are negatively affected by awareness of course-required technology, there are several research-

supported strategies for increasing motivation and achievement in an online setting (Bonk & Lee, 2017; Hegeman, 2015; Kayalar, 2016; McCombs & Vakili, 2005; Song & Bonk, 2016; Vai & Sosulski, 2016).

First, effective instructor feedback plays a huge role in online learning, particularly when observing student achievement (Bokhove, 2014). Without feedback in online learning, students are likely to be unaware of their progress and may experience difficulties when determining how to continue their learning. In other words, feedback can increase students' autonomy. Bokhove (2014) suggests using a three-step process for effective student feedback: "(i) intentional crises are provoked in students, (ii) enable students to overcome these crises by providing feedback, and (iii) to avoid dependency on feedback, fade the feedback in the course of the digital intervention" (p.29). Combining Bokhove's (2014) feedback model with student choice entails that students are provoked with a problem or objective, given a set of choices in independent online learning, complete a designated or specified number of choices, receive feedback on the choices completed, and slowly receive less feedback as they progress through the online activities.

The next strategy for increasing motivation and achievement in an online setting lends itself directly to the mathematics field, specifically algebra. By using certain interactive manipulatives and online tools, students have a greater opportunity to acquire abstract algebraic concepts, and these tools "provide

experiences that help students discover and verify the relationships among symbols and representations of algebraic operations” (Cavanaugh et al., 2008, p. 68). Furthermore, “interactive manipulatives are effective for helping at least some students to develop abstract concepts and that interactive tools should be available for students who need them” (Cavanaugh et al., 2008, p. 87). According to Cavanaugh et al. (2008), these tools include the use of computerized and online graphics calculators, which are particularly useful for visual learners to see and solve algebra problems. Research suggests that tools for visualizing and manipulating algebraic equations and graphs amplify students’ cognitive abilities and better organize students’ thought patterns and current mathematical understandings (Cavanaugh et al., 2008, p.70).

The next approach is a strategy for education in general, but its principles can be applied to online settings. Curtis (2006) discusses how constructivist approaches to teaching and learning can improve student attitudes, particularly in a mathematics course. In a constructivist classroom, teachers do not simply tell students information, because this can lead to passivity in learning. Instead, students are encouraged to learn and do for themselves. This constructivist approach closely resembles the ideas of the previous two approaches discussed, Bokhove’s (2014) feedback strategies and Cavanaugh et al.’s (2008) interactive tools strategies. A constructivist approach in online learning would entail that students explore an idea or concept without overly explicit guidance, receive

feedback, continue to learn and explore using online tools and manipulatives, and slowly have feedback fade while strengthening mathematical understandings by continuing to complete online activities. By doing this, students have a better chance of “fostering a positive disposition toward mathematical learning and problem solving” (Curtis, 2006, p.4).

Another strategy for improving online learning involves teacher presence (Hegeman, 2015). At first, the idea of teacher presence in an online setting may be difficult to imagine. However, teacher presence in an online setting does not necessarily refer to the teacher being physically present. For instance, teacher presence can take the form of electronic feedback, as discussed with Bokhove (2014). Meanwhile, Hegeman (2015) articulates that by replacing publisher-generated learning aids with instructor-generated video lectures, an online course can place the instructor in the role of content provider, enhancing teacher presence in the online environment. From Hegeman’s (2015) work, it is clear that students should have a choice of videos that include instructor-generated content in order to increase teacher presence in the online portion of the course. While creating instructor-generated video lectures entails a substantial workload for the teacher, Hegeman (2015) suggests that the benefits of doing so are worth the teacher’s initial investment in time. Hegeman’s (2015) study found that students were more motivated to view and interact with video content that was instructor-generated versus video content that was publisher-generated.

Next, Kebritchi, Hirumi, and Bai (2010) suggest the use of games in online learning to increase achievement and engagement. According to this research, “games had a significant positive effect on students’ mathematics achievement in the public high school setting” (p. 435). In addition to mathematical achievement, Kebritchi, Hirumi, and Bai (2010) state that gaming had a positive impact on student engagement. “Although the mathematics games did not provide authentic mathematics problems, issues and experiences as required by experiential theory, they did provide hands-on activities and simulated missions that engaged students in learning by doing and experiencing” (p. 436). It is also important to point out that Kebritchi, Hirumi, and Bai (2010) used just one type of mathematics gaming software, known as DimensionM™.

According to Murphy et al. (2016), another strategy for improving students’ experiences in an online learning environment is to use a “flipped” approach. The flipped approach, in which students watch introductory videos online independently and then complete homework type practice with the instructor, can be an effective strategy to increase student achievement in a hybrid course. “Overall benefits of the flipped learning experience have been reported to be the ability of students to determine their own pacing, rewind and re-watch video lectures as need, and watch in a time and place that is convenient for them” (Murphy et al., 2016, p. 654). Murphy et al. (2016) also suggest that the flipped

approach can increase student engagement, particularly in science and mathematics courses.

Collectively, providing appropriate feedback, utilizing interactive tools, applying principles of constructivism, teacher presence, the inclusion of games (gamification), and flipped approaches are all research-supported strategies for enhancing the student experience in online learning (Bokhove, 2014; Cavanaugh et al., 2008; Curtis, 2006; Hegeman, 2015; Kebritchi, Hirumi, & Bai, 2010; Murphy et al., 2016). While providing student choice in independent online learning can increase student motivation and achievement, research suggests that these choices must meet certain criteria to be effective. Upon review, the three most important aspects for student choice to be effective include making choices meaningful, making choices organized and accessible, and providing adequate support and guidance (Bonk & Lee, 2017; Kashden & Silvia, 2009; Kayalar, 2016; McCombs, 2012; Schwartz, 2009; Song & Bonk, 2016).

Student Choice in Independent Online Learning

“In effect there is a growing need for allowing greater learner choice and fostering volition and inner will or purposeful striving toward some action or learning gains” (Bonk & Lee, 2017, p.38). Student choice, or a student’s ability to select from two or more options, has long been considered an effective motivational strategy in education to increase student autonomy and motivation. McCombs (2012) relates motivation, autonomy, and choice, by stating,

“motivation is related to whether or not students have opportunities to be autonomous and to make important academic choices. Having choices allows children through young adults feel empowered that they have control or ownership over their learning” (p.1). In addition to choice and control, in order to stimulate intrinsic motivation amongst students, learning tasks being provided in the choices must be of optimal novelty and difficulty and relevant to personal interests (McCombs & Vakili, 2005).

When relating student choice to achievement, Bennett (2012) states, “Requiring all students to attempt mathematics for which they did not feel prepared or did not believe they could be successful does not instill confidence or increase their-self efficacy” which are both important when considering and promoting student achievement (p.170). In terms of mathematics learning, choice is important in helping students develop mathematical competencies and proficiencies because students become more motivated, assume greater responsibility for their learning, and become more engaged (Bennett, 2012).

Collectively, when providing student choice in an online environment, McCombs (2012) offers several suggestions. These suggestions include tying learning to students’ personal interests, letting students work together to meet learning goals, giving students a voice in their own learning, setting clear performance standards from the start, helping students develop a sense of ownership over the learning process, providing feedback to students, encouraging

students to assess their own learning progress, providing students opportunities to ask questions, encouraging self-monitoring, using mistakes as learning opportunities, controlling negative attitudes and emotions, providing praise for extra effort, involving students in the setting of objectives and learning goals, helping students define their personal learning goals and objectives, appealing to students' interest and curiosity by introducing the unfamiliar with the familiar, rewarding success, and using self-reward strategies to increase motivation and achievement. These ideas can be summarized into three specific categories; making choices meaningful, organization and accessibility of choices, and instructor guidance and support.

Making choices meaningful. There are several strategies to consider when making choices meaningful for students. For choices to be considered meaningful, the choices must demonstrate relevance and authenticity, as well as incorporate effective technological resources. The relevance and authenticity of choices drastically impacts student motivation (Curtis, 2006; Bennet, 2012; McCombs, 2012; Kayalar, 2016). When students find relevancy in the content, or feel an authentic personal connection with the material, motivation for learning increases and students feel encouraged to continue learning. Kayalar (2016) explains, "Students get encouragements in lessons with which they connect, and apply them to their own life and experiences," (p. 869). A key strategy to increase the relevance of content is to have the students actively involved in the creation

process. When students have a voice, they are more motivated to engage in learning as they have the opportunity to maximize content relevance (Kayalar, 2016). Similar to making student choices relevant and authentic, the choices must be able to elicit students' curiosities and interests. Kashdan and Silvia (2009) undoubtedly make the connection between curiosity and motivation to learn. "Curiosity motivates people to act and think in new ways and investigate, be immersed, and learn about whatever is the immediate interesting target of their attention" (p. 368). Kashdan and Silvia (2009) review a variety of studies on interest and curiosity, but in terms of education, the best teachers are able to elicit this curiosity by catering content to students' interests. This cannot be accomplished, however, unless the teacher knows what it is that interests students. McCombs (2012) provides many strategies for eliciting curiosities and interest, including introducing the unfamiliar with the familiar, while Kayalar (2016) mentions that interest surveys can be a helpful tool when designing content catered to students.

To make choices meaningful in an online setting, instructors must seek technological tools that can reduce cognitive complexities, enhance curricular content, and provide a fun alternative way to learn the content (Cavanaugh et al., 2008). In a 2010 market study conducted by Innosight Institute, teachers in hybrid environments report on their experiences with technology and share characteristics of effective technological tools (Horn & Staker, 2011). Teachers in

this study suggest providing an assimilation of online content from different sources into the student experience in order to maximize motivation and learning opportunities. This entails finding hundreds of hours of high-quality, relevant, authentic, and dynamic online content that is aligned to standards. Cavanaugh et al. (2008) suggest that instructors offer computerized, online manipulatives such as graphing calculators as a means to increase student motivation and to help visual learners see and solve math problems. Hegeman (2015) suggests using instructor-generated videos in place of provider-generated videos to improve student learning by giving the online course strengthened teacher presence. Meanwhile, Hardway et al. (2017) argue that students achieve more success online when given text-based resources as opposed to video-based resources. While many strategies exist, so, too, do free and open online resources. However, research into free and open learning materials and resources and what learners encounter as they explore them lacks modern research (Bonk & Lee, 2017).

Instructor guidance and support. When using student choice to increase motivation, teacher guidance and support remain vital. According to McCombs (2012), “teachers need to learn how to help students develop the ability to make appropriate choices and take responsible control over their own learning” (p. 2). Further, Schwartz (2009) states, “children must learn how to choose so as to minimize regret and unreasonably high expectations” (pp. 399-400). Hence, it is not enough for the teacher to simply provide choices, but the teacher must also

model and explain how to use the choices responsibility and how to monitor the positive or negative consequences of their choices. “This is a trial-and-error process that requires teacher support, modeling, and encouragement” (McCombs, 2012, p.2). An additional concern includes educators’ ineffective or inappropriate use of technology in a hybrid or online setting. For instance, Cargile (2015) states, “ineffective use of any instructional strategy could increase students’ rampant dislike of mathematics and jeopardize reforms aimed at increasing mathematics achievement” (p.35). Therefore, effective teacher support and guidance are essential when students engage with independent online mathematics content.

The first realm of support when providing students with choice-based assignments involves the setting of clear performance standards. When setting performance standards, students need to know exactly what is expected of them, how they will be graded, and what supports will be available to them when developing new skills or understandings. In order to foster more positive student development and engaged learning, performance outcomes should focus on each student’s strengths and abilities while keeping the diverse backgrounds and experiences of each student in mind (McCombs, 2012).

Helping students develop a sense of ownership over the learning process is essential when considering independent work. “As part of the process of offering students meaningful choices, teachers must be clear about how the choices relate to the learning objectives or standards” (McCombs, 2012, p.4). As an example,

the teacher can provide an explanation about how to use supplied choices to demonstrate mastery of a concept, how to approach particular assignments, whether to work independently or with peers, and how to achieve at their distinct competency level.

In addition, to maximize the benefits of providing student choice in independent online learning, the instructor needs to help students become more self-directed learners. Self-directed learning can be defined as “a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating outcomes” (Knowles, 1975, p. 18). In self-directed learning, the learners need to be empowered to make their own learning decisions (Downes, 2010; Song & Bonk, 2016). An important aspect of self-directed learning is that learners can choose and personalize their learning content and necessary tools through a variety of online resources, which leads to the success of independent learning (McLoughlin & Lee, 2010; Song & Bonk, 2016).

Another important realm of support to consider when using choice-based independent work involves helping students learn how to monitor their learning and self-assess their progress as they learn. In order to help students assess their own learning process, one may consider using charts or journals (McCombs, 2012). These aides can help students evaluate the progress they are making as

they acquire new knowledge and skills. By monitoring their learning process and keeping track of successes, students feel a heightened sense of motivation, ownership, and responsibility for the role they play in these successes. McCombs (2012) provides several other tips for self-assessment and progress monitoring including goal sheets, while Vai and Sosulski (2016) suggest having students create an ongoing online portfolio of the work they have completed or using checklists to stay organized with online work.

Organization and accessibility. The organization of content in an online setting can be challenging. When introducing and organizing choice-based curriculum in an online setting, the challenges become greater. Factors such as format and structure, accessibility of content, how time is used, and communication require understanding and frequent adaptation (Vai & Sosulski, 2016). As incorporating choice based content into independent online learning gradually shifts control of the learning environment toward the learner, “there are problems, challenges, and opportunities for learners related to effective resource use,” such as less immediate feedback, learner procrastination, and feeling overwhelmed by resources being presented (Bonk and Lee, 2017, p. 39). Specific to online settings, “Instructors creating Web-based courses must confront pedagogical, technological, organizational, and motivational challenges” (Weems, 2002, p. 10). These challenges include confusion with navigation, technical and hardware issues, and resentment of students to try online software and tools

(Aichele et al., 2012). Furthermore, there are concerns that online learning and student-centered learning “can result in a chaotic classroom environment, and that some students won’t progress quickly enough to cover the required curriculum” (Richmond, 2014, p. 7). Unmistakably, determining how many choices to include and the structuring and formatting online content being offered as choices remain organizational challenges that can influence student motivation and achievement.

Previous research indicates that providing students with too many options or choices can produce paralysis rather than liberation (Schwartz, 2009). Moreover, “If one manages to overcome paralysis and choose, evidence suggests that the quality of performance deteriorates with increases in the number of options” (Schwartz, 2009, pp. 397-398). Beyond paralysis and impaired performance, large choice sets seem to undermine the satisfaction one gets from a decision and can lead to enhanced regret and enhanced concern over missed opportunities (Schwartz, 2004). In addition, large choice sets can raise expectations about how good the chosen option will be and consequently can result in disappointment. The experienced result of a decision suffers when compared against these high expectations (Schwartz, 2009). Evidently, more choice is not necessarily better, but the quality of choices being provided matters. Accordingly, the teacher must be willing to review seemingly endless supplies of online content while documenting and listing effective resources. It cannot be

stressed enough, this process requires a dedication of time on the teacher's behalf (Vai & Sosulski, 2016).

Vai and Sosulski (2016) suggest utilizing a learning management system (LMS), which is a program used to create and manage an online course. Common LMSs include Schoology, Canvas, Moodle, Google Classroom, and Blackboard. In order to use these platforms, basic computer literacy is required, such as understanding how to properly save, upload, and download files. One organizational strategy for the delivery of online course content that can boost student motivation may include utilizing a flipped approach. In a recent study, Murphy, Chang, and Suaray (2016) compared student attitudes in a collaborative and flipped algebra course. Overall, findings indicate “students felt more confident about their ability to learn mathematics independently, showed better retention of materials over time, and enjoyed the flipped experience” (p. 653). Moreover, “benefits of the flipped learning experience have been reported to be the ability of students to determine their own pacing, rewind and re-watch video lectures as needed, and watch in a time and place that is convenient for them” (p. 654).

Vai and Sosulsk (2016) offer many other organizational strategies to consider for online content including setting clear deadlines and guidelines, reviewing how to navigate the LMS, allowing for timely feedback, sending out digital reminders of due dates, using simplistic and clear language when creating

learning outcomes, providing a means of technical support, and creating a course calendar, and using checklists.

While student choice in independent online learning presents an opportunity to increase students' motivation and achievement, as is apparent, there are many organizational challenges to be aware of and hurdles to overcome when creating and initiating student-choice based work, especially in an online setting. From dedicating time to search for resources to formatting and presenting the options, choice-based independent work is clearly demanding on the part of the teacher. As the literature suggests, student choice in independent online learning, when organized and managed appropriately, increases students' motivation, autonomy, engagement, and achievement (Vai & Sosulski, 2016; Bonk & Lee, 2017; Weems, 2002; Aichele et al., 2012; Richmond, 2014; Schwartz, 2009; Schwartz & Ward, 2004; Murphy, Chang, & Suaray, 2016).

Summary

Stemming from the ineffectiveness of traditional teaching and learning methods, public calls for change, and newly accessible and available technologies, online learning was born and continues to grow in contemporary education at all levels. With the rise of online learning came the rise of new teaching formats, such as hybrid learning. As new formats of teaching and learning developed around online learning, so too did new hurdles and issues such as poor course designs and ineffective management of online resources. In light of

these new issues, researchers continue to discover best practices and effective intervention strategies that can be applied to newly designed online and hybrid courses (Bonk & Lee, 2017; Vai & Sosulski, 2016; McCombs, 2012).

Several case studies presented cite the need for more research in the field of online and hybrid education. For instance, Ashby, Sadera, and McNary (2011) state, “Future research must be conducted to further examine success rates of developmental students in online and blended learning environments” (p.138). Similarly, Heppen (2012) suggests, “future research on online courses should compare online options to various other relevant business-as-usual situations and curricula” (p.12), while Murphy et al., (2016) implore “we urgently need more educational research to examine different modes of instruction, the effects these instructional methods have on students, and the contexts in which the instruction takes place” (p.668). In addition, Amro, Mundy, and Kupczynski (2015) state “the need for more research with regard to online learning and its impact on student achievement is warranted, particularly in establishing the characteristics of successful students and course design” (p.2). Student choice is a widely accepted strategy for increasing motivation and achievement, but more research is needed into the effects of providing student choice in an online setting and how to manage student choice in an online or independent hybrid station.

In conclusion, online and hybrid learning is a fairly new phenomenon in education, and effective strategies for online learning such as providing student

choice-based assignments are still developing and ongoing. After a comprehensive review of literature, it is apparent that making choices meaningful, appropriately organizing the choices, and providing sufficient support and guidance are all challenging and demanding tasks that require diligence on the part of the teacher to ensure the online content provided to students enhances learning experiences and promotes motivation and achievement (McCombs, 2012). Moreover, when initiating choice-based content, teachers must make sure they are tying learning to students' personal interests, giving students a voice in their own learning, setting clear performance standards from the start, helping students develop a sense of ownership over the learning process, providing feedback to students, encouraging students to assess their own learning progress, involving students in the setting of objectives and learning goals, helping students define their personal learning goals and objectives, and structuring and formatting online content effectively (Hardway et al., 2017; Bonk & Lee, 2017; Vai & Sosulski, 2016). By providing meaningful, accessible, and organized choices to students completing independent online learning activities while effectively managing these choices with feedback and student input, students' motivation to learn and overall achievement shall both increase, thus creating a more powerful and engaging learning experience (Schwartz, 2009; Murphy et al., 2016; Cargile, 2015; Knowles, 1975; Downes, 2010; Song & Bonk, 2016; McLoughlin & Lee, 2010).

Research Design and Methodology

In a rotational three-station hybrid-learning model, students are expected to spend one-third of their time in class working independently on a variety of tasks. Far too often, and especially in a mathematics course, students are seemingly uninterested, unmotivated, and unwilling to participate in independent learning for a variety of reasons. Some students may feel uninterested in the content, while other students may feel like they simply cannot learn independently, regardless of content or concept. Students who lack the motivation to work independently in a hybrid course may display a variety of behaviors, not necessarily ideal for the learning environment. While some students completely shut down and may try to hide from view, other students may utilize the time allocated for independent work to socialize with friends, play on cell phones, surf the internet, or engage in other activities that are often distracting to the learning environment. Colleagues and I agree that motivating students to work independently in a hybrid classroom can be a challenge. Students are motivated in different ways, and what works for one student may not work for another. However, by providing choices to students who are partaking in independent learning, a teacher can maximize the opportunity to motivate all students to meaningfully engage with independent learning materials. Accordingly, this research project was designed to determine the effects of student choice in independent online mathematics learning of high school students' motivation and

achievement in a three-station hybrid-learning model. This study was conducted over nine weeks and relied on data sources in the forms of surveys, student artifacts such as assessment items, observational notes, and participant discussions. The content in this study included algebra 1 specific standards and curriculum enhanced with choice-based checklists for learning and applying identified standards and proficiencies.

Setting

The setting of this study was a large urban high school in eastern Pennsylvania. The school has a diverse population and enrolls about 2,800 students in grades nine through twelve. Minority enrollment at the school is 53%, which is more than state average of 32%. The school's demographic breakdown is 47% White, 38% Hispanic, 12% Black, and 3% Asian. The school has 48% of students eligible for free lunch, which is slightly above the Pennsylvania average of 41%. In addition, the school has 6% of students eligible for reduced lunch, with the Pennsylvania average at 5%. The school is comprised of roughly 52% male and 48% female students. The student teacher ratio is approximately 18:1, which is slightly above the state average of 15:1. The district graduates 86% of its students, which is lower than the state average of 89%, and decreased from 95% five years ago (Public School Review, 2015). In terms of state standardized testing specific to Algebra 1, the school has been classified by Pennsylvania's Department of Education as a "Historically Underperforming School." Most

recent standardized test results at the school reveal 42.6% of students scoring Advanced or Proficient (passing scores), which is far below the state average of 65.6% (Pennsylvania Department of Education, 2017). The district offers all students vocational technical programs in addition to housing a variety of academic, athletic, and club activities.

Throughout this study, students worked in a rotational hybrid setting consisting of three stations. In a forty-five minute class, students participated in two out of the three stations: collaborative learning, direct instruction, and independent learning. At the collaborative station, students worked in small groups to create projects, complete hands-on activities, and support each other with independent learning activities. In the direct station, students worked with the teacher to complete a variety of tasks, including informal assessments, progress checks, and recording notes and examples of new content. At the independent station, which is the focus of this research, students worked by themselves on a variety of tasks that are choice-based. These tasks included activities that could be classified as “learn it,” “apply it,” and “self-assess it.” Students were given a variety of choices of content in each task classification. At the independent station, students were supported in making the best choices, as dictated by performance on informal or formal assessments at the direct station and one-on-one conversations with the teacher.

Participants

This study focused on two ninth grade Algebra 1 classes, with forty-five students in total. Student ages ranged from fourteen to fifteen. Of the forty-five students, twenty-five were male and twenty were female. Three students had Individualized Education Programs (IEPs), one for hearing issues, one for emotional support, and one for Gifted Learning. The classes were heterogeneously grouped in terms of mathematical proficiencies and fluencies, but gaps in mathematics proficiencies and fluencies among students were relatively small. The demographic make-up of these classes and the eligibility for free and reduced lunch closely resembled the school's overall data.

Procedures

Prior to setting up any choice-based independent work, I had students complete a pre-survey that focused on independent learning, motivation, and choice (Appendix B, section i.). In addition to administering this survey, students and I discussed the questions as a class to obtain additional pre-intervention data. Student responses on the initial survey and our class discussions revealed that choice was a seemingly exciting addition to the independent station.

Over the course of the study, students were given choice-based independent work in the form of checklists (Appendix C, sections i-v), and learning was monitored via brief assessments at the direct station and responses to formal assessment items (Appendix D, sections i-iv). As the study progressed,

students also were required to complete Accountability Slips (Appendix E) in order to keep track of what independent work they were completing during the week.

The mathematical content in this study was identified and developed using Pennsylvania's Common Core Standards for an Algebra 1 course. Over the course of nine weeks, the two algebra classes in this study worked through five units of algebraic study including order of operations, real numbers, equations, rates/proportions/unit analysis, and inequalities. Each unit of study contained a variety of eligible content and produced a large number of choice-based independent learning assignments as can be seen in the checklists.

Students worked through choice-based independent learning assignments over the course of twelve weeks. The following activities took place:

Week One

- Obtain principal consent (Appendix A, section i).
- Discuss research project with my classes. Pass out and obtain parent consent forms (Appendix A, section ii), and student assent forms (Appendix A, section iii).
- Have students complete initial pre-survey on student choice, motivation, and independent learning (Appendix B, section i).
- Introduce Order of Operations content as a whole class, including how to read and manage the first independent station checklist (Appendix C, section i).

Week Two

- Discuss initial survey results with students.
- Monitor and formative assess student understanding of order of operations content at the direct station.
- Formal Assessment: Order of Operations, including Order of Operations Assessment Item and Scoring Rubric (Appendix D, section i).
- Have students complete the Choice Improvement Survey (Appendix B, section ii.). Discuss results with students and determine how to revise next set of choice-based assignments.
- Review assessments with students.
- Introduce Real Numbers content as a whole class, including how to read and manage the second independent station checklist (Appendix C, section ii).

Week Three

- Introduce Student Accountability Slips (Appendix E), and explain how and why they will be completing these slips.
- Monitor students' independent work on Real Numbers via direct station mini-assessments. Support students' collaborative activities. Collect and grade accountability slips and proof of Real Numbers Checklist assignments.
- Formal Assessment: Real Numbers
- Have students complete the Choice Improvement Survey (Appendix B, section ii.). Discuss results with students and determine how to revise next set of choice-based assignments.
- Review assessments with students.

Week Four

- Introduce Equations content as a whole class, and pass out the Equations Checklist (Appendix C, section iii), and the Managing the Equations Checklist document (Appendix C, section iv).
- Monitor students' independent work on Equations via direct station mini-assessments. Support students' collaborative activities. Collect and grade accountability slips and proof of Equations Checklist assignments. Goals: One-and-Two Step Equation Content and formative assessment (direct station, independent station self-assessments).

Week Five

- Introduce Multi-Step Equations content as a whole class, and pass out new Accountability Slips.
- Support students working through multi-step equations assignments and help students determine best choice-based assignments to work on.
- Monitor student's independent work on Multi-Step Equations via direct station mini-assessments, and accountability slips.
- Collect proof of student work on the Multi-Step Equations Checklist items.
- Introduce Equations with Variables on Both Sides content as a whole class, and pass out new accountability slips.

Week Six

- Support students working through equations with variables on both sides assignments and help students determine best choice-based assignments to work on.

- Monitor student's independent work via direct station mini-assessments, and accountability slips.
- Collect proof of student work on the Equations with Variables on Both Sides Checklist items.
- Quiz Preparations: Equations Quiz.
- Formal Assessment: Equations. Including Multi-Step Equation Assessment Item and Scoring Rubric (Appendix D, section ii) and Word Problem Assessment Item and Scoring Rubric (Appendix D, section iii).
- Have students complete the Choice Improvement Survey (Appendix B, section ii.). Discuss results with students and determine how to revise next set of choice-based assignments.
- Review assessments with students.

Week Seven

- Introduce Rates, Proportions, Unit Analysis content as a whole class, and pass out the Rates, Proportions, Unit Analysis Checklist (Appendix C, section v)
- Have students work through the three sections while monitoring progress at the direct station. Student goals include completing all section on Rates, and begin the Unit analysis items.

Week Eight

- Students will finish Unit Analysis checklist items and begin Proportions checklist items.
- Support and monitor student independent work at the direct station.
- Assessment review and preparation.

Week Nine

- Assessment: Rates, Ratios, Proportions, Unit Analysis
- Review Assessments.

Week Ten

- Have students complete another round of the choice improvement survey.
- Have students complete the post-survey on choice and motivation (Appendix B, section i).
- Introduce inequalities content as a whole class, including the inequalities checklists (Appendix C, section vi).
- Student goals include completion one-and two-step inequality choice assignments by the following Monday.

Week Eleven

- Collect inequality checklist part one materials and accountability slips.
- Introduce Multi-Step Equations as a whole group and have students work through inequality checklist materials part two while providing support and guidance in making the best choices.
- Students have the goal of finishing part 2 by Friday.
- Introduce Compound Inequalities and checklist items as a whole group.

Week Twelve

- Students finish up their inequality checklist work and prepare for a summative assessment on inequalities including the Inequality Assessment Item and Scoring Rubric (Appendix D, section iv).

- Review assessments, and administer another choice improvement survey.
- Discuss research study with class and what results may be concluded.

Data Sources

Student Surveys. Student pre-and post-surveys (Appendix B, section i) and the choice improvement survey (Appendix B, section ii) were essential pieces of data in this research when considering whether or not providing choice in independent learning activities increases student motivation and achievement in a rotational three-station hybrid model. The pre-survey, administered prior to introducing student choice, gave me baseline data on students' thoughts and feelings of mathematics, motivation, and choice. The post-survey was administered during week ten, and allowed for a comparison of student responses prior to and after completing independent choice-based assignments. The pre-and post-survey asked the same exact questions and included questions that were essentially the same but worded differently in order to increase validity (McNiff, 2016). The choice improvement survey was a simple one-question open-ended survey administered after each major unit assessment. These surveys allowed for students to record any thoughts or ideas they had in relation to what they completed in terms of independent choice-based work with what they learned based on how they thought they did on the five major assessments. By not simply relying on the pre-and post-survey, and allowing for open-ended responses,

students had the opportunity to express a broader range of ideas and allowed me to make better judgments about the effectiveness of choice-based content on students' motivation and achievement (McNiff, 2016).

Student Artifacts. In order to measure and observe student motivation and achievement, I collected and analyzed a variety of student artifacts. Artifacts collected in this study included proof of checklist assignment completion for each unit (Appendix C, sections i-vi), specific assessment item responses that were graded using rubrics (Appendix D, sections i-iv), and student accountability slips (Appendix E). In addition, I documented student responses to direct station questions, online assessment scores for given units, IXL software data, and documented student misconceptions arising at the direct station. Student responses to assessment questions were the main indicator of student achievement, while student's completion of checklist items, surveys, and accountability slips were used to further understand what motivated students to complete their independent work.

Participant Observations. A fundamental aspect in determining whether an intervention is working is to observe the participants being exposed to the intervention (McNiff, 2016). Although seemingly trivial, participant observations often produce very telling data (McNiff, 2013). For instance, during this study, I observed how often students were on-task at the independent station, recorded student conversations when working at the independent station, and simply

observed students' dialing interactions with choice-based content in order to reflect on whether or not students were more or less motivated to complete assignments when given a choice. In a hybrid class, it can be difficult to observe the independent and collaborative stations, as I am required to only interact with the direct station. However, as students worked on mini-assessment items and practice questions, I would often monitor the independent station students and recorded my observations an ongoing field log, as will be discussed.

Participant Interviews. Participant interviews, in the form of whole class and individual discussions, were an important data piece in this research. As McNiff (2016) explains, interviews hold certain advantages over questionnaires or surveys for many reasons. For instance, conversations often lead to enhanced insights for all participants, provide richer data through probing questions, are free flowing and can allow for more in-depth explanations and clarifications when compared to a survey or questionnaire.

Accordingly, participant interviews such as whole class and individual conversations remained important throughout this research. Primarily, these conversations and informal interviews were documented in an ongoing field log, discussed below.

Field Log. McNiff (2016) states, "People keep diaries (logs) to record their thoughts and feelings about events, remind themselves of future appointments, and to keep a record of these events when they are past" (p.179).

Furthermore, in terms of action research, McNiff (2016) suggests, “Aim to use a research diary throughout your project,” because, “Diary entries will provide you with the documentary data that you can return to and reflect on” (p.179). In this research, I maintained a daily field log in order to maintain a chronological account of important research data including student observation notes and responses. Briefly at the end of each class, I would write down any important ideas or events that occurred during class, including my own thoughts and feelings. The field log housed all of my documented participant observations as well as participant interview responses.

The field log became an extremely important piece of data in my research. The field log allowed me to reflect upon daily student performance and interactions in a manner that I was able to make judgments about how to proceed with choice-based content and how I could potentially differentiate my instruction and creation of choice-based activities. Furthermore, documenting my own thoughts and feelings and reflecting on these allowed me to be more honest with my research and helped me to stay focused on my ultimate research goals, which were to increase student motivation and achievement.

Collectively, by triangulating data collected in the forms of student surveys, student artifacts such as assessment responses, observations, interviews, and my own field log, I was able to make better judgments in relation to the

effects of student choice in independent learning activities on high school students' motivation and achievement in a three-station hybrid model.

Trustworthiness Statement

To optimize the trustworthiness and validity of the results of this study, I followed certain ethical research strategies and guidelines. Prior to initiating this study, I was granted approval and documented permission from Moravian College's Human Subjects Internal Review Board (Appendix A, section iv). To obtain this permission I outlined my objectives for the study, and the overall design of the study including specific procedures for data collection and steps followed to reduce risk to participants in the study. In addition, I provided the board with critical documents including the student assent form (Appendix A, section iii), the parent consent form (Appendix A, section ii), the signed principal consent form (Appendix A, section i), and the surveys to be used in the study including the pre-and-post survey (Appendix B, section i) and the choice improvement survey (Appendix B, section ii). McNiff (2013) explains that to ensure good ethical practice in a research study, participants must be promised confidentiality of information, identity and data, as well as the unwavering right to withdraw from the research at any time (p.124). These promises are clearly explained in both the student assent form and the parent consent form, but "Explaining things verbally is still central" (McNiff, 2013, p.110). Accordingly, class time was devoted to verbalizing and allowing discussion of these promises.

To further ensure good ethical practice, pseudonyms were assigned to participants and all materials and data collected during the study were stored in a secure location in which only I could access. All hard copies of student work samples were destroyed at the completion of this study.

After obtaining the necessary consent forms and permissions, I began my study and the process of collecting and analyzing data. In this study, data was collected via an ongoing field log, pre-and post-surveys, and participant artifacts including student performance on designated algebra tasks and assessments (Appendix D, sections i-iv). The field log was an ongoing daily list of observational notes, class discussion notes, and one-on-one participant discussion notes. Maintaining a field log demonstrated persistency in relation to documenting and reflecting on the effectiveness of this study's intervention strategy and became an additional source of data to add to the credibility and validity of research findings. The pre-and post-surveys and the choice improvement surveys administered during this study allowed me to make critical decisions in terms of how to either maintain or alter the course of the research to maximize student learning. As McNiff (2013) explains, "...you analyze the data in relation to whether improved learning is evident in the data" (p. 111). In order to triangulate data and increase validity, the choice improvement survey included an open-ended question for students to complete. "Open-ended questions can provide richer data than closed questions, but analyzing the responses is usually

more labor – and time – intensive” (McNiff, 2013, p.109). Triangulating data collected from the field log, surveys, and student artifacts ensured my ability to make any necessary procedural adjustments aimed at providing the highest quality of instruction possible to the students in this study.

In addition, I remained open to new research findings as well as multiple points of views when collecting and analyzing the data in this study. This strategy involved a consistent and honest reflection of my teaching practices. “It is important to understand that engaging in deep reflection can reveal your hidden assumptions and biases, as well as disconnections between what you say you value (your espoused values) and what you actually do (your enacted values)” (Hendricks, 2012, p. 29). During the duration of this research study, I participated in teacher research support groups with trusted peers and fellow educators at Moravian College. During these meetings, my peers and I discussed ways to enhance and/or improve my research including the identification of any understandings that could be made about my study, and strategies to increase the validity of the data presented in this study. Furthermore, my peers and I were able to support each other through peer editing, providing weekly updates and feedback, coding data, and analyzing our field logs together. Moreover, during this study I sought the advice and knowledge of several respected professors and professional colleagues. The advice and strategies provided by my professors and professional colleagues proved immensely helpful during the course of this study

and provided me with further confidence in the study's credibility and validity.

My clear intent has been to design and conduct a research study in a manner that optimizes ethics and trustworthiness.

My Story

Why Student Choice?

Two years ago, a colleague and I pioneered a hybrid algebra course at the request of our district. As we learned only too well, preparing for and teaching in a hybrid setting was not an easy task. In the hybrid setting, students are split into three groups and rotate through three different stations, including the direct instruction station, the collaborative station, and the independent station. At each station, students completed a variety of activities aimed at developing their understandings of a particular unit or topic of study, and in my case, algebra 1 content.

The direct station resembled a typical classroom in which one-third of the class interacted with the teacher to strengthen skills, complete informal assessments, or get introduced to new content. I particularly liked this aspect of our hybrid rotational model, as I had an opportunity for small-group instruction and remediation on a daily basis. Meanwhile, at the collaborative station, students were split into groups of three or four and then worked together to complete a range of hands-on activities such as matching games and designing posters about a given topic. Last, at the independent station, students utilized newly purchased Chrome books to practice and learn algebraic concepts in an online setting.

While I had my struggles with each of the stations, I especially did not like the way students were performing at independent station. On a daily basis,

students were off-task, disengaged, and overall, seemingly uninterested in completing independent online activities. I reflected daily on ways I could improve students' learning experiences at this station, especially in terms of motivation and achievement.

In light of student disengagement at the independent station, I proposed a curricular change designed to increase student motivation and achievement in independent online learning in the hybrid model. This curricular change was simply providing students with choice-based independent online work. My intentions for initiating this curricular change included eliminating off-task behaviors at the independent station, enhancing students' appreciation of mathematics, and increasing students' motivation, self-efficacy, and achievement in my courses.

On the first day of class, students were immediately interested in the room set-up. Rather than the typical rows of desks facing the front of the room, my hybrid class was divided into three stations. The collaborative station had three clusters of four desks each; the independent station contained rows of tables with two laptops per table; and the independent station displayed a horseshoe shape of student desks around my desk and the projector.

Many students were completely confused by the room set-up.

“What the heck is up with these desks and tables!?”

“Do we have assigned seats, cuz I wanna sit at this back table all year.”

Meanwhile, other students made it clear that they had been exposed to a hybrid course previously.

“Oh no, not hybrid learning.”

“We did this last year with Mr. Blue and I hated it.”

“I couldn’t learn in a hybrid class last year! Why the heck do we still have this in high school?”

“I actually liked hybrid learning,” responded another student. “You guys just didn’t do your work.”

Administering my first dose of teacher voice, I directed, “Please just find a seat for today, and I will explain everything.”

Students shuffled around, and many reunited with peers they had not seen since last year. As this was the first day, I patiently allowed for a few more seconds of student socializing before calling the attention of the class.

Flickering the classroom lights to begin, I stated, “Okay, settle-down and let me introduce myself and welcome you to your first high school mathematics course!”

I began by introducing myself including where I attended school, why I became a teacher, my personal interests, my family, and my interactions and performance in mathematics classes growing up. I explained that I was always naturally interested in mathematics, and that many of my friends had actually asked me to tutor them when we were in school.

Having taken a few minutes to introduce myself, the next order of business was to explain the hybrid-learning model. Having overheard many students' initial comments at the room set-up, it was obvious that some had taken a hybrid course in middle school, but I wanted to see exactly how many.

Accordingly, I asked, "How many of you had a hybrid course in middle school?"

To my surprise, about half of the students in class raised their hands. Our district expanded hybrid learning since a colleague and I first pioneered the model two years ago, and apparently hybrid-learning classes were growing in numbers in the middle schools. When I asked this question last year, not a single hand had been raised.

On my agenda, the next order of business was to introduce hybrid learning using a PowerPoint Presentation. However, seeing so many hands raised, I altered my plan to allow for a class discussion aimed at gathering students' definitions of hybrid learning and their thoughts and opinions of the model in general.

I asked, "For those of you who had a hybrid class last year, can you define hybrid-learning for your peers who did not have a hybrid class?"

"It's a lot of computer work, and uh, we get up and move around the room and we get into our groups and we all work on different stuff, well sometimes the same stuff, but it's not like a normal class," explained Jamel.

“Thank you for your explanation,” I continued, “Can anyone add to what Jamel said?”

“We get a lot of work to do by ourselves but we also get to work on projects together,” added Melanie.

Natalie chimed in, “We’re not allowed to ask you questions unless we’re at your station, and I hated that last year cuz I could never do good.”

“Yeah I hated hybrid learning too, Mr. Blue didn’t help us ever and he would give us too much work to do alone,” said Jamel.

“Did all of you that raised your hands have Mr. Blue?” I asked.

All but three students raised their hands again.

“And for you three, what did you think of hybrid learning?”

“Well we had Ms. Pete and it was okay. I mean I didn’t try real hard but I got a B,” said Suzy.

“Yea Ms. Pete was pretty easy. As long as you did good on her quizzes, it really didn’t matter what else we did,” added Jackie.

“Oh that is certainly interesting, so would you three say that you liked hybrid learning compared to a normal class?” I inquired.

The three students cautiously nodded. Jackie seemed to notice their caution and clarified, “There is a lot I liked and did not like, but overall I think hybrid-learning is better because you’re not stuck in one spot all class.”

“Thank you for your honesty!” I exclaimed.

I wanted to learn more, so I asked, “For those of you who had Mr. Blue last year, can you tell me more about why you did or did not like the hybrid model?”

“He wouldn’t teach us. He would just tell us to do our IXL and never actually taught us anything,” Eddie explained.

“Well then, I understand your concern. Please know that I intend to actually teach you the material this year. But to be honest, IXL is still here!” I explained.

Judging by the grunts I overheard, it was apparent that some students did not appreciate the learning software IXL. I figured, rather than going through my PowerPoint in detail, now was the perfect time to introduce my action research project to the class. I wanted to reassure students like Eddie and Jamel that because I had taught in a hybrid environment for two years, I had more experience in creating lessons and interactions that would, I hoped, benefit their learning more than what they had experienced previously. I did not know Mr. Blue, and I could not speak for how he ran his hybrid class, but I could speak for myself. I wanted to explain how my hybrid courses evolved over the last two years and I wanted students to understand how I came to select student choice as an important way forward.

“I do not know Mr. Blue, and it would be unfair for me to criticize how he ran a hybrid course. But from my experience, it sounds like my own first year teaching in this model, and it’s not easy.”

“Yeah, he said he was forced to and that even he hated it,” an unknown voice chimed in.

“Well, then it is even more important for me to tell you that this is my third year teaching hybrid classes, and I really think I have only gotten better! For those of you that still look confused, let me briefly walk you through the hybrid model we will be following this year.”

I flew through my PowerPoint faster than I initially intended because I did not want to waste the time of students who already knew about hybrid learning. Without getting into specific content, I walked students through the details of each station, starting with collaborative, continuing to direct, and finishing with independent.

Having reviewed the rotational model and the duties and expectations of the independent station, I asked the class, “Many of you seemed disappointed with IXL, is that correct?”

Several students nodded, some enthusiastically, revealing deeper concern.

I inquired further, “Do you think IXL is ever helpful?”

“I mean, yeah at times but it was like that was all we was doin’ in that class and it got mad boring,” Shelly confessed.

“So do you think you would have done better or tried harder if you had a choice in assignments and you were not just limited to IXL on the computer?”

“Uh, yeah, I mean that’s obvious Mr. Kuh...kuh... what’s your name again?” Shelly queried honestly.

“Mr. Kapral, but Mr. K is fine. Your name is Shelly right?” I asked.

Shelly nodded with a smile.

“So you think that allowing choice at the independent station is an obvious improvement to a hybrid class?”

“Yes!” Shelly exclaimed without a moment’s hesitation.

“Well, Shelly, thank you for setting up an amazing introduction to my research project. This year, as part of my graduate work, I will be studying the effects of providing you with choice-based work at the independent station!”

I anticipated students to be excited, but the response I received was nothing short of comical.

“Wait, you didn’t graduate college?” Shelly shouted.

I paused to allow for the laughter to subside and replied, “Yes, I can assure you, I have my college degree and all my required clearances. If you remember, I mentioned that I went to Temple University for my degree, known as a bachelor’s. Now however, I am enrolled at Moravian College earning my Master’s degree.”

“Oh like Mrs. Evans was doing last year!”

“Yeah a lot of my teachers were getting Master’s degrees last year too.”

Shelly began to blush in embarrassment, so I chimed in, “I would have asked the same question, Shelly!”

The class chuckled, and I remember feeling my first impressions of this particular group of students. I was already beginning to feel a strong sense of community and unity with this class, more so than any other class I had taught, and this was only the first day.

To my surprise, when I looked at the clock, I realized that class would be over in only five minutes. Our discussion on hybrid learning, including my explanations of the stations and station expectations, had dominated the first day of class.

At this point, I was excited to see how students would interact with the choice-based work I had laid out for them, and I was even more excited to learn that students in this class were willing to share their opinions. Student voice immediately played a role in how I managed the first day of class. In fact, manipulating and adjusting my actions as a result of student voice and opinions became significantly important throughout my research.

Before We Begin...

The next day, students shuffled into the room and many echoed their comments from yesterday’s class, “Wait, where do I sit again?”

“Just find a seat for now, anywhere you like. We are going to handle several logistical items today.”

“What’s a logistical item?” One student asked.

“It means like a management plan. Since we have a large part of our course online, we need to get our login information taken care of, and I need to pass out some consent forms for my action research.”

Satisfied, at least temporarily, with my explanation, the class took their seats and awaited direction. I began by refreshing students on the hybrid model and the expectations of each station. I purposely finished with the independent station in order to smoothly transition to a discussion on my research project.

“Yesterday I learned that many of you had a bad experience with hybrid learning last year for a variety of reasons. Many of you seemed unhappy with how you interacted and learned at the independent station, is this correct?”

A majority of the class nodded in agreement.

“Well, I’d like to remind you again that this year, you will have a choice of assignments at the independent station. I admit I have an idea of what I would like to do to incorporate this choice, but throughout this research I will be relying on your feedback in order to make the most appropriate adjustments. Your feedback will be in the form of survey responses and discussions. The more honest you are, the better I can improve your hybrid experience. Let me start by passing out some legal documents.”

Seeing that Zane seemed a bit restless this day, I asked him to help me pass out the student assent forms (Appendix A, section iii).

After Zane handed out the assent forms, I asked the class, “Who knows what assent means?”

“Doesn’t it mean like permission?” said a voice in the back of the room.

“Exactly!” I exclaimed. “There is a bit more to the definition, but for now, you can think of assent as you giving permission to participate in my research.”

I proceeded to read aloud the first paragraph, which was a recap of what I had just explained.

As I got to the second paragraph, I mentioned, “Please pay particular attention to the following three paragraphs.”

I read the paragraphs out loud, pausing to stress important points.

“Remember, you do not have to agree to be part of my study, and your participation will not affect your grade in any way. If you do agree to be a part of this study, you are simply agreeing to let me analyze your data from motivation surveys and assessments. Your names will be kept confidential, as will all work I collect from you. Are there any questions?”

“So we can say no?” asked Antuan.

“Correct, Antuan. It would be very beneficial to me to have as many participants as possible, but you do not have to be a part of this study if you don’t want to.”

“Do we have to do more work if we say yes?” asked Alexis.

“Absolutely not. Whether you agree or not, you will all have the exact same amount of work. These are great questions, are there any more?”

The class remained quiet, and I felt confident that students understood my goals for research and the assent form. Next, I transitioned into introducing the parent consent form (Appendix A, section ii).

“So we defined assent as you giving permission to be a part of my study. But does anyone know what consent means?”

“Doesn’t that mean the same thing as assent?” asked Blane.

“You are on the right track. Think about your last field trip. Who ultimately gave the school permission to let you go or not go on the trip?”

“Our parents,” many students said at once.

“Correct, your parents or guardians had to give the school permission. Has anyone picked up on the difference between assent and consent?”

“Well assent is like giving you our permission, and consent is like giving you our parent’s permission,” said Shelly.

“Boom, you hit the nail on the head Shelly!” I continued, “So in order to be fully participating in my research, I need both your assent and your parent or guardian’s consent. Even if your parents give me permission, you can still decide not to be a part of my study. Also, it is important for you to know that you may withdrawal, or pull out of my study at any time without any penalty. Again,

whether you agree to be a part of my study or not, your grades will not be affected. I know we just covered a ton of information, so let it sink in for a minute and I'll pause for any remaining questions.”

Students shuffled between the assent and consent forms. Many students began filling out the assent form, and some tried turning it in immediately.

“While I appreciate your immediate attention to the assent form, remember, I would prefer to collect both forms at once so that you can show your parents the assent form. Whether you and your parents agree or not, returning the forms will count as a homework grade and I will need all forms brought back with appropriate signatures by Monday of next week. Are there any other questions?”

When there were none, we moved on to assigning classroom computers. Students were called up to the Chromebook one at a time where I gave them a number corresponding to the computer they would use in class.

As students obtained their Chromebooks, I addressed the class, “If you know how to login from last year, please go ahead and do so. If you do not know how to login to the Chromebook, please raise your hand and I will be around to give you your login information.”

As any hybrid teacher or teacher utilizing technology knows, simply having a class of students login to a computer can be the first major headache. While this went smoother than last year, I still had to assist several students who did not know how to log in. Some were new to the district and did not know their

email accounts or usernames, while others did not remember their passwords, which was their school identification number. Overall, the process of having the entire class sign in to their computers for the first time took about fifteen minutes.

After I made sure all students were able to log in to the Chromebooks, I directed the class to navigate to our learning management system (LMS) known as Schoology, basically our course's webpage, with links to agendas, videos, assignments, readings, and online assessments. Thankfully, most of the students were familiar with Schoology from last year. While three students had never used Schoology, they seemed comfortable navigating to and logging into the LMS. A snapshot of my course's Schoology page is shown below in Figure 1.

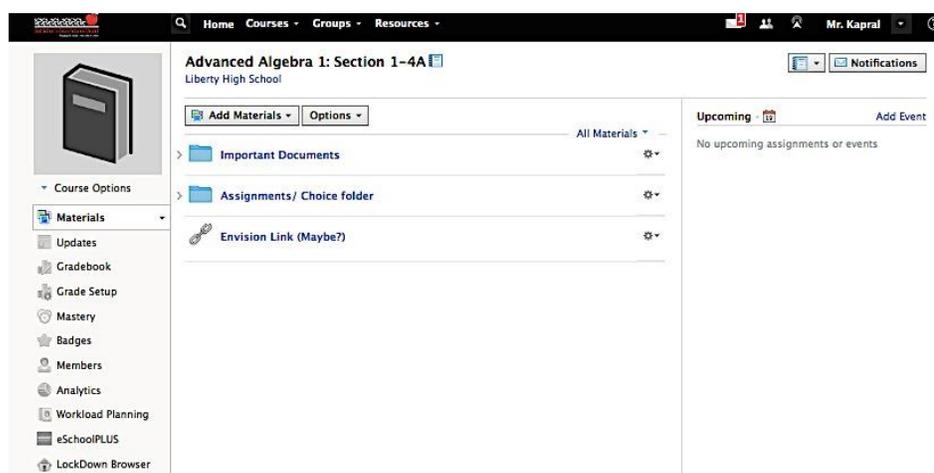


Figure 1. Schoology Homepage Screen Shot

“At this point, we have two separate login usernames and passwords to remember. Please at this point, begin keeping track of your login information in your planners.”

Many students shuffled in their backpacks to locate their planners and proceeded to write down their Chromebook and Schoology login information.

Subsequently, I addressed the class, “Let us all try to login to one more thing today, the notorious IXL!”

“Aw crap!” said a voice from the back.

“NOOOOOOOOO!” expressed Brayden, drawing chuckles around the room.

“Don’t be scared!” I reassured the class. “Remember, I will be giving you choices of assignments at the independent station. IXL is always a highly recommended choice, and in addition, we must complete district-required diagnostics tests on IXL, so we all need to know how to login regardless of how much we individually decide to use it.”

“Is it the same login as last year?” asked Brayden.

“I believe it is. Usually, your username is your email address and your password is your school identification number.”

“Yup, then it’s the same,” said Brayden.

“Okay, then why don’t you all try to login using that information. If you cannot login, please raise your hand.”

I paced the room and helped five students login to IXL. When all students were logged in, I reminded the class to write down their login information.

Having less than ten minutes of class, I directed students to play around with some IXL sections and I reviewed my typical requirements for IXL sections.

“For the most part, if you choose to complete IXL assignments, to get full credit you will need to obtain a SmartScore of 70 or above on a given section. I give partial credit for scores lower than 70 at my discretion.”

“What!? Mr. Blue would always make us get to a 100. I remember last year I spent over 4 hours and answered over 400 questions on one section and still couldn’t get to a 100 and I failed that section because of it,” expressed Justin.

“Wow, Justin, that does seem frustrating. From my experience with the software, obtaining a SmartScore of 70 or greater is a good indicator that you know the material. Of course, I love to see 100s whenever possible and I do give bonus points, but it sounds like the way you interacted with IXL last year left a bad taste in your mouth. What do you think could have been done differently?” I asked.

Justin answered, “He didn’t help me at all. He would say, read why you got the problem wrong, and that was it. I would try to ask questions but never got any help.”

“So did you feel like you needed more support?”

“Definitely,” Justin responded.

“Were you ever given any additional resources to support you? Like videos or readings?”

“No, we would do a couple problems on the board, and then we were on our own.”

“Well, if that’s the case, I hope you will be pleasantly surprised at the amount of helpful resources you’ll have this year at the independent station. I know in a true rotational hybrid class, getting support at the independent station can be tough, so I always stockpile a set of helpful videos and readings to support you with your work.”

Justin began to lose his anxious expression and even smiled.

Seemingly on cue, a former student of mine named Kyle walked into my room and gained the attention of the class with a loud, “Hey!”

Kyle had failed my class last year, and on his own merit. Although an extremely gifted student, outside pressures and stresses proved to be his downfall. Despite failing the course last year, Kyle continued to show improvement academically and behaviorally. After a rocky start, Kyle and I developed a solid relationship and I offered him my support for the duration of his time in high school, even if I did not have him in class again. I was uncertain of why he wanted the attention of my class now, and I feared he might say something inappropriate.

Before I could redirect Kyle out of my room, having the attention of my class, he yelled, “Don’t give Mr. Kapral a hard time! He is the best teacher in this school and if I find out you’re not being good, I’m coming for ya!”

The class was amused at Kyle's statement, and I admit, I felt flattered at the time that a student who failed my course would still support my teaching.

"Thank you, Kyle, now if you will kindly return to your class, I will pretend you did not just barge into my room and interrupt us."

"No prob, Mr. K, but let me know if any of these kids give you trouble and I'll be on them."

"Noted Kyle, but that will not be necessary. Now go back to class and start getting those A's you know you can get!"

Kyle left the room, with many students still chuckling about what had just happened.

I refocused myself and directed the class, "Since we only have a few minutes left, please play around in IXL or Schoology for the remainder of class. A good place to start is by navigating to your syllabus and assignments page in Schoology. This is where all online content will be housed, so it's important to know where to find these resources. I will be walking around to answer any questions you may have. I am very excited to start teaching, but tomorrow we will have to address one more logistical concern before we can start the actual content. I will discuss this tomorrow. But again, for now, see if you can locate the syllabus and assignments page in Schoology, then play around in some IXL sections."

I remember looking around the room and seeing students' facial expressions with brows raised. We were all in the process of forming impressions:

the students of the class and of me, and I was, of course, forming my first impressions of the students. Looks of curiosity and excitement dominated my room, and the vibe of the class that was developing got me excited as well.

For the next two days, students were required by the district to complete the Scholastic Math Inventory (SMI), which is an online test that gives students a score corresponding to their level of mathematical proficiency. The test is long, rigorous, and, unfortunately, very disengaging. Primarily, the district looks at students' SMI scores when forming Individualized Education Programs (IEPs) or placement in subsequent courses. Occasionally the district looks at these scores for growth, but admittedly, I saw too many issues and inconsistencies with scores to consider them for use in my research.

Finally Getting to Algebra

After a long two day SMI testing period, I decided to have students complete their pre-survey on motivation (Appendix B, section i). For the first round, students completed the survey using paper and pencil. In hindsight, I regret not using an electronic version for the initial survey, as gathering and sorting the data became more cumbersome than necessary.

When designing this survey, I aimed to increase the validity of student responses by rewording key questions in a negative way so that I could compare answers to both questions. For instance, one item states, "I enjoy learning online," while another says, "I do not enjoy learning online."

“Wait aren’t these the same questions just worded differently?” asked Shelly.

“You certainly caught on to my reworded questions, Shelly.”

I paused at Shelly’s discovery and decided to address the class, “It appears that some of you caught on to the rewording of survey questions. Please, rather than going back and trying to match your answers to similar questions, answer them honestly in a natural flow. I included reworded survey questions along the way to ensure the validity of your responses, but don’t feel pressured to have matching answers everywhere. Just answer honestly.”

Upon hearing this, I noticed many students erasing and changing answers.

Accordingly, I added, “Your response one way or the other will not affect your grade. I will not be upset at your answers, and your honesty will only help my research. Don’t feel pressured to impress me or tell me what you think I want to hear!”

As a result of this first survey, I learned that I needed to be as specific as possible with directions, remind students that their responses do not affect their grades, and that surveys should be completed honestly with a natural flow.

The survey lasted about twenty minutes before all students were finished. The baseline data gave me a lot to think about and is summarized below in Table 1.

Table 1

Pre-Survey Data

<u>Question</u>	<u>Agree</u>	<u>Slightly Agree</u>	<u>Neutral</u>	<u>Slightly Disagree</u>	<u>Disagree</u>
1. I think that the math being taught in this class is important:	42	2	6	0	0
2. I can think of ways to use the math being taught in this class outside of school:	14	23	7	2	4
3. I can see myself using the math being taught in this class in a future job or schooling:	14	19	10	5	2
4. I enjoy learning online:	10	9	19	3	9
5. I enjoy working independently on math assignments:	14	9	15	7	5
6. I like having a choice of assignments:	26	16	7	0	1
7. I work harder when I am given a choice of assignments:	19	12	13	3	3
8. I enjoy online learning when I have a choice of assignments:	12	7	20	2	9
9. I am more willing to complete online assignments when given a choice:	12	9	17	4	8
10. It is easier to stay on-task when I have a choice of online assignments:	6	14	22	3	5
11. There is no way I will use the math taught in this class outside of school:	2	6	10	15	17
12. I do not enjoy learning online:	8	8	13	9	12
13. It is difficult to learn math when I have a choice of online assignments:	2	3	9	14	22
14. Having a choice of assignments does not make me work harder:	5	3	12	16	14

Table 1 Continued

15. I am less likely to stay on-task when I have a choice in online learning assignments:	1	5	17	7	20
16. I am less focused when I have a choice of online assignments:	3	4	10	13	20
17. I cannot learn math by myself:	14	5	9	9	13
18. Having choice has had no impact on whether or not I complete assignments:	15	5	18	5	7

Table 1 Pre-Survey Data

Specifically, I learned that my students were essentially equally split on the survey item, “I enjoy learning online, I enjoy learning online when given a choice of assignments,” and, “I cannot learn math by myself.” This made me realize that as a part of student independent choice work, I should consider keeping pencil and paper practice, as a large number of students indicated that they did not enjoy learning online. The pre-survey also indicated that I needed to differentiate my direct instruction in a way that caters to those who feel they can and those who feel they cannot learn math by themselves, or even regroup students based on this response. Fortunately, this survey did indicate that most students viewed choice as a positive strategy for increasing motivation and achievement.

With twenty minutes remaining in class, I finally got to introduce algebraic content. We began by completing a study guide on the order of operations, including exponent properties, absolute value, a review of PEMDAS,

and basic algebraic evaluations. As we worked through various examples, it became evident that many students recalled the content from last year.

“I remember this from last year!” someone called out.

“That is great news; you are ahead of the game!” I stated.

We completed the entire study guide, and I directed students to save it for the next class. Before students left the room, I outlined our plans for the next several classes, including the introduction to our first checklist, and our first go with the rotational hybrid design.

May the Choices Begin

During the next class, I introduced the Order of Operations Checklist by passing out a paper copy to each student (Appendix C, section i). I mentioned that the checklists can also be found on Schoology, and additional paper copies would hang on their agenda board if they ever needed an extra.

For the first part of their independent work, students were required to take a pretest. The figure below is a screen shot showing part one of the order of operations checklist:

Order of Operations Checklists (due before quiz, date TBA)

Directions: This checklist is worth 10 points. To receive full credit, you must hand this sheet in with the required work complete. Points may be deducted for not following directions. Remember, in order to be eligible for a retest, you must complete certain assignments (see below). Initial and date any and all of the following activities:

Part 1: Mandatory Pretest (5 points)

- Order of Operations Pretest + Reflection (below)
(Schoolology Assignments/ Choice folder → Order of Operations folder → Pretest)

Score: _____ Date Completed: _____ Initials: _____

Reflection:

1. What was most difficult in the pretest?

2. How will you prepare for a quiz on this material?

Figure 2. Order of Operations Checklist Part 1

For part two of their independent checklist, students were required to record twelve vocabulary words and definitions for this section from Schoolology.

Last, in part three of the Order of Operations Checklist (Appendix C, section i), I introduced student choice. Hence, as we discussed, students were required to complete a pretest in part one, followed by being required to record twelve vocabulary words, and last, given a choice of activities to complete. The figure below shows how student choice was displayed in the Order of Operations Checklist:

Part 3: The choices!! (5 points)

Directions: Complete **AT LEAST 3** of the assignments below. Assignments required for a retest are stated in **BOLD**. Check, Initial and date the assignments you have completed.

Completing more than 3 assignments will certainly help your grade on this checklist! All assignments are located in Schoology: Assignments/Choice Folder (Order of Operations).

 Text Based Review and Notes

Directions: Read both parts and take notes on a separate sheet. (You must submit notes with this checklist).

Initials: _____ Date Completed: _____

 Videos

Directions: Watch all videos and take notes on a separate sheet. (You must submit notes with this checklist).

Initials: _____ Date Completed: _____

 CK-12 Practice

Directions: Complete all three CK-12 practice sessions. On a separate sheet, answer three questions: What was most difficult? What did you like? Would you use CK-12 again? (You must submit answers with this checklist).

Initials: _____ Date Completed: _____

 IXL (Required for Retests) HIGHLY RECOMMENDED!!!!

Directions: Obtain a Smart Score of 70 or above on each section. In order to retest, you **MUST** complete this assignment.

- B2: SmartScore: _____ Initials: _____ Date Completed: _____
- B3: SmartScore: _____ Initials: _____ Date Completed: _____
- B6: SmartScore: _____ Initials: _____ Date Completed: _____
- B7: SmartScore: _____ Initials: _____ Date Completed: _____

 Old School Paper and Pencil Practice

Directions: Print or copy all questions from both parts. You must show your work since answers are provided! No credit will be given unless work is shown!!! (You must submit this work with checklist).

- Evaluating Algebraic Expressions Practice. Initials: _____ Date Completed: _____
- Order of Operations. Initials: _____ Date Completed: _____

 Khan Academy Practice

Directions: Complete both practice sessions. Record problems and show all work. Submit with this checklist.

- Order of Operations: Initials: _____ Date Completed: _____
- Evaluating Expressions: Initials: _____ Date Completed: _____

Figure 3. Order of Operations Checklist Choices

As a class, I discussed the requirements of the choice based assignments.

For instance, as in Figure 3 above, students were directed to complete at least three of the choices following all requirements per choice. In order to take a retest

if necessary, students had to complete choices highlighted in bold. In this case, the required choices for a potential retest included the IXL assignment, largely because it was easy for me to analyze student data such as completion and areas in which students needed support. Figure 4 below shows a snapshot of a student's progress in a particular unit, demonstrating just one of IXL's many analytic tools that I use to assess student understanding and monitor progress.

SKILL	TIME SPENT	QUESTIONS	SCORE IMPROVEMENT
LEVEL K			
Ratios, rates, and proportions			
K-C.1 Identify equivalent ratios	31 min	66	0 70
K-C.2 Write an equivalent ratio	6 min	17	0 73
K-C.3 Unit rates	1 min	14	0 81
K-C.4 Unit prices	2 min	11	0 72
K-C.5 Solve proportions	20 min	13	0 70
K-C.6 Solve proportions: word problems	25 min	22	0 75
K-C.7 Scale drawings: word problems	3 min	14	0 70

Figure 4. IXL Analytic Screen Shot

Such data would be impossible to gather in terms of paper and pencil assignments, so completion of IXL, because it provided such meaningful data, was required for retests.

For the next two classes, I allowed students to work on their independent checklists as a whole class prior to starting the hybrid rotational model. I delayed selecting groups and doing the hybrid run-through in order to make sure the first checklist would run as smoothly as possible. I knew that once we started the

rotations, students would not necessarily seek me for support at the independent station, so I wanted to be easily accessible as they were beginning.

During the next two classes, I witnessed several important scenarios unfold in relation to the first set of choice-based work. Some students had trouble navigating and finding the choices in Schoology, while other students forgot or misplaced computer and/or IXL login information. Furthermore, students had questions about the pretest that I had never considered.

“What happens if I started the pre-test but I don’t finish it today?”

“It will save your progress when you log out and you will not lose any work you completed.”

“Does it matter if we do good or bad on the pretest?”

“The pretest is like a self-assessment. I am not necessarily interested in the score you obtain initially, but you should take it seriously. The pretest is designed to help you identify where you need more help!”

Upon hearing this, Jack called me over to his desk with the pretest open and was looking at a question asking him to evaluate an algebraic expression (What is the value of $2x^3$ given $x = -2$?).

Jack asked, “So like since I don’t remember doing this at all should I just guess?”

I replied, “Think about it for a little, maybe it will come back to you or maybe you can think of a strategy. If not, then take your best guess and just

remember to pay close attention to algebraic evaluation content in Schoology such as the videos and readings to further support your learning.”

“Yeah, I don’t know this at all,” Jack replied.

“Part of learning is knowing what you don’t know. That’s why we have a pretest!” I replied.

In the meantime, during these two checklist introductory days, I witnessed many students seemingly off-task.

“I’ll just do it at home,” Zane exclaimed as he walked around the room conversing with friends.

I responded, “If you do it now, I can support you, and you will have less to do at home. Plus, some of your peers are trying to work and you are being distracting.”

Zane said, “Okay, I’m sorry.”

Zane managed to control his distracting behavior, but periodic checks indicated he was not completing checklist work during the two-day introductory window. It was apparent that many students like Zane lacked intrinsic motivation to master the order of operations content. I learned that I needed to find a way to ensure students actually worked during class time in order to avoid unwanted socialization and disruptive behaviors. I knew that the content itself needed to be more meaningful and relevant to students like Zane, but at the time I was still gaging my students’ interests.

I had many informal conversations with my students over the course of the order of operations checklist content, and I continued to search for more meaningful and relevant content to include in the next round of independent checklist assignments.

Student Voices Shaping Choices

Unfortunately, as I observed and interacted with students during these two classes, other checklist issues came to light. Student voices became a source of important data in terms of improving future choice based work. For instance, as a result of several one-on-one conversations, I realized that future video and reading notes assignments would need to be revised. Students who selected these choices did not understand clearly what to write down or how much to write down from the videos and readings provided. I realized that to be successful, students would likely need a more structured guided reading process to interact meaningfully with the presented content.

Towards the end of these two days, Ezekial came up with a strong adaptation to the choice-based work provided in the Order of Operations Checklist, suggesting: “Instead of completing three mandatory assignments, if we get to 100’s in IXL and not to 70’s, can we eliminate one of the mandatory choices?”

“So what you’re saying is if each IXL Score is a 100, you should only have to complete one other choice item instead of two others?”

Ezekial responded, “Yea exactly. If we get to 100’s, we clearly know our stuff, so why waste our time doing more of the same thing we know?”

“I must say Ezekial, that sounds brilliant and I cannot find a flaw with your argument.

“Class, one of your peers came up with a wonderful suggestion for which I am sure many of you will be thankful. Ezekial suggests that if you get to a 100 smart score on your IXLs, then you only need to complete one other choice based assignment.”

The class enthusiastically agreed. Ezekial’s idea was brilliant, and his input altered the way in which students interacted with choices. As I learned, this was just one of the many examples of how student voices would begin to shape the choices offered at the independent station.

After the two-day introduction to checklists, it was time to engage in our rotational hybrid model and introduce the first collaborative project. For the first set of groupings, I let student self-select their groups (A, B, or C), since I felt the class could handle the task well, and they did. After students were in groups, I passed out a weekly agenda as shown in Figure 5.

Advanced Algebra 1 Periods 4A, 4B
Week of 9/11/2017

Whole Group Instruction (Second half of Friday)	Direct Station	Independent Station	Collaborative Station
Checklists Check in: What do you need help with? How is your progress? When should we schedule a quiz?	<ul style="list-style-type: none"> • Order of Operations Notes and Examples • Evaluating Expressions • Practice 1-2 • Exit Ticket (time) 	Order of Operations Checklists. Be sure to complete all three parts and submit all required materials. Checklists and all required materials due before the quiz (Date TBA)	<ul style="list-style-type: none"> • Four 4's Activity • Matchmaker • Discussion Board Post (Schoolology)

Figure 5. Hybrid Weekly Agenda

As can be seen in Figure 5, our hybrid classes had three separate areas of interaction. Although many students were familiar with the workings of a hybrid class, I wanted to be as clear as possible about what students would be completing at each station. We had already discussed the independent station, and students spent two days interacting with the materials, but collaborative assignments now needed to be explained. During this particular week, students worked on an activity called “Four 4’s,” in which they practiced using the order of operations with only the number four to set up various expressions.

“Should you have questions on the collaborative assignments, be sure to ask me at the direct station. If you finish the collaborative assignments early, there are additional worksheets for further practice you may work on with your group.”

I also discussed our plans for the direct station for the week.

“While you are at the direct station this week, I will be providing some additional examples on the order of operations and evaluating expressions,

providing support with checklist items, and gauging progress in order to determine due dates for checklist work.”

Amanda asked, “But what about the whole group stuff?”

“Ah yes. Being the advanced mathematicians that you are, see if you can answer this question: If we have three groups, and we rotate through two stations per day, how many *complete* rotations can we make in a week?”

Ezekial was quick to answer, “We can have three full rotations in 4 and a half days.”

“Awesome, Ezekial, how did you figure this out?”

“So I just focused on one station, say direct. On Monday, you can have groups A and B. Tuesday you have groups C and then A for the second time. Wednesday you have groups B and C for the second time. Thursday you have groups A and B for the third time, and Friday you have group C for the third time. If you had group A again Friday, it would be their fourth time, but B and C only had you three times.”

Puzzled looks around the room led me to demonstrate Ezekial’s explanation using a table on the blackboard.

“So, yes, we can complete three full rotations in a given five day week. From my experiences teaching hybrid classes, it is always nice to have the second half of Fridays for a whole group check in. I call this ‘free for all’ time, in which

you can work on or finish any project or activity from any of the three stations, and I will be around for help.”

Having outlined the agenda and selected our groups, we began our first round of rotating through stations. Over the course of the week, I heard many positive conversations at the collaborative station, and I remember thinking that this group of kids seemed to collaborate better than any I had taught in the past.

During this week, the direct station became a critical location in the classroom for establishing due dates and monitoring students’ progress, on top of giving extra examples and gauging understandings with one or two question ungraded mini-assessments. In terms of choice-based independent work, the most questions I was asked at the direct station regarded due dates. Initially and admittedly, I was completely uncertain of how long it would take students to complete their checklist work. My initial thoughts were twenty minutes in class for the pre-test, twenty minutes in class for the vocabulary, and an hour or two for choice assignments. However, as I monitored students’ progress at the direct station, I realized that they needed more than the one or two hours I had allotted for the choice-based work. During our time at the direct station, students and I agreed on a due date for the first checklist, which was also the day of their first quiz on the order of operations and evaluating expressions. Additional time in class was granted upon periodic check-ins of student progress. Students whom I

had observed to be on-task all week still had a lot of checklist items to complete, so I allotted extra time.

Furthermore, I witnessed several students working on their independent assignments at the collaborative station while neglecting the collaborative work. I got the sense that some students were overwhelmed with the checklist. Although these students did not participate in the completion of collaborative work, I was still happy that they were completing course work, but Brayden was another story.

Brayden was having a rough week, where he was off-task, holding side conversations, walking around the room, distracting others, and overall, not at all motivated to complete his checklist assignments in class. Furthermore, when working with Brayden at the direct station, he did poorly on several practice problems. I began to ponder. Was he just not motivated, or was it incompetence resulting in off-task behavior? I recalled Lisa Delpit's (2012) argument that students may sometimes falsely be labeled as unmotivated, uninterested, or behaviorally disordered when the reality is that the behaviors resulting in these labels are actually the product of student's personal self-doubt and his or her lack of confidence to learn. Through years of systemic oppression and being told they are unable to perform, students develop defense mechanisms to avoid scenarios in which they may feel embarrassed, such as hiding under their hoods or acting out to avoid publicly being unable to perform to the expectations set by the teacher.

This is especially true for minority students (Delpit, 2012). Considering it was just the first week, I wanted to avoid labels and learn more about Brayden.

Overall, I came to several ideas for improving future choice-based work after this first week in a rotational hybrid model. As I mentioned, some students neglected the collaborative assignment and instead worked on independent assignments at the collaborative station. However, I could not deny the powerful conversations that I heard taking place.

“No! You’re not supposed to multiply yet, Suzy! You go left to right first, remember the M and D are interchangeable!” called out a student voice supporting a peer with independent work.

Hence, I thought to myself, “Why not let students collaborate on their choice-based work?”

As lessons unfolded, some collaborative activities I had stockpiled seemed forced for the sake of running the rotational hybrid model. Instead of forcing collaborative activities, I thought it would be beneficial to all to allow for this powerful collaboration to occur on choice-based work, too. Another idea I had after this week was to break down the checklist into portions, each of which would be due at a separate time to avoid having students feel overwhelmed.

In addition, as I continued to field questions at the direct station about what specifically needed to be done in terms of checklist materials, I realized that I needed to be clearer with procedural directions for the next set of choices.

Throughout the week, I held one-on-one conversations with students at the direct station, and I came to realize the power of individual conferencing. These conferences allowed me to help students make appropriate choices. For instance, Billy was stuck on IXL for an extended period of time, so I redirected him to first watch the videos then try the IXL, which proved beneficial. He needed to be shown that some of the resources were there to help him learn, while IXL was there for him to apply what he had learned. Hence, Billy needed support in making the best choices. Accordingly, these important individual conferences continue throughout this research project.

After going through several classes in the hybrid model, it came time for our agreed-upon assessment date, the same date in which all checklist materials were to be turned in. In addition to the assessment, students were also required to complete a one-question Choice Improvement Survey (Appendix B, section i) such that I could obtain suggestions for improving choice-based work. Little did I realize at the time that this would become one of the most important days of my research.

Show Me What You Did and What You Learned

The following day, it came time to collect students' checklists. It was also the day of the students' first quiz on the order of operations.

"Please find a seat and have your checklist materials ready to be submitted."

Students fumbled around with stacks of papers, uncertain of how to organize them for collection.

“Should I staple all these papers together?” asked Amelia.

“Great question, Amelia. I guess that would make it easier for me to keep your work together and not mix it up with another student’s.”

Turning to the class, I stated, “Amelia had a good question. To keep things organized, please place your actual checklist on the top of your documents, make sure your name is on it, and I will come around with the stapler to collect them.”

I proceeded to collect students’ work, but it took away valuable class time. The process of collecting and gathering student work took almost ten minutes and I still had to pass out the quizzes. Luckily, the first quiz was not too lengthy, and students had sufficient time to finish.

As students completed their quizzes, they were given a copy of the Choice Improvement Survey (Figure 6) to complete and turn in before leaving the classroom.

NAME _____

What suggestions do you have to improve the way in which you are given choices at the independent station? What would make your choices better? If you do not have any suggestions, feel free to write I don't know. Be honest, this is for you, not me!!!!

|

Figure 6. Choice Improvement Survey Question

By the end of this class, I had gathered a tremendous amount of valuable data that needed to be analyzed. I felt completely overwhelmed with the volume of student work I had just collected, and I began to think of ways to improve the process.

The first obvious change I needed to make was not collecting checklist materials on the day of a quiz. I spent nearly four hours that night grading quizzes, reviewing and grading checklists, and analyzing responses to choice improvement surveys. As a student, I despised when my assignments were not graded in a timely fashion. As a teacher, I vowed to have student work graded within twenty-four hours. While I managed to get all the grading and analysis completed, I was completely exhausted. Importantly, I established that in the

future, it would be far easier for me to collect checklist work prior to the day of quiz in order to avoid grading fatigue.

Resulting from the data I collected, I managed to identify many areas in which I could improve the independent choice-based work in terms of student motivation and achievement. Specifically, I had gathered three important pieces of data, including students' checklists and accompanying work, students' quizzes, and students' choice improvement surveys. Each piece of data was valuable when considering ways to improve the choice-based independent assignments.

The Results are in

I began my analysis with the students' checklists. The order of operations checklist (Appendix C, section i) contained three graded sections. Part one consisted of a mandatory pretest and reflection questions (Figure 2) and was worth five points. Students were awarded three points for completion of the pretest, and one point for completion of each reflection question. Part two of the checklist required students to record twelve vocabulary words for the unit on a sheet of paper, and was worth five points. Last, in part three, students completed the choice-based work (Figure 3). Part three was worth ten points, and grading varied by choice, as can be seen in Figure 3. Of the students who did submit checklists, 37/43 scored an 18/20 or better, one student got a 17/20, one student got a 15/20, and one student got a 10/20. Points were most commonly deducted for missing portions of the checklist, such as the recorded vocabulary words.

The initial grading and reviewing of checklists gave me a lot to consider in terms of this research. I had already mentioned that collecting choice-based work on the same day as a quiz was not an ideal procedure, and after comparing checklist scores with assessment grades and open-ended responses, I had identified many flaws with the first round of choice-based work.

First, for students completing paper and pencil work, it dawned on me that they were never given feedback on their completed work prior to the quiz. I felt ashamed at my poor management of this assignment, especially when I realized I could have helped several students avoid a common mistake with the order of operations.

As I graded two students' paper and pencil checklist assignments, I noticed that both made the same mistake throughout the worksheet. Both students consistently performed the wrong order of operations when given problems that had division and multiplication.

When introducing this content, students are often familiarized with the acronym PEMDAS to help them remember the order of operations. In the acronym PEMDAS, M stands for multiply, while D stands for divide. Many students incorrectly assume that multiplication always occurs before division. However, when working left to right on a mathematics problem such as the order of operations assessment item (Appendix D, section i), the correct order of operations involves dividing before multiplying. This tricky aspect was explicitly

taught at the direct station using a staggered table (Figure 7) to help students remember this tricky aspect of the content.

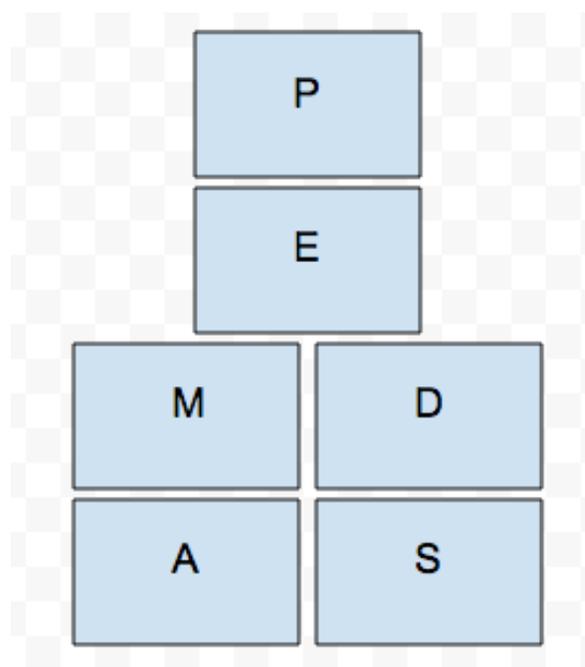


Figure 7. PEMDAS Staggered Table

“Remember, the table looks like this for a reason. While PEMDAS is a helpful acronym, it is not perfect! We just completed two examples in which we actually did PEDMAS and PEMDSA, not PEMDAS!”

While this notion was stressed in class at the direct station with many examples, it was apparent that some students forgot about this. In particular, two students completing pencil and paper work made this mistake consistently throughout, and carried over their incorrect procedures to the quiz as can be seen in Figure 8.

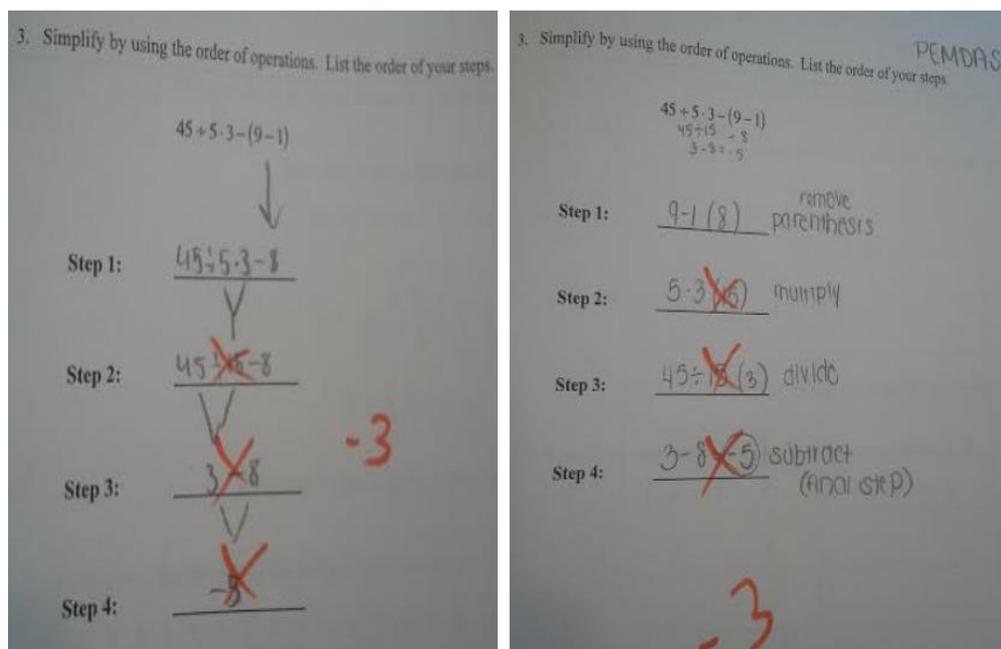


Figure 8. Student Responses Incorrectly Using PEMDAS

Figure 8 shows that both students made the mistake of multiplying before dividing, as was seen in their paper and pencil assignment as well. Had I caught this error prior to the quiz, I may have been able to help these two students avoid this mistake.

For students who chose to complete IXL as part of their choice-based work in the order of operations checklist, the common PEMDAS mistake was not as frequent, as 35 out of 38 students answered the item correctly. IXL does provide immediate feedback, and from the data I obtained, this feedback absolutely helped students avoid the common PEMDAS error. Figure 9 shows a correct student response to the Order of Operations Assessment Item (Appendix D, section i).

P
10
4-5

3. Simplify by using the order of operations. List the order of your steps.

$$45 + 5 \cdot 3 - (9 - 1)$$

$$45 : 15 \quad 8$$

Step 1: 9 - 1 = 8 Parenthesis

Step 2: 45 ÷ 5 = 9 Divide

Step 3: 9 · 3 = 27 Multiply

Step 4: 27 - 8 = 19 Subtract

Solution is 19.

Figure 9. Correct Student Response to Order of Operations Assessment Item

The student who completed the order of operations assessment item correctly in Figure 9 chose to complete IXL as one of his choices. This student also labeled PEMDAS in the staggered form at the top of the page, suggesting he knew the importance of looking left to right at numerical expressions. While students who completed IXL performed better on this assessment item, I theorized that had I given timely feedback to students who did not complete IXL, they too would have answered this assessment item correctly. The two particular students who answered the assessment item incorrectly made the same mistake throughout

their paper and pencil work, and while I felt deflated, I was pleased that I had realized my error.

I was determined to not make this mistake again. I established that future work must be turned in before the quiz in order for students to obtain timely feedback on their assignments and avoid making costly errors. Furthermore, this incident made me consider breaking down the choice-based aspect of checklists into sections with specific due dates in which I could monitor student progress, provide timely feedback, and avoid overwhelming amounts of grading on a given night. Moreover, to support students who chose paper and pencil work, I considered including solutions to the assignments such that students could check their answers and ask questions accordingly at the direct station.

“I Think You Need to Do it First”

The checklists and assessment data had my head spinning with possible ways to improve the choice-based curriculum I provided students. However, I was delighted to review students’ responses to the choice improvement survey, as many responses gave me further suggestions to improve the choice-based content, many of which I did not consider previously. Figure 10 outlines important student responses to the first choice improvement survey (Figure 6):

<u>Student</u>	<u>Response</u>
Anny	"There is no way to make it better. It was all good. I like taking direct notes better though."
Evan	"I think the independent should have a worksheet to document their results and have a goal to reach everyday. If the goal isn't completed, it's homework."
Erik	"I don't know, I just didn't want to do it."
Jayson	"I feel that the choices could be a little more clear. Like what we have to choose from."
Brayden	"The more choices the better."
Angel	"To be honest, I really don't enjoy online work, especially at the independent station. I would much prefer to do pencil and paper work at independent stations. (Easier to focus)."
Ren	"I need help with multiplying decimals."
Kaitlyn	"Idk, the vocab was just not needed because of watching the videos and reading the notes."
Ava	"I think that maybe you should do a test run of the online programs from a student point of view, just to make sure that all the programs function as they should. With CK-12, I couldn't access other sessions (the second and third one) without making an account, and the students themselves can't even make the account. Ultimately, I was unable to use the tool. So just check to make sure that sort of thing won't happen beforehand. Other than that, I think it ran smoothly."
Anthony	"I would add one or two harder topics and make it an option to do if the other topics are easier."

Figure 10. Key Responses to Initial Improvement Survey

As I read through student responses to this survey, the importance of this data piece became apparent. Many of the responses surprised me. All responses made me reflect on students' experiences and perceptions of having a choice in independent online work. In addition, upon reviewing students' responses to this survey, certain themes in relation to providing choice-based independent work emerged. It was evident that the students needed support with their choices and that the choices themselves had to be meaningful, relevant, organized, and accessible.

Some students expressed a lack of motivation.

"I don't know, I just didn't want to do it," wrote Erik.

Erik was clearly not motivated by the choices being provided. I began to think, choice alone was not enough to increase Erik's motivation.

Meanwhile, Brayden wrote, "The more choices the better."

I wondered, "If Brayden wants more choices, did he not like the choices that I provided? Did he not feel like the choices were meaningful?"

Other responses made me reconsider whether I provided enough support. For instance, I could have done a better job helping Jayson.

"I feel like the choices could be a little more clear. Like what we have to choose from," wrote Jayson.

I wish Jayson had relayed his confusion to me during class. Hence, I learned that this survey is a great tool for gaining genuine insight into students' thoughts, ideas, and suggestions that they may have never shared in class. While I was upset that I missed the chance to provide needed support for Jayson, I was proud that I had the idea to include the choice improvement survey as student answers were helpful when considering construction of future choices.

Closely related to Jayson's response, Evan's response seemed to resemble confusion with the choices, but he also provided some great suggestions.

"I think that the independent station should have a worksheet to document their results and have a goal to reach every day. If the goal isn't completed, it's homework," wrote Evan.

Evan seemed to want a better way to document his interactions with the independent work. When I designed the original order of operations checklist (Appendix C, section i), I had designated places for students to check off what they had completed, but I failed to discuss any type of specific goals. The only real goal students had was to get all parts finished by the quiz. Hence, this response was extremely important and changed the way I provided future choice-based work.

Although I had already created and made copies of the next choice checklist on Real Numbers (Appendix C, section ii), I began to include sections for due dates and goals on the Equations Checklist (Appendix C, section iii), the Rates, Proportions and Unit Analysis Checklist (Appendix C, section v), and the Inequalities Checklist (Appendix C, section vi). Furthermore, I had broken down the checklists into smaller sections to allow for daily and weekly goal setting and due dates.

Also in terms of support, Ren mentioned, “I need help multiplying decimals.”

I had no idea Ren struggled when multiplying decimals. Admittedly, most of the examples and practice problems completed at the direct station did not include decimals. Although students are expected to have learned operations with decimals, I failed to provide sufficient review on the material. At the very least, I should have included some review videos on fractions and decimals, even though

I had assumed such content would be understood prior to enrollment in an algebra course.

Along with support and guidance, another central theme that emerged from the first choice improvement survey was that choices needed to be organized and accessible. When I read Ava's survey response, I felt terrible that she struggled to access one of the provided choices. Her response reflected frustration, which was the last thing I wanted my students to feel. She responded:

I think that maybe you should do a test run of the online programs from a student point of view, just to make sure that all the programs function as they should. With CK-12, I couldn't access other sessions (the second and third one) without making an account, and the students themselves can't even make the account. Ultimately, I was unable to use the tool. So just check to make sure that sort of thing won't happen beforehand. Other than that, I think it ran smoothly.

Like Ren and Jayson, Ava did not discuss this with me in class, further showing how important this survey became to my research in terms of gaining students' thoughts. I could have easily helped Ava manage this online tool in a variety of ways, but I failed to support her at the point of need. Ava got frustrated at the inaccessibility of this choice, and I felt embarrassed for not thinking about the potential login confusion that this choice entailed. It was errant to think that

students could manage to navigate a new resource without any guidance. I learned that taking time to review the parts of each choice, including account set-up information, was essential for the choices to be effective.

The worst part about learning of Ava's frustration was that I could have easily showed her how to use the tool by clicking on a few strategic links. Ava made it to a certain point and got stuck, but she could have continued by using her Google account without having to type a single word. Not knowing this, Ava got frustrated and found the choice inaccessible. Since the choice was inaccessible, she did not find the choice meaningful.

I felt compelled to discuss Ava's response with her in class.

"Ava, first of all, I want to apologize that you felt so frustrated with the CK-12 program. When I included it in the choices, I remember considering the login issue, but then I failed to give directions on this choice. I feel really bad for wasting your time. I know it's late now, but if you grab a computer I can show you how to navigate the software in case you wanted to try it."

"Yeah, I got stuck after the first part, and it wouldn't let me continue without creating an account. Then I tried to create an account and it said I couldn't because I'm a student."

"Yes, this is an unfortunate aspect of CK-12. However, I can show you how to continue by using your Google account. You don't even have to type a word!"

Ava proceeded to grab her computer and I showed her how to navigate through the website and the online software. Ava was surprised to learn how she could have avoided the headache.

“That’s all I had to do?”

“Yes! Now I have to ask you, why didn’t you ask me for help when you encountered this problem? Don’t think I’m upset; I am just curious and looking to be a better teacher!”

“Well, I was at home when I tried it and got stuck. When I was in class the next day, I was at the collaborative and independent station, so I didn’t get to see you and ask.”

“Oh no, well I need to be more accessible for days that you do not have the direct station. That goes for everyone. I have an idea.”

I proceeded to post a course update to Schoology.

“If you have questions about your online tools or independent work and I am not available please email me using the following link and I will respond within 24 hours!”

After posting this course update, I relayed the update to the entire class.

“On days where you do not have the direct station and you have questions, please use the Schoology support link I have just posted to our class. I will respond within 24 hours, much like the vow I made to have your assignments

graded within 24 hours. Use this link any time you have a question but you do not have access to me.”

Ava seemed satisfied, as did the entire class. Once again, the choice improvement survey allowed a student to express a concern that led to an improved learning experience for students at the independent station.

When I first started talking to Ava, she seemed stressed and still frustrated. When she noticed, though, that I wanted nothing more than to support her, I witnessed a serious transformation in her daily interactions and overall mood. Normally Ava looked stern at all times, rarely talking, and rarely smiling. After our conversation, Ava was smiling and seemed to remain happy each day she was in class. Ava was no longer afraid to ask questions, and her engagement at the direct station improved tremendously. I felt proud for having been able to provide Ava with a comfortable learning environment, both online and face-to-face.

The last central theme that emerged from the first choice improvement survey was that choices needed to be meaningful and relevant to students. Students did not enjoy doing work for the sake of doing work, and I felt embarrassed that some students did excess work, like Kaitlyn.

Kaitlyn wrote, “IDK, the vocab just wasn’t needed because of watching the videos and reading the notes.”

It was apparent that Kaitlyn did not find the vocabulary section meaningful, as she was able to gather this information from other choices. I

considered revising the way in which vocabulary was presented in classes in light of Kaitlyn's survey response. Unfortunately, the Real Numbers Checklist (Appendix C, section i) was a vocabulary dominant section, and I had already included two sections of mandatory vocabulary. However, I was set on having a class discussion about avoiding repeat work with the Real Numbers Checklist. Without having Kaitlyn's response, I may have never considered this discussion.

Anthony's survey response was also related to the meaningfulness of the choices being provided.

"I would add one or two harder topics and make it an option to do if the other topics are easier," wrote Anthony.

Anthony's response demonstrated that he would find extension and enrichment work meaningful to include as a choice for when he feels the content is too easy. Including this extension work was an area I focused on as I developed future checklists, and it was credit to Anthony for relaying his thoughts on the choice improvement survey.

Angel's survey response also demonstrated the need for choices to be meaningful.

"To be honest, I really don't enjoy online work, especially at the independent station. I would much prefer to do pencil and paper work at independent stations. (Easier to focus)," wrote Angel.

Angel would select paper and pencil assignments over IXL because it helped him focus. Angel found paper and pencil assignments to be more meaningful to his learning than the IXL. As I learned the next day, Angel was not the only student who shared this view.

Sara, like Angel, also chose to complete the paper and pencil work rather than the choices provided online. Angel was not in class, so I spoke to Sara to get further understanding of why she preferred this option.

Sara explained, “I really like the old-school practice. I hate trying to use computers to learn math, so I’m glad I didn’t have to do the IXL. I learn better from printed stuff and practice.”

“Can you elaborate on how the paper and pencil assignment seemed more helpful than the computer work?”

“I just like to have a hard copy of what I am doing. Computer screens make my eyes hurt and it’s harder for me to focus on a screen than on a paper,” Sara elaborated.

“Well, that is certainly interesting and helpful. Thank you for your insight. Can you think of ways I can make computer work more productive or more effective for you?”

“I just don’t want to be staring at the computer for extended periods of time. I can only focus so long,” Sara responded.

“So do you think a mixture of practice would be beneficial?”

“I think so. Maybe I can try the online stuff and if I get frustrated with the computer I can switch to the paper and pencil practice.”

“That sounds like a plan! I push for the online content because it does give you immediate feedback, unlike the paper and pencil assignments. The most important thing is that we can find a course of action for you to gain the understandings you need while feeling motivated to continue your learning! Keep talking to me this year, our conversation was very productive and helpful for you and I both!”

Sara replied, “A lot of teachers don’t care this much, thank you!”

“Of course I care. I want you to have the best experience possible in this class, especially when you work independently. If you ever have any further suggestions or need support with the independent content, make sure you talk to me!”

Sara returned to her work with a smile on her face. It appeared as though students like Sara felt comfortable sharing their opinions and trusted me for guidance and support. Prior to this conversation, I had considered eliminating the paper and pencil practice from future checklists due to the lack of feedback provided to students as they worked, and the delay in feedback students received after they submitted work. However, as students like Sara and Angel expressed, they found the paper and pencil practice to be more meaningful, and so I could

not justify eliminating this option. I just needed to find a way to make feedback faster for students who chose the paper and pencil option.

To provide a bit more support, I included an answer sheet to all future paper and pencil assignments such that students could at least check to see if they completed a problem correctly. This proved especially helpful for days in which students could not access me.

As a result of the data I collected from checklists, assessments, and the choice improvement survey, I knew that I needed to make several adjustments to future choice-based checklists, especially the manner in which they were organized, collected, and managed. I needed to find ways to make future choices more meaningful while continuing to provide students with needed support and guidance.

Even with all that I had learned from the initial data I collected, the next round of checklists proved that I had more work to do.

Let's Set Goals This Time

Upon completing our unit on the order of operations, we embarked on our next curricular unit, Real Numbers. The Real Numbers unit was especially heavy with vocabulary, including properties of real numbers and the definitions of real numbers. Over the course of this unit, the Real Numbers Checklist (Appendix C, section ii) was completely altered. I regretted having printed and copied so many checklists prior to reviewing the choice improvement survey, as I was unable to

make changes to document prior to distribution. I did, however, support students by breaking down the content into the four specific sections with four specific completion goals while at the direct station.

“Everyone grab a yellow, blue, green, and orange highlighter and take out your Real Numbers Checklists.”

Students gathered their supplies and returned to their direct station sheets.

“From you improvement surveys, I learned that we need to break down these units into smaller parts and set short term goals and due dates. That is what we will be doing today. I am hopeful by the end of this station, you will all have a clear understanding of what is due and when it is due.”

Students sat patiently, but did not look excited.

“First of all, the vocabulary in this section is extremely important, so you are still required to record parts one and two in your checklists. Your goal to record this vocabulary and the properties is this Thursday. Please write that down on your checklists now.”

Students wrote down the due date and waited patiently for further directions.

“Now I am going to help you break down the choice portion of your checklist into four specific sections. First we will need to make a key.”

I proceeded to write a key on the projector and had students copy them on the top of page three of their Real Numbers Checklists. Yellow represented

classifying real numbers, blue represented ordering real numbers, green represented the properties of real numbers, and orange represented simplifying algebraic expressions.

“Take your yellow highlighter and follow along with me as I highlight the choices that relate to classification of real numbers.”

I proceeded to highlight each choice item according to our key. I paced the direct station to ensure all students followed along and highlighted items correctly.

“Now let’s discuss goals for completion. Your goal to complete the yellow section is Friday, blue is Monday, green is Tuesday, and orange is next Friday. Please write these goals down like I have on the projector.”

I did this with each group as the first direct station activity for the new content.

Collaborative Station Disconnect

In the meantime, students worked on a Real Numbers Poster project at the collaborative station during the course of this unit, so balancing time between assignments proved tricky. In hindsight, I recall feeling like the poster project was a waste of students’ time. The poster project did not in any way support students’ learning of the real numbers and felt like a forced collaborative activity that added to student stress.

I thought to myself, “Why did I even include this collaborative activity? Why not utilize the collaborative station as a means for peer support on their checklist choices?”

As I watched students struggle to balance the project with their independent work, I wanted to make changes to future activities at the collaborative station. I felt that it would be more beneficial to give students time to collaborate on their checklists rather than complete a collaborative activity that seemed forced.

Apply it or Learn it?

Another important revelation that emerged during the Real Numbers unit occurred when I witnessed Ava struggle with the distributive property as she practiced problems at the direct station.

“I suck at the distribution property. I did last year and I will this year, so I don’t think I can ever learn it,” Ava stated as I watched her make an error.

I was upset at Ava’s response.

“Ava, you got to have some confidence! I’ve seen you do great things so far this year, and I know you are bright. I promise by the end of this week, you will be a distributive master!”

Ava smiled nervously, and proceeded to try the next problem.

“I like that you drew in the arrows this time Ava, but remember to multiply not add.”

“See, I told you. I can’t do it.”

“But you did do it! You just forgot to multiply. You even combined your like terms correctly! I promise you are getting better!”

“I guess so, but I still need more practice.”

Looking at the clock, I realized that I only had four more minutes with Ava’s group at the direct station. Ava’s group would be at the independent and collaborative station tomorrow, and so I would not be able to provide her direct support if she was struggling. To accommodate, I wanted to show Ava which choices would best support her learning, so I asked her take out her checklist.

“Ava, could you take out your checklist for me so I can show you where to find the best support for the distributive property?”

Ava took out her Real Numbers Checklist and opened it to page 3. I took a seat in the vacant desk next to her and started reviewing the choices, specifically those that we had highlighted in orange for the simplifying algebraic expressions content, which included the distributive property.

“Okay Ava, these choices are a great place to practice the distributive property in a variety of formats with a range of difficulty. I’ll circle these.”

I circled the choices including the IXL, CK-12, and old school practice.

“If you get stuck and need to see some examples, these are the choices that will be there for support. I’ll underline those.”

I underlined the support choices including the videos and the readings.

“Start with some of the circled choices. If you get stuck go to the underlined choices.”

Ava replied, “So the circled one’s are like applying it and the underlined ones are like learning it?”

“Exactly! Do you find this more helpful?”

“Yes, this is actually tremendously helpful.”

“Well, Ava, you have again led me to another important discovery with this new choice content and I can’t thank you enough for being open and talking to me.”

“Your welcome!”

The bell rang before I had the chance to announce this idea to the class. I was very happy with Ava’s suggestion, and so the next day I made sure the rest of the class circled and underlined choices accordingly.

Ava’s struggles with the distributive property led me to an important realization with the choices I provided students. While I was in the process of creating the Equations Checklist (Appendix C, section iii), I realized that I needed to break the choices down into the learn it or apply it category in order to further support students in making meaningful choices. Thus, I began simultaneously creating the Managing the Equations Checklist document (Appendix C, section iv) when I managed to free up time.

What Went Wrong?

When it came time to collect students' Real Number checklists and have them take the assessment, I was disappointed in students' performance on both. I was beginning to feel discouraged with my curricular changes. I thought that I was improving students' interactions and learning at the independent station, but the results of the checklists and assessment indicated that something had gone wrong. There was a clear disconnect between what students were doing and what students were being asked to demonstrate.

Starting with the checklists, even though we set specific goals for each part, I decided to collect all parts on the same day. That was a bad idea. Not only did I once again increase my amount of grading at one time, I realized that some students hardly completed anything at all! Had I collected each of the four parts on four separate dates, I would have been able to see which students were not meeting their goals. I initially wanted to leave goal management solely up to the students, but I now understood that this is a skill that needed to be modeled.

I obtained about half of the checklists on the due date, despite asking daily about progress. "Are we certain that this due date is still feasible?"

Students nodded their heads, but I failed to actually check their work. In hindsight, I should have dug deeper and asked for proof periodically and not just asked if the due date was feasible.

I thought, “Maybe a student would be too embarrassed to ask for an extended due date.”

Hence, future checklists must be broken down into smaller chunks with periodic requests for proof of work.

After reviewing the Real Number Checklists that I did receive on time, I realized that I should include reflection questions for practice quizzes, as some students met the requirement, but got 0’s on the quiz and learned nothing from it. Will was one of those students.

“Will, I saw you got very low scores on the practice quizzes. Can I ask you honestly, did you actually try them or did you just rush through them to get credit? I promise I won’t get mad, so be honest.”

Secretly, I already knew the answer.

“Yea, I didn’t even read them. You never said we needed to get a certain score, just that we did them.”

“Will, you are correct. We both know that was a waste of time, but I hope you can show some more effort on the next set of choices.”

“Yeah, I will. I just thought the stuff was boring. it was like all vocab.”

“Don’t worry Will, we are starting equations next week!”

I was thankful for Will’s honesty, but once again I felt embarrassed at my mismanagement of this particular choice. I did a poor job planning the online

practice quizzes. I considered using the online quizzes as pre-assessments in future checklists rather than a choice option.

After students were quizzed on the Real Numbers unit, I further reflected on how to improve future choice based work. As expected, students who did not turn in checklist work were the students who were unable to finish the quiz on time. I felt compelled to establish a procedure for handling late work. For now on, all checklists need to be turned in prior to the quizzes. Quizzes will be two days after that to allow for grading and increasingly apparent much needed feedback.

Upon grading this quiz, I was excited to discuss results and my thoughts with the students. While upset with quiz scores, I was at least conscious of what possibly went wrong and I strove to improve the next checklists for equations based on what I learned from the Real Numbers Checklists and Quizzes.

“Okay class, the quizzes were pretty bad. I have some theories about what went wrong, but now is another chance for you to give me feedback. I am passing out another choice improvement survey prior to starting the equations unit. I know some of you have some good ideas, so please help me, help your peers, and help yourself! This was a powerful activity last time, and I hope we can get some helpful suggestions again.”

Students completed the choice improvement survey for the second time, and the remainder of class was dedicated to reviewing the Real Numbers assessments.

That evening, I took home the students' surveys and read through each one. Key responses to the second improvement survey can be seen in Figure 11.

<u>Student</u>	<u>Response</u>
Erny	"I think the independent station is working very well. :)"
Kathy	"Honestly they're fine but I can never focus."
Norman	"I want more times to work with you instead of on the computer. Also the choices should change too."
Angel	"Everything went much better than last time! My group seemed much more focused...this was overall much more fun :)"
Steve	"I would have more paper stuff like worksheets."
Alexa	"More understanding on the checklist."
Tristan	"What I have in mind for the independent station is that a checklist could be assigned to you if all work is done and could serve as extra credit. If there was a specific order to do my work I think I would be able to do better."
Matt	"It's great how it is."

Figure 11. Key Responses to Second Improvement Survey

A Great Idea

The following class, I wanted to share the survey results with students and allow for a class conversation on what was said in the surveys and offer an opportunity for further suggestions.

"Find a seat and read through some survey responses I have projected on the board."

Student names were not visible on the projector. I did not want anyone to feel embarrassed for sharing something they did not want the class to see, so I kept the responses anonymous on the projector.

“After seeing some of these responses, what are your thoughts?”

“There aren’t many good suggestions,” stated Isaiah.

“Why do you say that?”

“Because there are no specific suggestions. Some one said ‘more understandings on the checklists,’ but didn’t give any suggestions or explain what was confusing.”

“That makes more sense. I admit that I felt the same way. For the next five minutes, I would like you to get into your small collaborative groups and talk about specific strategies. We will then come back together and see what you came up with!”

Students split into their collaborative groups and discussed strategies to improve the independent station as I paced the room and listened. When it came time to share, Mady came up with a wonderful suggestion.

“I think that when we start new checklists we should spend the first day as a whole class reviewing the parts together,” stated Mady.

“Mady, that is so simple yet so powerful. I can’t see a flaw in your suggestion, and I think it is a great idea.”

Previously, I would administer checklists and go right into the rotations. I would discuss checklists at the direct station, but some groups started their independent work without having any explanation! Clearly, Mady came up with a brilliant plan to eliminate potential confusion with the checklists.

Upon hearing Mady's suggestion, the class seemed to agree enthusiastically with having an introductory day.

"Hearing Mady's suggestion, and seeing how we all agree, it is settled. For now on, when we start new content, we will have an entire day dedicated to reviewing the independent checklists. This will give you time to ask questions and start exploring some of the choices. Mady, what a great idea!"

Mady was excited to help improve the checklist procedures. Meanwhile, the entire class was excited that I was taking their voices into consideration and actually acting on the suggestions they provided.

"So, Mady just gave us a great idea. Would any other group like to share a suggestion?"

Sara raised her hand.

"What suggestion did your group come up with, Sara?"

"It's similar to Mady's. We decided that we need a quiz review day as a whole class prior to the quiz. A lot of us felt like we didn't know what would be on the quiz."

"Great suggestion, Sara. I had also considered doing this. One important thing needs to be discussed, though. On the last checklist, I was disappointed at how few of you were able to turn them in on time. If I were to dedicate a day for a quiz review, we need to make sure that our assignments are completed on time."

Some students who were guilty of not turning in their checklists on time looked down and avoided eye contact.

“To help this process, your next checklist will contain three specific parts and three specific due dates. As per Mady’s request, I will introduce each of the three parts as a whole class and will collect materials from your checklists at three separate intervals rather than all at once.”

At the time of our discussion, I remember feeling upset that students were so focused on quiz grades and were not showing an appreciation of the math they were learning. I knew that I had to do a better job making choices more meaningful and interesting, and I wanted students to actually appreciate the content itself. I felt as if all the procedural endeavors that the checklist entailed were decreasing students’ appreciation of mathematics. I reminded myself of this daily and revised the activities at the direct station to include fun, real-world examples of equations in order to increase students’ passion and interest towards mathematics.

The class discussion lasted about 25 minutes, and the remainder of class was spent introducing one-and two-step equations. I was thrilled to see so many students recall how to solve these equations from last year, telling me that the due date for part one of the checklist may be sooner than I initially planned. I was going to pass out the Equations Checklist (Appendix C, section iii), but I decided to wait until the following class.

That night when I got home, I reviewed the equations checklist and finalized the Managing the Equations Checklist document (Appendix C, section iv). The Equations Checklist resembled the previous two checklists, but the Managing the Equations Checklist document was quite different. This document took into account all of the suggestions and student feedback I had received over the course of school year.

A Major Shift: Learn or Apply?

The following class, I passed out the Equations Checklist (Appendix C, section iii).

“This document was the original checklist I had designed for equations. However, I also designed a document to help you manage this new checklist. I call it the Managing the Equations Checklist document.” I passed it out and directed students to take a minute and review it. As I glanced around the room, I saw some confused looks.

“Clearly, these checklists are different than our previous two. To clarify, the first document is a set of all the activities, while the second document breaks down the content into three specific sections with step-by-step procedures for managing the choices. Let’s first look at the Equations Checklist.”

Students shuffled between the two papers and I made sure everyone was looking at the correct document. In hindsight, I remember thinking that I should have passed out one document at a time to avoid confusing students.

“Looking at the set of activities, what seems new?”

“The practice quizzes have reflection questions,” Pete noticed.

Practice Quizzes

Directions: Complete each practice test on a separate sheet and record your score. You must submit ALL work including each question and your solution/steps. In addition, please complete the reflection questions after completing each practice quiz. You need to answer all reflection questions for each quiz on a separate sheet of paper.

- One-Step Equations Quiz: Score: _____ Date Completed: _____
- Two-Step Equations Quiz: Score: _____ Date Completed: _____
- Multi-Step Equations Quiz: Score: _____ Date Completed: _____
- Variables on Both Sides Quiz: Score: _____ Date Completed: _____

Reflection Questions (Complete for each quiz)

1. What problems did you get wrong and what did you do wrong?
2. What is the correct solution to each problem you got incorrect? (SHOW WORK!)
3. What can you do to better prepare for such a quiz?

Figure 12. Practice Quiz Reflection Questions

“Keen observation Pete. Does anyone know why I decided to include these questions?”

The class did not have a response.

“For those of you who completed the practice quizzes previously, can you think about why it was not a great activity in terms of helping you learn?”

“Because we could get a zero on it but still get credit for completing it,” said Brayden.

“Exactly. Some of you seemed to have found a loophole with that assignment. To better support your learning, the reflection questions require you to review what you got wrong and write a few sentences about how you can better learn the material.”

“Aw, now we have to actually take them seriously,” said Norman.

“Yes. The practice quizzes were like a boat with a hole in it. But I found a plug, so our boat can sail again. In other words, the new practice quizzes are more effective for helping you learn. Thank you for pointing that out Pete. What else is new with this set of choices?”

“The videos have note-taking guides,” said a voice from the back.

Videos + Guided Notes (NEW)

Directions: Watch all videos and take notes on the accompanying guided notes pages. There are three guided notes pages, with seven total videos. **Submit completed guided notes along with this checklist for credit!!!**

- [One and Two-Step Equations Guided Notes](#) (3 videos):
Date Completed: _____
- [Multi-Step Equations Guided Notes](#) (2 videos):
Date Completed: _____
- [Variables on Both Sides Guided Notes](#) (2 videos):
Date Completed: _____

Figure 13. Videos + Guided Notes Choice

“Correct! I remember several of you had questions about the video assignments and what exactly needed to be recorded in your notes. If you look at the back of the room, on top of the Chromebook cart, there are several bins with folders inside. Each bin contains guided notes for each of the three sections in the equations checklist. When you choose to complete a video assignment, you must grab the corresponding guided notes and turn these in as part of you checklist assignment proof. Suzy, could you grab me a copy of one of the guided notes?”

Suzy obliged and brought the solving one-and two-step guided notes to the front of the room. I projected the document so the entire class could see it. Figure 14 is a snapshot of the guided notes being projected.

Solving One-and Two-Step Equations

Video Notetaking Guide

Directions: You will be watching three brief videos on how to solve one-and two-step equations. Follow along with the outline below as you watch each video. Be sure to include all required notes, and add any questions you may have. Begin by watching the first video titled: "Solving One-Step Equations: Addition and Subtraction."

Video 1: Solving One-Step Equations: Addition and Subtraction.

Answer the following:

(0:45) What is an equation?

(0:58) What is the opposite or inverse operation to addition?

(1:09) What is the opposite or inverse operation to subtraction?

Fill in the following as you watch the remainder of the video:

Problem	$x + 12 = 20$	$x - 9 = 4$
How do you solve this problem? (Show work AND explain your steps)		
Solution		

Figure 14. Video Guided Notes Snapshot

“So taking a look at the guided notes, you can see that I included the times in the video for which you should pause and take notes, and I left space for you to record specific examples. I am hopeful that this will make the video assignments more meaningful for you. Before we move on, are there any questions about this change to the video choice?”

I looked around the room, and there were no questions. I observed several students appeared happy with my inclusion of a note-taking guide. The class was quiet, but deeply engaged in listening to me present checklist alterations.

I felt compelled to mention, “Had it not been for your suggestions, I may never have created this document. As I look around, I see a lot of you seem excited with this new change, which makes me super happy! Keep the suggestions coming. I want you to have the best learning experience possible. Let’s now look back at the Equations Checklist and look for more changes. What else do you see that is different?”

“There’s a poster project. We never had a project option before. And also there is the Envision stuff,” mentioned Antonio.

Figure 15 shows the final two equation checklist choices, namely the Story Problems Poster Project and the Envision Textbook Readings + Practice Problems.

Story Problems Poster Project (NEW!)

Directions: In Schoology (Equations Folder), click on the Story Problems Poster Project folder. Read the directions and be sure to follow the rubric. If you choose to do this project, you only need to complete one other choice assignment! Remember, make your poster look nice!!!!

Date Completed: _____

Envision Textbook Readings + Practice Problems (NEW!)

Directions: Grab an Envision book in the classroom. You may not take the book home unfortunately, so need be you may take a picture of the following pages to complete this assignment at home.

- **Part 1: Read pages 11-15. Complete problems 1-9 on page 15 AND problems 16-38 on page 16.** Turn in all problems with this checklist.

Date Completed: _____

- **Part 2: Read pages 18-21. Complete problems 1-9 on page 21 AND problems 16-41 on page 22.** Turn in all problems with this checklist.

Date Completed: _____

Figure 15. Poster Project and Envision Textbook Choices

“Absolutely right, Antonio. I realized that the last set of choices did not seem to have any meaningful real-world applications. I want you all to appreciate the math you are learning, and so I found a real-world project to go along with equations that seemed really fun. Making these checklists takes a lot of time, and prior to now I did a poor job of including more interesting activities. Rather than explain the project now, I will wait until we approach multi-step equations. For those of you choosing this option, it will most likely be the last item you complete on your checklist. Antonio, you also pointed out that the Envision stuff was new. Did anyone in the room use Envision last year?”

Anna chimed in, “We used it a little bit last year but the online stuff was confusing.”

“I actually agree with you, Anna. When we got these textbooks and the software, I was disappointed with the online material. However, the actual

textbook and workbook give us solid examples and practice problems that will be very helpful for this unit on equations. This choice is similar to the Old School Paper and Pencil materials, but a bit more technical for those of you looking for a challenge.”

At this point in class, I noticed some students were beginning to lose attention. I had done a bit too much talking, perhaps, and students seemed restless.

“That was a lot of information. Why don’t we take a two or three minute break before I discuss the second document because it is extremely important and I want to make sure you are listening!”

Following the break, the students took out the Managing the Equations Checklist document as I projected it on the board. Figure 16 displays the procedures for completing part one of the equations unit, one-and two-step equations. This is the first column in the Managing the Equations Checklists document (Appendix C, section iv).

Equations Checklist Navigation + Goals
<p>One-and Two-Step Equations</p> <p>Pre-Assess....</p> <ul style="list-style-type: none"> • One-Step Equations Quiz • Two-Step Equations Quiz <p>Did you do well(85% or better)? Answer the reflection questions (from checklist) then Go on to Apply it.</p> <p>Did you do poor? Go on to learn it, then answer the reflection questions (See checklist)</p>
<p>Learn it....</p> <ul style="list-style-type: none"> • Videos + One and Two-Step Equations Guided Notes (3 videos): • Readings + One and Two-Step Equations Notes
<p>Apply it..</p> <ul style="list-style-type: none"> • Old School: Practice 3-1. • IXL: J.3: Solve one-step linear equations AND J.4: Solve two-step linear equations
<p>Goal: October 17th</p>

Figure 16. One-and Two-Step Equations Checklist Procedures

“From our discussions in class and your feedback on the choice improvement surveys, it was obvious that the choice checklists needed more structure. Essentially, this is my solution to help you all navigate through the choices more effectively. First of all, notice how I broke down the equations unit into three specific sections and included goal dates for each section. We will start with one-and two-step equations, then move on to multi-step equations, and finish up the unit with equations with variables on both sides.”

Students examined their documents carefully as I proceeded to explain the manner in which they should approach the equations assignments.

“When you start your checklist work, you will begin with the first column, one-and two-step equations. Start with the ‘Pre-Assess...’ box. There are two pre-assessments for one-and two-step equations and you must complete both. Can I have a volunteer read the text under the bullets?”

Suzy volunteered and read to the class, “Did you do well? 85% or better? Answer the reflection questions (from checklist) then go on to apply it. Did you do poor? Go on to learn it, then answer the reflections questions (see checklist).”

“Thank you, Suzy. That is very important that we all understand this procedure. It came to my attention from previous checklist work, that there were times a lot of you were doing assignments even though you knew the material. I do not want you to waste your time in here, and I would much rather have you move ahead at your own pace. So to me, I thought, ‘what sense does it make to have you watch a video on material of which you already demonstrated understandings?’ Hence, I made the middle row of this document to include materials that are strictly for learning content. The final row, or ‘Apply it...’ is the assignments you complete to prove your understanding. Whenever you do poorly on a pre-assessment or you struggle on the ‘Apply it...’ materials, you will refer to the middle column of this document for extra support when I am unable to help you. Remember, there is also a goal for completing part one of your equations

checklists on one-and two-step equations. I may alter this goal, but for now these materials will be due on October 17th. I made the mistake previously of collecting all checklist materials at once. This time, there are three separate parts, making it more effective for me to grade and give timely feedback. I am hoping that breaking down the checklist into smaller parts will be helpful for you as well. That was a lot of new stuff. Are there any questions at this point?"

Students sat quietly, so, I was uncertain if they understood the steps I had just laid out. I was positive that questions would arise as we got into the actual material.

With five minutes left in class, I stated, "Go ahead and start the pre-assessments with the time we have left. If you are unable to navigate to the correct parts of Schoology to find these choices, now would be the time to ask for help!"

Students had no issues navigating to the pre-assessment, and a few students finished the first assessment, but most did not.

"Remember, the Schoology assessments will save your progress if you do not finish, so don't rush!"

As class concluded, I felt exhausted, but I knew it was important and I reminded myself of Mady's suggestion in that the first day of new content should be whole class. I recall Mady being excited that I put her suggestion into action, as she had a smile on her face the entire class. Again, this was a simple suggestion but very powerful. Considering it took nearly the entire class to review the

checklist changes, trying to explain these changes in the hybrid model would have entailed that I condensed my lecture into twenty minutes. In the meantime, students at the independent station would have had to start their work without any explanation at all. Mady's suggestion altered my procedures, and I continued to listen to student suggestions for the remainder of the year.

Rather than jump into the hybrid rotation the next class, I decided to have one more whole-class instruction day to outline the activities students would be working on at the collaborative and direct stations. I also wanted to get suggestions on how I should grade checklist work, as I was debating this idea the entire time I was creating the equations documents.

How Should I Grade Your Work?

During the next class, I reviewed the collaborative assignments and outlined the agenda for the upcoming two weeks. In addition, students and I discussed potential grading policies for the Equations Checklist assignments. There were many unique ideas brought up in class for how I should grade their checklist work, and I was entirely open for hearing all opinions.

“You should collect everything we do for each of the three sections and give us three separate scores.”

“You should only grade the Apply it... stuff.”

“You should make us turn in at least one Learn it... and one Apply it... item for each section.”

“You shouldn’t grade them at all,” yelled Jared.

The class laughed at Jared’s response, as he intended it to be a joke. But I thought, “Maybe Jared is on to something?”

I stood in the front of the room and proceeded to think aloud, “What if Jared is right? Is there a way I can ensure you are all working to learn the material without collecting and grading it? What happens when you do well on assessment and demonstrate you understood the content, but you get a bad checklist grade? Is that fair? Hmmm....”

Students shared my puzzled look as they thought about what I mentioned. I looked around the room and saw Shelby’s face light up with excitement. She raised her hand and said, “Last year Ms. Evans would only give us assessment scores and she never graded our classwork. If we did bad on an assessment, then she would go back into IXL and see what sections we completed. If we failed a quiz and wanted to get a better score, we knew we had to have certain IXLs completed first.”

“That’s interesting, Shelby. So how many grades did you have in a marking period?”

“We only had like four grades per marking period. I mean we did a ton of work, but only the assessments went in gradebook.”

“Hmmm. This is something we may be able to adapt in our class. Would you all be interested in having some mini-assessments at the direct station as opposed to me collecting checklist materials for each of the three sections?”

I was surprised to see how excited this made students, but I was also fearful. I thought about the project assignment and I thought about how this grading procedure may affect students’ decisions to interact with certain choices.

“I am leaning towards this idea, but I do have many concerns obviously. I have a lot to think about, but I think we can try this out, at least for the one-and two-step equations checklist materials. So come October 16th-17th, instead of turning in your materials for one-and two-step equations, I will have you complete a mini-assessment in order for you to demonstrate your understanding.”

I paused and thought further to myself before sharing, “Your mini-assessment grades will replace the checklist grade. If you do poorly, we can individually conference and assign the appropriate materials. If you do well, you can continue working through the next two sections at your own pace. Of course, I will be monitoring what you are doing in the meantime with daily check-ins when possible. But, your class has given me excellent suggestions in the past, so let’s try this out!”

By the end of this discussion and my introduction to the collaborative activities and upcoming agenda, class was almost over. I gave students the remainder of class to work on either checklist or collaborative work. Most chose

to continue their checklist work, while a few worked on the collaborative assignment. For the students working on the collaborative assignment, I began to question why I had included it in the first place. The assignment was to create a poster on the real numbers, but I realized that there was not enough mathematical learning involved with it.

Trusting my own instincts, the next class, I decided to completely scrap the collaborative assignment.

“While I had good intentions for including the collaborative assignment, after a personal reflection, I have decided to scrap this from the unit. Frankly, it really doesn’t help you learn what I intended. Instead, use your time at the collaborative station to work together on checklist materials. Last week, I saw many of you do just that instead of the actual collaborative work. While that frustrated me at first, I realized that I overheard some of the best collaboration of the year when you supported each other with independent work. So why not continue what works?”

The students seemed thrilled. Some were probably just happy to have one less assignment, but I know that some students appreciated my intentions of making their time in class more valuable.

Over the next several classes, the students rotated through the hybrid stations, working on checklists at the independent and collaborative station. At the direct station, I introduced a variety of fun word problems with equations and

even had students create and share their own. I wanted to increase students' appreciation of mathematics, and so many of the examples I included were built directly on my students' interests. For instance, I knew DeMarcus dreamed of owning a Lamborghini and living in Miami, so I created a word problem that required him to figure out the time it would take to reach Miami from our school when driving in his Lamborghini at a designated average speed. DeMarcus excitedly researched the distance to Miami, and was fully engaged in trying to solve the problem.

Our interactions at the direct station also included checklist check-ins, in which I asked each group at the beginning of class, "Who needs help or support with your checklist?"

I rarely received questions, and I felt confident students were doing well and meeting my instructional objectives.

After going through the rotations for several classes, it came time to our agreed assessment days at the direct station (one group completed it on October 16th, while the other two groups completed it on October 17th). Having a formal assessment at the direct station was new for me, and I was confused about how to administer it. Students were sitting directly next to each other in a horseshoe shape, and I was concerned about potential copying or cheating, so I made three separate worksheets containing a variety of one- and two-step equations. The

worksheets started easy and became progressively more difficult. Essentially, it was a brief yet telling formative assessment for one- and two-step equations.

As students worked on the mini-assessments, I walked about the group and observed. It was clear who understood how to solve the equations and who did not. For instance, Karen sat down and sped through the problems, solving them all correctly. Figure 17 shows Karen's work on this assessment.

Figure 17 shows six equations solved by Karen. The work is as follows:

- (5.) $6x - 2 = 10$
 $+2 \quad +2$
 $6x = 12$
 $\frac{6x}{6} = \frac{12}{6}$
 $x = 2$
- (6.) $9b + 14 = 23$
 $-14 \quad -14$
 $9b = 9$
 $\frac{9b}{9} = \frac{9}{9}$
 $b = 1$
- (7.) $\frac{x}{4} - 7 = -3$
 $+7 \quad +7$
 $\frac{x}{4} = 4$
 $4(\frac{x}{4} = 4)4$
 $x = 16$
- (8.) $6b + 11 = -7$
 $-11 \quad -11$
 $6b = -18$
 $\frac{6b}{6} = \frac{-18}{6}$
 $b = -3$
- (9.) $11x - 12 = 109$
 $+12 \quad +12$
 $11x = 121$
 $\frac{11x}{11} = \frac{121}{11}$
 $x = 11$
- (10.) $7 - x = 13$
 $-7 \quad -7$
 $-x = 6$
 $x = -6$

Figure 17. Karen's One-and Two-Step Equations Work Sample

Most students solved their equations quite well, just as Karen had done. These students were subsequently directed to move on to the multi-step equations checklist materials and received 10/10 as grades for one- and two-step equations.

Some students made minor mistakes, such as multiplying incorrectly ($5 \times 3 = 18$). While incorrect, this was a trivial mistake and the student did perform the correct steps. Students making these computational rather than procedural errors received an 8/10 on their checklists, but were also directed to move on to the multi-step equations materials with a reminder to watch out for such careless errors.

In all groups, students had no issues with the one-step equations. However, one or two students in each group clearly needed more support with the two-step equations. This was obvious when I walked about the direct station and saw students staring at the paper when they made it to the first two-step equation. Rather than watch the student sit there and struggle, I intervened to help. A typical conversation went like this:

“Okay Ishmael, I see you are stuck on number 5. What are you thinking about here?”

“I have no idea. I see the fraction but there’s also a number next to it.”

“But you proved you know how to undo addition and division in the first four problems! It seems as though you are confused about when to add first versus when to multiply first? Am I correct?”

“I guess so.”

“Okay, so here is the deal. Since you knew half of the checklist materials, I am going to give you a 5/10, or a 50% on one-and two-step equations. I assume

you do not want that grade, so I will also give you some guidance and a chance to improve that grade if you choose.”

Ishmael and I then went through his checklist and I highlighted the reading assignment for him to go back to and complete, as it presented rich examples of the content he had not yet mastered. I then looked at his IXL scores, and noticed he did not complete the two-step equation IXL section. He had started it, but only answered one question. Figure 18 shows the IXL data for Ishmael.

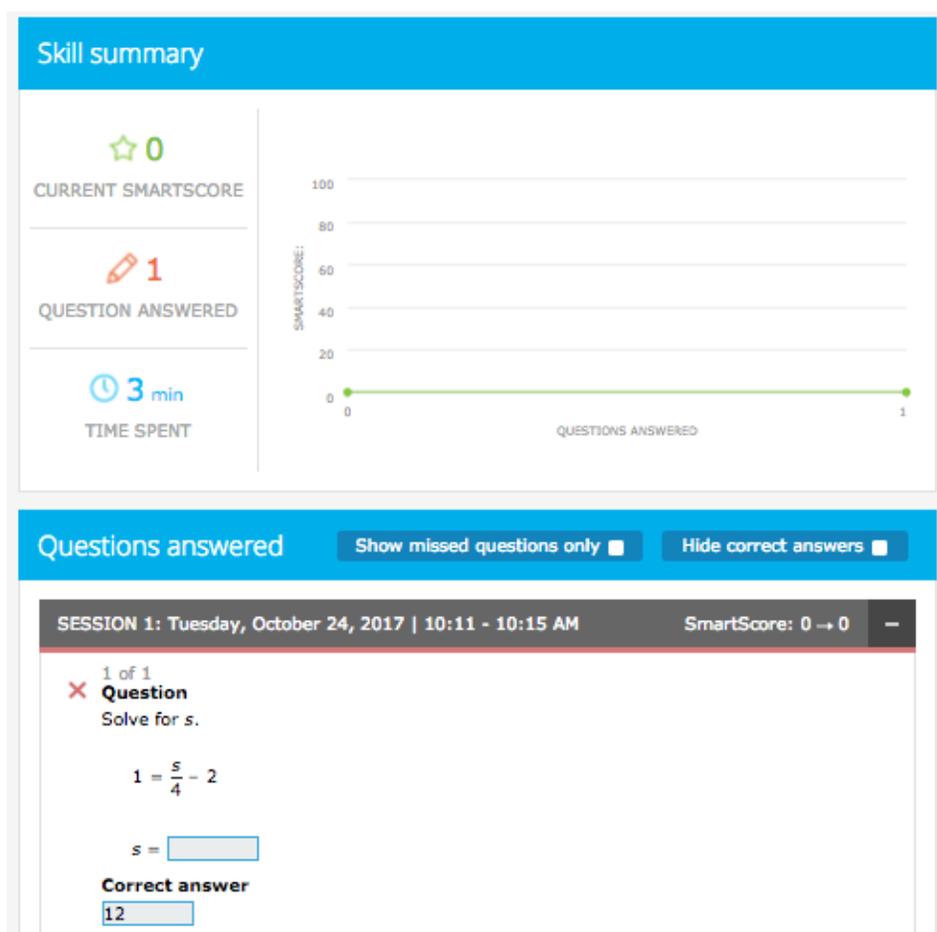


Figure 18. Ishmael’s Two-Step Equation IXL Score

“So, looking at what you’ve done and what you are struggling with, if you want to get these points back, I need you to complete the reading assignment and then get to at least a 70 in this IXL section. If you choose to do this, inform me as soon as you’re done and I will re-assess you. Keep in mind though, you will also need to be working on the multi-step equations materials that are due on October 23rd.”

Ishmael completed both the reading assignment and his IXL at home that very night. I was delighted when he came in the next class eager to inform me that he now understood how to solve two-step equations. I gave him the assessment again at the direct station, and directed him to just complete the two-step equations. It was clear he now understood it, so I bumped his grade on the one- and two-step equations checklists to an 8/10. We agreed this was fair, as he had initially been unprepared for the quiz, despite our class agreed due date.

I had similar conversations with other students who had struggled, and all eventually completed their required work to make up the points they had lost.

Students seemed to be enjoying the new grading policies and checklist format, so we proceeded to follow this format as we entered the next topic, multi-step equations.

Making it Meaningful

Over the next several classes, I helped students set personal goals for completing part two assignments of the Equations Checklist. For instance, we

would set due dates for the specific IXL sections in addition to determining an appropriate SmartScore for the given sections. While at the direct station, students and I worked through a variety of multi-step equations and word problems. To make the content more meaningful, I adapted several word problems to reflect students' interests. For example, Figure 19 displays a word problem about determining the number of hours an electrician worked.

The cost to hire an electrician is \$50 plus \$65 per hour. How many hours did the electrician work if his bill was \$505?

Figure 19. Uninteresting Word Problem

I knew my students would find this word problem uninteresting, so I adapted it to involve a topic that students had been debating over the last several weeks. As my students explained to me, a professional basketball player named Lonzo Ball released a professional shoe called the ZO2's that retailed at \$500.00. I overheard many debates about the controversial cost of this shoe in my class.

“That is crazy! Nobody is going to buy those!”

“I'm totally buying a pair. No I'm buying two pairs!”

“I think it's actually a brilliant marketing move. They're probably just regular shoes but now everyone wants them because they cost so expensive.”

Since I had overheard many conversations about the cost of this shoe in class, I took advantage of this nationally debated topic that interested my students and built the word problem displayed in Figure 20.

James cannot wait to buy a pair of Lonzo Ball ZO2's. Yesterday after school James went to Foot Locker and was shocked to learn that the shoes cost \$500. James had \$125 in his savings account, and he worked as a paperboy for \$75 a week. After how many weeks did James have enough money to buy the ZO2's?

Figure 20. Adapted Word Problem Reflecting Students' Interests

Students noticed that I was creating word problems about things they were interested in, and many appreciated it. Avery was particularly excited about the Lonzo Ball word problem, as he enthusiastically tried solving the problem out loud, even though I never called on him.

“So he’s got one hundred twenty-five dollars, that means he needs... uhh... three hundred seventy-five more dollars.”

“That would be correct Avery, so what’s next?” I asked.

“We got to see how many weeks he needs to make three hundred seventy-five dollars when he’s making seventy-five dollars a week.”

“Also correct. But how can we set up an algebraic equation to model this scenario like we did with the previous examples?”

With my guidance, Avery and I built and solved the equation for the Lonzo Ball word problem on the projector as the rest of his group listened and copied the work from the projector.

At this point, students were becoming more comfortable with variable expressions and building equations from word problems, so we progressed to solving a variety of puzzle-like word problems such as consecutive integers

problems and problems that involved figuring out someone's age when given a set a hints.

On two occasions, I gave students formative assessments on solving multi-step equations. The first formative assessment involved solving a multi-step equation by distributing first, adding second, and dividing last. The assessment and scoring rubric can be found in Appendix D, section ii., "Multi-Step Equation Assessment Item and Scoring Rubric."

The assessment was one problem: $3(7x - 10) = 54$. However, the assessment also required students to explain their reasoning for each step, and additionally, check their answers. This assessment proved helpful when setting goals with students at the direct station, as it allowed me to determine which students knew how to distribute and subsequently solve a two-step equation.

Most students solved this problem correctly and produced work similar to Cory's in Figure 21.

Step	Equation	Reason
p 1	$3(7x - 10) = 54$ Multiply 3 by 7x and -10 $21x - 30 = 54$	You need to distribute the 3 so you can simplify the equation down to addition and subtraction
p 2	$21x - 30 = 54$ Add 30 to both sides $21x = 84$	Simplify the equation to the last step
p 3	Divide 84 by 21 $\frac{21x}{21} = \frac{84}{21}$ $x = 4$	Get x by itself and solve the equation

Check your solution. Show your work.

$$3(7(4) - 10) = 54$$

$$3(28 - 10) = 54$$

$$3(18) = 54$$

$$54 = 54$$

Figure 21. Cory's Response to the Multi-Step Equation Assessment Item

I directed students like Cory to move on to part 3 of their equations checklist, but I first checked for completion of the IXLs or paper and pencil work for part 2 of the Equations Checklist. There were many different multi-step equations and potential areas of student difficulty that were not assessed in the Multi-Step Equation Assessment Item (Appendix D, section ii), but were assessed in the assigned IXLs. For instance, solving multi-step equations involving operations with fractions was not formally assessed at the direct station, and so I relied on the IXL data to gauge students' understanding of this concept. Students who solved the assessment item correctly and completed all IXLs or all paper and

pencil practice in part two of the Equations Checklist were directed to move on to part three of the checklist. Students who solved the assessment item correctly and did not complete the required IXL's or paper and pencil work in part two of the Equations Checklist were directed to first complete any missing part two checklist work prior to moving on to part 3. Depending on how much part two checklist work was missing, I also helped students set goal dates for completion. When students faced any struggles, they were directed to several helpful resources in Schoology including videos and readings.

While most students correctly answered the Multi-Step Equations Assessment Item, there were a few students like Mark who struggled to solve it.

Solve the following equation by showing your steps and identifying the reason for each step:

$$3(7x - 10) = 54$$

(2) $21x - 30 = 54$ $\frac{54}{-9}$

A. Fill in the table below with your steps and reasons.

Equation	$3(7x - 10) = 54$	Reason
Step 1		
Step 2		
Step 3		

B. Check your solution. Show your work.

Figure 22. Mark's Response to the Multi-Step Equation Assessment Item

In Figure 22, Mark correctly utilized the distributive property. However, Mark did not explain his reason, and was unable to continue the problem.

I thought to myself, “How did Mark forget to solve a two-step equation?”

After distributing, Mark wrote, “ $54/-9$.”

I identified that Mark was confused about like terms, as the only way he obtained a negative nine was to incorrectly combine positive twenty-one x with negative thirty. As situations like these arose, I conferenced with the student and tried to pinpoint areas of review in addition to setting checklist goals.

After students completed the Multi-Step Equation Assessment Item, I introduced content from part three of the Equations Checklist, namely solving equations with variables on both sides. I wanted students to have examples to help them as they worked on part three of their checklist, but I also wanted to assess what students retained in regards to solving multi-step equation word problems.

I decided that it would be beneficial to hold another one-question assessment on solving word problems involving equations, so the following class I administered the Word Problem Assessment Item (Appendix D, section iii). Similar to the previous assessment, most students answered this problem correctly. Figure 23 displays a correct response to the Word Problem Assessment Item.

A. If Alicia's age is represented by x , write an expression for Anthony's age of Alicia's age.

$$\underline{x \cdot 2 + 15}$$

B. Write an equation that you can use to find the ages of both Alicia and Anthony.

$$\underline{(x \cdot 2 + 15) + x = 66}$$

C. Solve the equation. Show your work.

$$\begin{aligned} (x \cdot 2 + 15) + x &= 66 \\ 2x + 15 + x &= 66 \\ 3x + 15 &= 66 \\ -15 \quad -15 & \\ \hline 3x &= 51 \\ \frac{3}{3} \quad \frac{51}{3} & \\ \hline x &= 17 \end{aligned}$$

Solution: $\underline{x = 17}$

D. Alicia's age: $\underline{17}$ Anthony's age: $\underline{49}$

Figure 23. Correct Response to the Word Problem Assessment Item

Most students produced work similar to that in Figure 23. However, some students forgot how to set up the correct equation from the given scenario. Figure 24 shows an example of an incorrect response to the Word Problem Assessment Item.

Anthony is 15 years older than twice Alicia's age. The sum of their ages is 66.

If Alicia's age is represented by x , write an expression for Anthony's age in terms of Alicia's age.

$$\underline{66 = x^2 + 15}$$

Write an equation that you can use to find the ages of both Alicia and Anthony.

$$\begin{array}{r} 66 = x^2 + 15 \\ \hline -15 \\ \hline 51 = \frac{x^2}{2} - 15 \end{array}$$

Solve the equation. Show your work.

Solution: $\underline{26 = x}$

D. Alicia's age: $\underline{26}$ Anthony's age: $\underline{40}$

Figure 24. Incorrect Response to the Word Problem Assessment Item

In Figure 24, the student forgot to include an addition x to represent the age of Alicia when asked to write an equation modeling the scenario. Furthermore, this student also forgot important vocabulary, as he wrote an equation for the first question, when he was directed to write an expression. Of the students who made mistakes on this assessment item, the mistakes shown in Figure 24 were the two most frequent. To help students who made these mistakes, I conferenced with them individually, explained their errors on the assessment

item, and had them try an alternative version of the problem to demonstrate that they understood how to correctly model and solve multi-step equation word problems.

Raising Accountability

After completing the Word Problem Assessment Item, students continued to work on part three of the Equations Checklist. During class, however, I witnessed an increase in off-task behavior at the independent station coming from two students. These behaviors were drastically different, but neither was ideal for my classroom. Zavier was frequently talking, loud, and distracting his peers with noises and side conversations. Meanwhile, Aaron could not stay seated and attempted to leave his computer frequently to walk around the room. It was obvious that neither student was doing work at the independent station, and I attempted multiple times to redirect their behaviors. I needed to find a way to keep Aaron and Zavier on-task, as they were consistently performing poorly on practice problems at the direct station.

I questioned both students, “What can be done to help you stay on-task in class?”

“Nothing, I’m sorry Mr. K, it’s just been a rough couple of days for me, I know I haven’t been good, but I will try harder,” responded Aaron.

While Aaron managed to stay seated more often, over the next several classes, he still managed to do very little in terms of independent work.

When asked the same question, Zavier responded, “It’s just the whole hybrid stuff- it’s hard for me to stay on-task unless I’m working with you and you’re there to remind me. I have severe A.D.D. if you couldn’t tell!”

Zavier’s response came with a chuckle, and lacking any documentation of this claim, I was unsure about the truthfulness of this statement. It was clear, however, Zavier had trouble focusing and needed more support than I was able to provide him in a hybrid scenario.

“You know that is very difficult to do in our hybrid setting. Can you think of any other way to keep on task?”

“Um, no not really.”

“What if you were required to write down what you do everyday and were graded on staying on-task?”

“Well, I guess I could try that. I don’t like getting bad grades so I think it would help.”

After this conversation, the Student Accountability Slips were created (Appendix E).

The following class, I introduced the procedures for filling out the Student Accountability Slips.

“In order to better monitor your progress and keep you on-task at the independent station, you will be completing these weekly accountability slips. All

you have to do is simply write down what you did while you were at the independent station and turn it in on Friday for five points.”

As it turned out, the accountability slips were helpful at first. Students like Zavier and Aaron seemed to be on-task each day, and both turned in accountability slips on Friday. However, there were several issues with the accountability slips.

“Mr. K, I got a zero on my accountability slip because I forgot to turn it in. I did work everyday I was here, but I lost the slip and I forgot exactly what I worked on,” said Mary.

I was stuck with how to handle this situation. Mary was a great student who showed a tremendous amount of effort in class, and I know she was on-task each day at the independent station. I did not want to punish her grade because she lost her accountability slip.

Another issue that arose from the accountability slips was the unclear grading policy and procedures for filling the slips out. For instance, one student wrote “IXL” for each day on the accountability slip. Without listing a specific section and score, I had no way of knowing if this student was actually working on IXL.

When I realized that students needed to write down specific IXL sections, I made this clear to the class.

“In order to verify the information on your accountability slips, I will need you to write the specific IXL section down and the score you obtained while in class.”

While most students were able to follow these guidelines, more issues arose. One student simply lied on his accountability slip, and I was lucky enough to catch it. While at the direct station, students and I were working on practice problems for determining the number of solutions to an equation with variables on both sides. On the last round of accountability slips, my notes indicated that each member in the group at the direct station completed the corresponding IXL section on determining the number of solutions. I expected that it would be a review session, as students demonstrated that they understood the concept by completing the IXL section. When I noticed Justin was staring at his paper and not working on it, I approached him.

“Justin, this is just like section J.8 on your IXL that you completed last week. Remember the rules for determining how many solutions these equations have?”

“No, I don’t remember this at all.”

“But you just completed this section! Perhaps you need a refresher?”

“Yeah, that would help.”

I proceeded to write out three examples for Justin on his paper. Justin followed along with me as I solved them, but he was completely lost when I asked him to try three on his own.

I thought to myself, “How did Justin complete this IXL section? Why did he forget the procedures so quickly?”

At the end of class, I logged into my IXL account and did some investigation. As it turned out, Justin did not complete his IXL on determining the number of solutions to an equation with variables on both sides. In fact, Justin did not log in to his IXL account in over a week. Everything Justin wrote down on his accountability slip was false. I felt deflated and I wondered how many other students had written false information on their accountability slips.

The next day I addressed the class, “As it turns out, some of us have not been honest about what we have been working on at the independent station. I was upset yesterday when I saw false information on an accountability slip. To fix this issue, I will check each IXL score individually listed on accountability slips. If you chose to do another practice item, such as video notes or paper and pencil practice, you must submit this evidence with your accountability slips to receive credit.”

I thought that I had figured out a solution to the problem of writing down false information on the accountability slips. While this procedure eliminated the false statements, it also created more unintended management issues. First, it was

very time consuming to verify all accountability slips each Friday. I was already pressed for time trying to search for choice-based resources for upcoming checklists, and the process of reviewing accountability slips took away valuable time. Second, when student submitted proof of work in the form of video notes, I realized that these students had to sacrifice their notes to receive a grade.

“Mr. K, can I please have the notes back right away? I want to work on IXL this weekend, but you have my notes,” Stella exclaimed.

“Oh wow, of course you can have the notes back.”

I fumbled around the student work folder looking for Stella’s notes and eventually returned them.

At this point, I was unhappy with the accountability slips. While I had good intentions for using them, many issues arose that were unintended. Issues included the increased time it took to print, copy, cut out, grade and verify accountability slips, students’ inability to use the notes they submitted, students making false statements, students losing accountability slips and forgetting what they completed, and students sacrificing valuable work time to fill out the accountability slips daily. In light of these issues, I abandoned the accountability slips, deciding that I would need to be more diligent in observing and managing the one or two students who were off-task. After all, the accountability slips were really only created for two students, Aaron and Zavier.

Aaron and Zavier showed improvement in their ability to stay on-task even after we abandoned the accountability slips. I think that I effectively communicated my feelings about staying on-task in class, and I think that students like Aaron and Zavier respected me enough to improve their focus at the independent station.

Previous to this year, I had never taken so many student suggestions into account, and I think students respected that I also acted on these suggestions. At this point in the school year, I was forming meaningful relationships with students, catering my content to students' interests, and showing that I genuinely cared about each student and their success in my class. The accountability slips may have kick started the increased engagement shown at the independent station, but I felt like my relationship with students and their trust in me ultimately proved more effective in keeping students on-task than were the accountability slips.

Wiser Choices: Guidance and Support

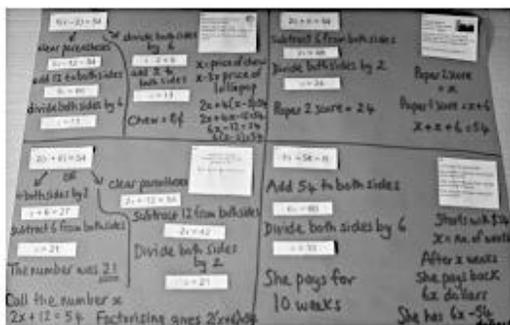
As students continued to work on part three of the Equations Checklist, I noticed Keith attempting to complete the Story Problems Poster Project. From my interactions with Keith at the direct station, I realized that Keith needed a bit more support with solving equations when compared to his peers. Keith worked hard every class, but learned the material at a slower rate than his peers. Students like Keith should not have been working on the poster project, as this was a more

advanced choice. Figure 25 shows the directions to the story project that students viewed in Schoology.

Directions

1. You must first pick one of the 4 story problems. (There are six different sets of 4 problems). Pick your story problem set here. (Also located in Story Problems Poster Project Folder). You can either download and print your selection, or you may simply write down a story set.
2. Write an equation for each problem and then solve the equation.
3. On a poster board, you will be completing the following:
 - a. Divide the poster board into 4 equal spaces.
 - b. Each space in the poster board should have:
 - i. The story problem.
 - ii. The correct equation for the story problem.
 - iii. The work on how to solve the equation.
 - iv. Written directions on the steps taken to solve the problem.

4. Example:



5. Show all your work for each story problem. Draw a table like the one below to show your work:

Story Problem 1	Story Problem 2	Story Problem 3	Story Problem 4

Figure 25. Story Problems Poster Project Directions

Initially, this project was created for the collaborative station, but I included it in students' set of independent choices as a means of extension work

or enrichment for students who were looking for a challenge. Keith was not ready for the poster project, but I respected his effort.

“Keith I love that you are attempting the poster project, but at this time, I would recommend making another choice.”

“Yeah I’m completely confused but I didn’t want to stop.”

“You certainly have the drive, and I would love to see you complete this project, but I think you need a bit more review with equation solving first.”

“Should I be doing something else instead?”

“You are welcome to come back to the project, but first let me direct you to some of the choices that will help you better understand how to build and solve equations from word problems.”

For the next five minutes, I sat down with Keith and reviewed his checklist. I knew that it would be more beneficial to Keith if he were to complete the video notes for solving word problems in addition to the readings and his choice of independent practice. Keith obliged, and proceeded to complete the video notes and readings the subsequent class.

The next day, Keith called me to his computer and said, “This is making a lot more sense now. You were right about the poster, I wasn’t ready for that yet but I’m understanding a lot more now.”

“That is awesome Keith! I’d suggest you try this IXL after you are done the notes to see how much you’ve learned about setting up equations from word

problems. Then, if you feel comfortable, you can go back and attempt the poster project.”

“Sounds like a plan Mr. K, thanks for helping me out!”

“Any time Keith. You keep up the effort, and I’ll keep up the guidance and support. I absolutely love and respect your work ethic, so keep it up!”

Keith went on to complete the IXL practice section, but it took him several classes. As the test date for equations was rapidly approaching, Keith ran out of time to revisit the story project. However, Keith did very well on his equations quiz, especially for the word problems section shown in Figure 26.

(22.) The sum of 3 consecutive odd integers is 45. What are these integers?
 $x = 1$
 $x + 2 = 2$
 $x + 4 = 3$
 $3x + 6 = 45$
 $-6 \quad -6$
 $3x = 39$
 $\frac{3x}{3} = \frac{39}{3}$
 $x = 13, 15, 17$

(23.) The length of a rectangle is 9 inches more than its width. The perimeter is 46 inches. What is the length of the rectangle?
 $L = w + 9$
 $46 = w + w + 9 + w + w + 9$
 $46 = 4w + 18$
 $-18 \quad -18$
 $28 = 4w$
 $\frac{28}{4} = \frac{4w}{4}$
 $7 = w$
 $L = w + 9$
 $L = 7 + 9 = 16$

Diagram: A rectangle with width w and length $w + 9$. Perimeter $P = 46$.

Figure 26. Keith’s Solutions to Equations Assessment Word Problems

In Figure 26, Keith displayed his understanding of how to solve a consecutive integer problem and a problem involving finding the missing dimensions of a rectangle. These were the types of problems that Keith struggled

with at the direct station. While Keith attempted to do the Story Problems Poster Project, I knew he would need more practice and support before jumping into such a project. While he ran out of time to go back and complete the project, it was evident that my redirection and guidance helped Keith learn how to set up and solve word problems. Keith utilized drawing a picture in problem 23 from Figure 26, which was a strategy presented in the reading assignment that I had directed him to complete. I was thrilled to grade Keith's equations assessment, and he wound up with an A on it. I was beginning to see how important my guidance was in terms of helping students manage choices effectively.

Overall, students performed well on the equations assessment. Five students got perfect scores, and four students obtained a score of 51/52. The four students who lost one point all made the same mistake of incorrectly distributing a negative number, as can be seen in Figure 27.

The image shows a student's handwritten work on a piece of paper. At the top, the equation $(18) 9x - 4(x + 5) = 40$ is written. Below it, the student has written $9x - 4x + 20 = 40$, where the $+$ sign is circled in purple. The next line shows $5x + 20 = 40$, with -20 written below it. The following line is $5x = 20$. At the bottom, there is a boxed area containing x with a purple checkmark next to it.

Figure 27. Student Incorrectly Distributing a Negative Number

In Figure 27, the student incorrectly distributed the -4 into $(x + 5)$. This student forgot that the product of a negative number and a positive number was negative. Instead of writing $9x - 4x - 20 = 40$, this student wrote $9x - 4x + 20 = 40$.

Of all the mistakes on the equations assessment, this was the most common and occurred in about half of my students' assessments. I realized that multiplication with negatives would be worth a brief review at the direct station, and I planned for just that. However, some students did not necessarily need this review and answered these types of questions with mistakes, as can be seen in Figure 28.

$$\begin{aligned} 18) \quad & 9x - 4(x + 5) = 40 \\ & 9x - 4x - 20 = 40 \\ & 5x - 20 = 40 \\ & \quad + 20 + 20 \\ & 5x = 60 \\ & \frac{5}{5} \quad \frac{60}{5} \\ & x = 12 \end{aligned}$$

Figure 28. Student Correctly Distributing a Negative Number

We reviewed the quizzes in the subsequent two classes prior to introducing the Rates, Proportions, and Unit Analysis Checklists (Appendix C, section iv.). The Rates, Proportions, and Unit Analysis Checklists reflect many of the improvement ideas I received from students during the school year. For instance, students mentioned that they were confused with how to navigate previous checklists, and so I classified choices into “Learn it...” or “Apply it...” categories, depending on the content itself. In addition, under each of the three sections in the Rates, Proportions, and Unit Analysis Checklists, students viewed the following directions:

Begin with a Learn it Activity (Pick at least one, but I'd recommend viewing everything, especially before the quiz!) When done, complete either the IXLs or some paper and pencil practice under "Apply it". THE MORE PRACTICE THE BETTER!!!!

Furthermore, thanks to Mady's request in a previous class, we reviewed the "Rates, Proportions, and Unit Analysis Checklists" together as a whole class activity, since we had now encountered new content. In hindsight, I realized that making students complete a "Learn it..." activity may not have been a valuable use of time. Some students, like Caden, finished all IXL sections on part one of his checklist on Rates and Ratios without viewing a "Learn it" activity. Under our grading guidelines, Caden technically would have lost points for that section, even though he knew how to write and identify equivalent ratios and how to solve unit rates and unit prices.

I thought to myself, "Why make Caden go back and do a "Learn it" activity when he already demonstrated understanding?"

I decided that it would be a waste of Caden's time to go back and complete a "Learn it" activity, so I eliminated this requirement from future checklists. Instead, students were directed to start with the "Apply it" materials, and if they get stuck, then go to the "Learn it" resources. One thing I detested was wasting students' time in class, and students appreciated my adaptation of the grading procedures.

I Can't Learn Math This Weekend

As students worked through the Rates, Proportions, and Unit Analysis Checklists, I noticed Edgar was staring at his computer blankly. He was not logged in, despite being at the independent station for almost fifteen minutes. Students were working on practice problems at the direct station, so I had a few minutes to walk over to Edgar's desk and inquire about why he was sitting there doing nothing.

“What's up Edgar? Everything okay?”

“No, not really.”

“Did you forget your login information?”

“No.”

“Is there a reason you are not doing work? Are you bored? Are you lazy? What's going on? You've been doing so well in here up to this point. You know if you don't get part two done today it will become your homework?”

“Yeah, I know, I'm probably not going to be able to get it done. I can't learn math this weekend because I have to go to my dad's house.”

“If you don't have internet access, remember I have paper and pencil assignments as well.”

Edgar looked at me sadly before saying, “I hate my dad, and I don't want to go there. He's an alcoholic, he beats me, and he has forty dogs that he makes me take care of. I can never get school work done there, and he doesn't care

anyway. That's why we never have food, and I'm just thinking of a way to feed my sister right now. I know I should be doing my work, I'm sorry."

My heart sank. I felt terrible for Edgar, and I could see the pain in his eyes. I offered Edgar my support and gave him my contact information. I explained to Edgar that I wanted to talk with his counselor about what he had just mentioned, and he agreed to the meeting.

After class, Edgar and I visited his counselor. What I learned at this meeting was heart breaking. Edgar had a lot of issues at home that I had not previously had any idea about. I felt guilty for mistaking Edgar's off-task behavior for laziness, when as it turned out, Edgar was coping with several traumatic events that occurred outside of school. For students like Edward who faced trauma outside of school, choice had no effect on his motivation or achievement in my class. Furthermore, choice had no effect on whether he would complete work at home. It was clear that Edgar's time in class was extremely valuable as he was unable to get much done at his house, especially when visiting his father every other weekend.

I continued to monitor Edgar's performance in my class the next week. On Monday, I briefly pulled Edgar aside and asked him about his weekend. He explained that it was awful, and that he was thankful to be back in school.

Before returning to class, I told Edgar, "If you every need someone to talk to, you know I'm here for you."

Edgar appreciated my gesture and wound up having one of his best weeks in my class. As we worked on some tougher unit analysis problems, I observed Edgar teaching and supporting his peers at the collaborative station. I could not help myself from barging in on the conversation, and I had a free minute while students at the direct station were copying an example.

“I hear an awesome conversation about unit conversion back here. What are you guys trying to solve?”

Edgar and three other boys showed me the problem.

Edgar stated, “I’m trying to show Tommy that he’s setting up his conversion factors upside down. He’s trying to cancel the units, but they were both in the numerator so they wouldn’t cancel.”

“I see what you are saying. Tommy, does Edgar’s explanation make sense to you?”

“Yeah, I guess I wasn’t looking to have the units on top and bottom. It makes a lot more sense now.”

“Awesome job back here guys, keep up the great work. Sorry for interrupting, I just heard your conversation, and it got me excited.”

Edgar, Tommy, and the other two students laughed and got back to work as I walked back to the direct station. Last week, Edgar had not engaged at all. On this day, Edgar was not only engaged, but he was teaching concepts to his peers. I

knew Edgar learned concepts quickly, but he continued to impress me in terms of engagement.

That Friday, I called Edgar to my desk to give him credit for his hard work over the past week.

“Edgar, you have been doing awesome this week. Do you think that having a choice has helped you stay motivated?”

“Honestly, no,” Edgar said laughing.

Edgar continued, “I just do better when I like my teacher and it meant a lot to me that you actually care. I rarely have teachers like you so when I do I make sure I do well.”

“That just made my week Edgar. Of course I care about you, and it’s troubling to hear that you feel like a lot of teachers don’t care about you.”

“Well I’m sure some other teachers care about me, but none of them do anything.”

“Edgar, you have what it takes to do anything you put your mind to. You are extremely bright, and I know you are going through a lot at home. Keep getting good grades and focus on school. It will be your ticket out of that tough situation, and a kid like you can get scholarships. Keep it up young man, I am so proud of you.”

That night, I went home and reflected upon what Edgar had said. It felt like showing that I cared for my students seemed more effective for increasing

motivation than choices alone. However my genuine caring helped me understand just who my students were, what they go through, and what interests them. This information was pertinent when I considered what would be the most meaningful activities to include in students' choice-based work. I learned that part of making choices meaningful involved developing an understanding of my students that went beyond the classroom.

Revisiting the Motivation Survey

Prior to the assessment on Rates, Proportions, and Unit Analysis, I wanted to revisit the motivation survey that students took in the beginning of the year (Appendix B, section i). I administered the survey in class, and closely analyzed the data by comparing students' pre- and post-survey responses. I learned some important information from these surveys, primarily from questions 5, 17, 6, 9, 10, 15, and 18. The pre-survey included 50 responses, while the post survey included 45 responses, except for 6 and 15 in which there were 44 responses. Table 2 displays students' pre-and post-survey data for question number 5, "I enjoy working independently on math assignments."

Table 2

Pre-and Post-Survey Data for Question 5

5. I enjoy working independently on math assignments:									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
14	11	9	14	15	12	7	3	5	5
28%	24.4%	18%	31.1%	30%	26.7%	14%	6.7%	10%	11.1%

Compared to the pre-survey, a higher percentage of students responded “Agree,” or “Slightly Agree” to the survey question, “I enjoy working independently on math assignments.” I concluded that this increase resulted from students having better experiences with they hybrid model this year than they had last year. On the post-survey, over half of the student responses reflected that they enjoyed working independently on math assignments.

Table 3 displays students’ pre-and post-survey data for question number 17, “I cannot learn math by myself.”

Table 3

Pre-and Post-Survey Data for Question 17

17. I cannot learn math by myself:									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
14	14	5	4	9	9	9	8	13	10
28%	31.1%	10%	8.9%	18%	20%	18%	17.8%	26%	22.2%

Results for the survey question, “I cannot learn math by myself,” were very similar for the pre-and post-survey. The results of both the pre- and post-survey for this question were distributed fairly evenly, as roughly 40% of students answered, “Agree,” or, “Slightly Agree,” while approximately 20% of students answered, “Neutral,” and the remaining 40% of students answered, “Slightly Disagree,” or, “Disagree.” I learned that students’ perceptions of whether or not they are capable of learning math independently did not change as a result of having a choice of assignments at the independent station. I was surprised by this data, as I expected more students to answer, “Agree,” or, “Slightly Agree.”

Table 4 displays students’ pre-and post-survey data for question number 6, “I like having a choice of assignments.”

Table 4

Pre-and Post-Survey Data for Question 6

6. I like having a choice of assignments: (Only 44 post survey responses)									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
26	21	16	14	7	4	0	4	1	1
52%	47.7%	32%	31.8%	14%	9.1%	0%	9.1%	2%	2.3%

The data from survey question 6 indicated that there was a slight decrease in the percentage of students who liked having a choice of assignments. Much like

survey question 17 (Table 3), I expected the opposite results. I attribute this decrease to the many adjustments we have made during the year, and I admit that procedures were confusing at times. Managing the choice-based work has been a reflective process of adaptation and change. While I feel like the choice-based work and the manner in which students engage with assignments has improved, this survey question told me that I still had work to do in terms of finding more meaningful choices for students to enjoy.

Table 5 displays students' pre-and post-survey data for question number 9, "I am more willing to complete online assignments when given a choice."

Table 5

Pre-and Post-Survey Data for Question 9

9. I am more willing to complete online assignments when given a choice:									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
12	9	9	12	17	21	4	2	8	1
24%	20%	18%	26.7%	34%	46.7%	8%	4.4%	16%	2.2%

The biggest change in data from the pre- and post-survey for the question, "I am more willing to complete online assignments when given a choice," occurred with the "Disagree," and "Slightly Disagree," response. Initially, 24% percent of students responded either "Disagree," or, "Slightly Disagree." On the post survey, this number dropped to 6.6%. Meanwhile, the responses for

“Neutral,” increased by nearly 13%, the responses for “Slightly Agree,” increased by nearly 9%, and the responses for “Agree,” decreased by 4%. Overall, this survey item indicated that students appeared more willing to complete online assignments when given a choice after they had the opportunity to actually partake in the choice-based work. It was evident that many students held negative preconceptions of choice, but when they had the opportunity to interact with choice-based work, their opinions changed.

Table 6 displays students’ pre-and post-survey data for question number 10, “It is easier for me to stay on-task when I have a choice of online assignments.”

Table 6

Pre-and Post-Survey Data for Question 10

10. It is easier to stay on-task when I have a choice of online assignments:									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
6	7	14	11	22	13	3	10	5	4
12%	15.6%	28%	24.4%	44%	28.9%	6%	22.2%	10%	8.9%

When analyzing responses to survey question 10, “It is easier to stay on-task when I have a choice of online assignments,” it became evident that choice alone was not necessarily enough to keep students engaged and motivated. More students answered “Slightly Disagree,” or, “Disagree,” on the post-survey, with

an increase of about 15%. It would appear as though most of this increase came from students who initially responded, “Neutral,” as the post-survey saw a decrease of approximately 15%, while the percentage of students who responded, “Agree,” or, “Slightly Agree,” remained exactly the same at 40%. I concluded that those who found it easier to stay on-task when given a choice still felt that way; those who found it more difficult to stay on-task when given a choice still felt that way; and those who were uncertain initially started learning towards finding it more difficult to stay on-task when given a choice.

Table 7 displays students’ pre-and post-survey data for question 15, “I am less likely to stay on-task when I have a choice in online learning assignments.”

Table 7

Pre-and Post-Survey Data for Question 15

15. I am less likely to stay on-task when I have a choice in online learning assignments: (Only 44 post survey responses)									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1	1	5	7	17	11	7	15	20	10
2%	2.3%	10%	15.9%	34%	25%	14%	34.1%	40%	22.7%

Survey question 15 was very similar to survey question 10 (Table 6), but results were not the same. Far more students answered “Slightly Disagree,” or “Disagree,” to this survey item than did students who answered “Agree,” or “Slightly Agree,” on survey question 10. Essentially, they were the same

question, worded differently and so these results confused me. I questioned whether the wording of survey question 15 was confusing to students, as I expected the data in survey question 15 to closely reflect the data in survey question 10, but it did not.

Table 8 displays students' pre-and post-survey data for question number 18, "Having choice has had no impact on whether or not I complete assignments."

Table 8

Pre-and Post-Survey Data for Question 18

18. Having choice has had no impact on whether or not I complete assignments:									
Agree		Slightly Agree		Neutral		Slightly Disagree		Disagree	
Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
15	11	5	11	18	14	5	5	7	4
30%	24.4%	10%	24.4%	36%	31.1%	10%	11.1%	14%	8.9%

In survey question 18, a slightly higher percentage of students answered, "Agree," or "Slightly Agree," while a slightly smaller percentage of students answered, "Slightly Disagree," or, "Disagree," on the post-survey. Overall, the changes were not too significant. From these results, I concluded that it was not choice that motivates students, but rather, the choices themselves must be meaningful, and I must be there to guide students as they work on independent course work. Again, it was not that choice alone was motivating, but rather, the

manner in which I supported student with choice, as well as the organization and meaningfulness of choices being provided.

Sharing the Results

Upon analyzing the pre-and post-survey, I shared the results with the class, as well as my thoughts about the data.

“Some of this data surprised me. It appears as though choice alone may not be the single most motivating aspect in my class. My observations along with this survey data tell me that the most motivating factors for independent work include finding the content meaningful, organized, and feeling supported along the way. Would you agree or disagree? If you disagree, I’d love to hear from you.”

“The biggest thing for me is not knowing what choices I should start with, and it is the most helpful when you help me set the goals on the checklist,” said Charles.

“So you find my guidance to be the best way to keep you engaged and motivated?”

“Absolutely!”

“Thank you for sharing, Charles. Does anyone else want to share something or disagree with what I said?”

“I think you are right,” said Anthony. “I am most motivated when I find the assignment is actually helping me learn the stuff, and it’s not just busy work.”

“So you’re saying that part of a choice being meaningful is that it helps learn the objectives and does not make you do extra or unnecessary work?”

“Yes, like that time I had to do reading notes even though I knew it. That was boring and I felt unmotivated.”

“That is a great insight! Thank you for sharing Anthony.”

When students had nothing left to share, we proceeded to our quiz review for Ratios, Rates, Unit Analysis, and Proportions. One student suggested earlier in the year that we needed a quiz review day as a whole class prior to a summative assessment, and so I listened to this student’s suggestion.

The next day, students took their quiz on Ratios, Rates, Unit Analysis, and Proportions. Overall, I was pleased with the results. The most common error I observed on this assessment dealt with unit analysis, in particular question 11. Question 11 stated, “A cheetah ran 300 feet in 2.92 seconds. What was the cheetah’s average speed in miles per hour? (Round to the nearest integer).” Only 15% of students answered this question correctly. Figure 29 shows a correct student response.

Part C: (2 pts. each) Unit Analysis

11. A cheetah ran 300 feet in 2.92 seconds. What was the cheetah's average speed in miles per hour? (Round to the nearest INTEGER!)

5280
feet \rightarrow mile
60 sec \rightarrow min
60 min \rightarrow hour

$$\frac{300\text{ft}}{2.92\text{s}} \times \frac{1\text{mi}}{5280\text{ft}} \times \frac{60\text{s}}{1\text{min}} \times \frac{60\text{min}}{1\text{hr}} = \frac{1080000}{15417.6}$$

70.049

70 mph

Figure 29. Correct Response to Unit Analysis Assessment Item

Many students simply left the question blank, which indicated that they had no idea how to start the problem. For those that tried it and got it wrong, I did give partial credit. Figure 30 shows a student who answered the problem incorrectly.

A cheetah ran 300 feet in 2.92 seconds. What was the cheetah's average speed in miles per hour? (Round to the nearest INTEGER!)

102.74 \times 542407.2
1920000 3600

~~542407.2 miles per hour~~

Figure 30. Incorrect Response to Unit Analysis Assessment Item

The student's work in Figure 30 reflected little understanding of how to set up and solve a unit conversion problem, as did many other student responses. I realized that converting units and unit analysis problems needed to be reviewed in class, as too many students answered this question incorrectly and too many students left it blank.

Other than this unit analysis problem, the remainder of the quizzes went well, with the occasional error on cross multiply proportions that involved distributing negatives, much like in Figure 27. So I also set time aside to review

distribution with negatives, even though I had spent several days reviewing it. Again, too many students made errors when distributing negative numbers, so I wanted to review this in addition to unit analysis problems.

Coming to an End

After reviewing the Rates, Ratios, Unit Analysis, and Proportions Quizzes, and distribution with negatives, we were ready to move onto inequalities and the Inequalities Checklist (Appendix C, section v). The inequalities unit was the last content to be completed in my data collection window. Compared to the previous checklist, I did make several changes on the Inequalities Checklist. For instance, students are directed to jump right into an activity, either IXL or paper and pencil work. Should they struggle, the middle box of the Inequalities Checklist reads, “NEED HELP!?” in bold-faced write font. Students were directed to utilize these resources, including videos and readings, when they are stuck on IXL or paper and pencil work.

In addition to the different organization of choices, I also gave students a chance to self-assess what they learned on the checklist. I created and included online assessments to be completed in Schoology at the end of each of the four parts on the Inequalities Checklists. I did not check to see if these were completed at the time, but I did highly recommend that students completed them prior to formal quizzes.

After our formal assessment, I went back to see who completed the self-assessments prior to the quiz, and I compared results on the Inequality Assessment Item (Appendix D, section iv) with those who completed self-assessments and those who did not complete self-assessments. As it turned out, those who completed the Schoology self-assessments did far better on this assessment item than those who did not complete the Schoology self-assessments. For instance, Jillian completed the self-assessment on compound inequalities, and correctly answered the Inequality Assessment Item, as shown in Figure 31.

inequality. Show your work.

$$6 < 8x + 14 \leq 54$$

$$\begin{array}{r} +4 \quad -14 \quad -14 \\ \hline -8 < 8x \leq 40 \\ \frac{-8}{8} < \frac{8x}{8} \leq \frac{40}{8} \\ -1 < x \leq 5 \end{array}$$

solution on the number line below.

-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

Figure 31. Jillian's Response to the Inequality Assessment Item

Meanwhile, students who did not complete the self-assessments performed worse on the assessments. Ren, for instance, chose not to complete self-assessments and consequently struggled on the Inequality Assessment Item, as shown in Figure 32.

inequality. Show your work.

$$6 < 8x + 14 \leq 54$$

$$\begin{array}{r} 6 < 8x + 14 \leq 54 \\ \underline{-14} \quad \underline{-14} \\ 6 < 8x \leq 8 \\ \underline{8} \quad \underline{8} \\ > 8x < -6 \end{array}$$

the solution on the number line below.

The number line shows integers from -7 to 8. There are open circles at -6 and 1. The region between -6 and 1 is shaded, representing the solution set $-6 < x < 1$.

Figure 32. Ren's Response to the Inequality Assessment Item

While I did not share actual student names with the class, I did share these assessment results and comparisons with the class following our quiz on inequalities. Many students regretted not completing the self-assessments, and many students vowed to try them on the next checklist. This went along with the theme of guidance and support. I noticed something that benefitted many students, and I guided them to make wiser future decisions.

Why Stop Now?

Even though the data collection period had ended, I continued to make various checklists for upcoming units including slope, slope-intercept form, standard-form, and point-slope form. Students were comfortable with the checklists, and I wanted to keep the choices going throughout the duration of the school year.

Throughout the data collection period, student voice played a large role in shaping the content choices and the procedures for completing the choice-based assignments. In fact, students' suggestions and opinions led to the most substantial curricular changes throughout this research. Obviously, I continued to listen to students' opinions and suggestions as I created future checklists and choice-based work.

As I learned from completing this action research, choice alone was not enough to motivate students and keep them engaged in independent online learning. Rather, the choices themselves had to be meaningful to students, the choices had to be organized and accessible, and I needed to provide appropriate guidance and support to students working on independent choice-based work. I continue my search for meaningful choices, much like I continue to value the opinions and suggestions of my students.

Methods of Data Analysis

“When doing action research, you gather data to generate evidence in order to test the validity of knowledge claims” (McNiff, 2016, p.197). Prior to interpreting the data in this study, the data had to be analyzed. Analyzing data refers to the identification of trends and patterns to describe and explain actions (McNiff, 2016). The data analysis methods used in this study were an accumulation of many parts that were put together in order to support my overall interpretation of data. Data analysis methods used in this study included analysis of survey data, student work samples, field logs, reflective and analytic memos, and codes and bins.

Survey Data

My study included a pre- and post-survey on student choice and motivation (Appendix B, section i). The pre-survey allowed me to document students’ initial feelings about choice and motivation in independent online learning while the post-survey allowed me to document any developments related to choice and motivation in independent online learning. Specifically, I compared the pre-and post-survey data to determine if there were any changes in students’ motivation related to being provided choice in independent online learning. According to McNiff (2013), “In action research, use a questionnaire or survey only to get an idea of trends” (p.109). Accordingly, I used this pre-and post-

survey to get an idea of trends and compared these trends with data collected through other outlets.

This study also included a choice improvement survey (Appendix B, section ii). The choice improvement survey was administered multiple times during the data collection window. Unlike the pre-and post-survey, the choice improvement survey was a singular open-ended question. “Open-ended questions can provide richer data than closed questions” (McNiff, 2013, p.109). I analyzed students’ responses to this survey and documented ideas and methods for improving students’ motivation and overall experiences with the choice-based assignments being provided. The choice improvement survey also helped in establishing themes related to student choice when compared with other data sources, such as the pre-and post-survey (Appendix B, section i). Furthermore, the choice improvement survey allowed me to make appropriate adjustments to future choice-based work, collaborative work, and direct instruction based on students’ responses and suggestions.

Student Work Artifacts

Multiple forms of student work were collected and analyzed in this study including checklists, assessments, and accountability slips. By collecting and analyzing multiple forms of student work, I was able to gather evidence of student achievement in terms of goal completion and acquisition of outlined algebraic competencies.

In terms of checklists, students submitted a variety of work depending on the algebraic concept being taught. This study included six checklists (Appendix C, sections i-vi), each with a specific set of potential student work, such as paper and pencil assignments or completion of outlined IXL sections. Scores on IXL sections, online assessments, as well as hard copies of student checklist work such as video notes were analyzed and compared with assessment scores and survey responses in order to provide evidence in relation to student achievement and motivation.

This study included four specific open-ended assessment items and scoring rubrics (Appendix D, sections i-iv). These open-ended assessment items were items from summative assessments that were also included in this study's data, but allowed for a deeper analysis of skill acquisition. The open-ended assessment items and rubrics helped aid in the generation of evidence of student achievement related to specific algebraic competencies such as using the correct order of operations to evaluate a numerical expression, as can be seen in the order of operations assessment item and scoring rubric (Appendix D, section i). Overall, the open-ended assessment items correlated to the mathematical competencies and skills being practiced at the independent station. Furthermore, as these open-ended assessment items were part of larger summative tests, I also analyzed and compared students' overall assessment scores for each topic including the order of operations, real numbers, rates, ratios, proportions, and unit analysis, equations,

and inequalities. I analyzed this data from multiple scopes, including as an entire group or class as well as individual scores.

This study also included student accountability slips (Appendix E) in order to document student progress in independent online choice-based work. The accountability slips were analyzed to see how often students were working while at the independent station and also allowed me to determine what specific choice-based items students were working on in class. These slips were also helpful in analyzing student motivation such as I could determine which students were or were not on-task on a given day.

Field Log

Throughout the data collection period, I maintained an ongoing field log or diary of important events and classroom observations. “In a sense, all research begins with observation: you watch what is happening and systematically record your observations” (McNiff, 2016, p.180). The field log provided me with documentary data that I frequently returned to and reflected on in order to improve the choice-based assignments I was providing students. In my field log, I documented class discussions, student interactions, assessment data, student conversations, informal interviews, behavioral concerns, and more.

The field log provided me with a chronological account of research developments as they occurred. In addition, the field log was helpful in documenting students’ voices and important quotes that I would have otherwise

forgot about. For example, I documented a students' suggestion to hold an introductory day when new content was being introduced. I later visited this field log entry and altered my future plans when introducing the Rates, Proportions, and Unit Analysis Checklists (Appendix C, section v).

I also analyzed my field log entries in relation to survey and assessment data in order to have a rich collection of triangulated data. Overall, maintaining a daily ongoing field log further helped me document important research findings as they occurred chronologically and allowed me to reflect on how I could improve the manner in which I was providing students choice in independent online learning activities.

Memo Analysis

In order to analyze my data through multiple lenses, I wrote several analytic and reflective memos throughout the data collection period. As I read the works of Dewey (1938), Freire (1970), and Delpit (2012), I identified several key quotations applicable to my research study in order to help with the interpretation and analysis of the data I collected during my study. Dewey (1938) allowed me to analyze my study in terms of the quality of my students' educational experiences; Freire (1970) allowed me to analyze my study through the lens of dialogical discourse and critical thinking; and Delpit (2012) allowed me to analyze my study with an eye on sociocultural implications and impacts on learning. Overall, interpreting my study through these educational philosophers' diverse

perspectives allowed me to take multiple viewpoints on my study's data and assisted me in generating my study's themes and findings.

In addition to writing analytic memos on the works of Dewey (1938), Freire (1970), and Delpit (2012), I also wrote a mid-study data analysis memo halfway through the data collection period. In this memo, I first revisited my research question, and subsequently identified and listed a number of research sub-questions. Following the list of research sub-questions, I provided a chronological roster of field log entries to date, and wrote a small paragraph of insights gleaned for each date. This was a helpful and reflective process that helped me recall important events occurring during my study's data collection period. Next, I listed a roster of planned observations in order to establish when and where I would need to collect more observational data. Following this, I listed a roster of surveys and assessments to date, and like the field log roster, I wrote a paragraph of insights gleaned for each survey or assessment. This process was helpful in determining what data I possessed, and what data I still needed to collect. Collectively, by assessing my own data and summarizing my insights gleaned in the Mid-Study Memo, I was able to determine the best course of action for future data collection.

Codes

As my study progressed, I developed a coding system in order to organize the data being collected. "Developing a coding system involves several steps: You

search through your data for regularities and patterns as well as for topics your data cover, and then you write down words and phrases to represent these topics and patterns. These words and phrases are coding categories” (Bogdan & Biklen, 2007, p.161). Beginning with my field log, I reread the entries and summarized important ideas using a designated code or keyword. I continued the coding process by observing student work samples and surveys and I documented key ideas using codes developed in the field log. I recorded each code in an alphabetized index, and I continued to update the index periodically during the data collection period.

Key:

*FL = Observational Field Log

*SvPre = PreSurvey

*CiSv = Choice Improvement Survey Data

*SvPos = Post Survey/Pre-Post survey Comparison

*Msm = Mid Study Memo (MsmSur = Survey section, MsmFL = Field log section,

MsmSw = student work section)

*SW = Student Work Sample (SWc = Student Choice work, SWa = Student Assessment)

Examples:

- FL: 9/29 means it can be located on my Field Logs for 9/29.
- SvPre2: means it can be located on the presurvey under question 2
- CiSv (A.K.) means it can be located on the choice improvement survey data under student name A.K.
- MsmSur 9/29: Means it can be located on the mid-study memo survey discussion under the date 9/29.
- SWc 9/29 (AK): means it can be located on the student choice assignment work due 9/29 for student AK.
- SvPos 3^ means post survey question 3 positive trending results, SvPos 2~ means post survey question 2 negative trending results, SvPos.5* means post survey question 5 not much difference between pre and post results.

Codes	Location	Related Codes
Motivation	<p>MsmFL 9/15, FL 9/15, MsmFL 9/20, FL 9/20, MsmFL 10/2, FL 10/2, MsmFL 10/10, FL 10/10, MsmFL 10/12, FL 10/12, MsmSur 9/7, SvPre 4, 7, 8, 9, 15, MsmSur 10/11, CiSv2 (CC), MsmSW 10/6, SWc 10/6, MsmSW 10/18, SWa 10/18,</p> <p>FL 11/1, FL 11/3, FL 11/9, FL 11/14, FL 11/16, FL 11/17, FL 11/20,</p> <p>SvPos1~, SvPos2~, SvPos3*, SvPos4^, SvPos5*^, SvPos6*~-, SvPos7*, SvPos8^, SvPos9^, SvPos12*, SvPos14~-, SvPos15**-, SvPos17*, SvPos18~-,</p> <p>CiSv(NP), CiSv(TL),</p>	<p>Engagement, Achievement, Management/ Navigation/ Logistics, Personalized, Effort, Reflection, Confusion, Enjoy/ Happy, Dislike/ Disinterested/ Disengagement, Autonomy, Student input, Improvement, Frustration</p>

Figure 33. Coding Index Screen Shot

Bins and Theme Statements

At the end of my data collection period and following the coding of my study's data, I began searching for patterns within the data in order to identify research themes. To help me begin answering my research question, I categorized my codes based on similarities and developed a set of titled bins in which each

code was placed. Subsequently, I prepared a graphic organizer that visually displayed my codes and bins, and generated theme statements, or preliminary findings, based on these bins and the data that I had collected.

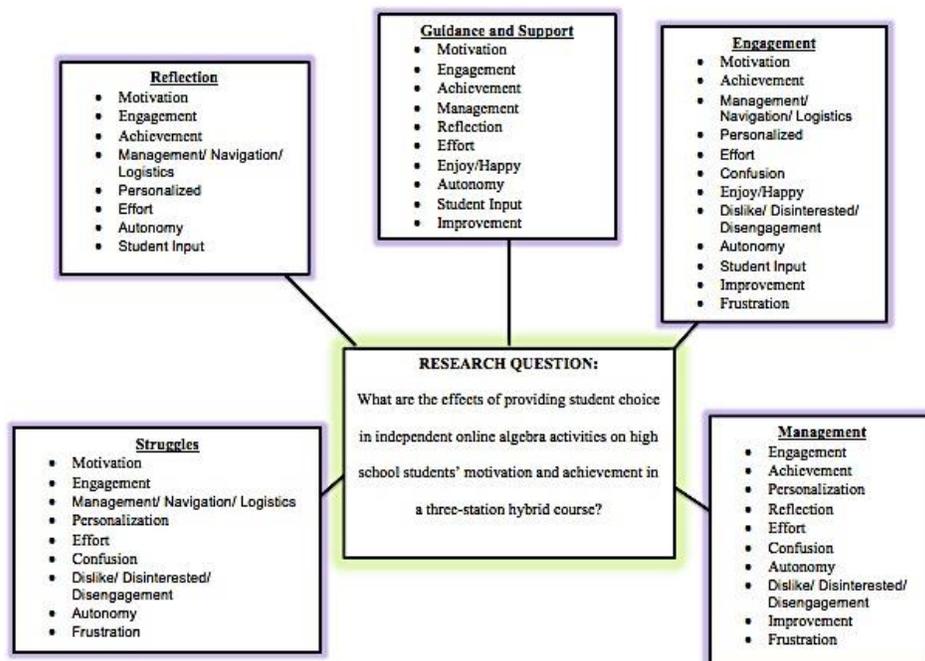


Figure 34. Codes and Bins

Collectively, I engaged in several methods of data analysis in this study to identify emerging trends and patterns. In addition, by engaging in an ongoing analysis of my study's data, I was able to make meaningful changes to curricular designs and instructional practices throughout the course of this study. Overall, engaging in data analysis proved helpful when considering the themes and findings of this research.

Research Findings

The purpose of my research study was to examine the effects of student choice in independent online mathematics learning on high school students' motivation and achievement in a rotational three-station hybrid model. I aimed to discover how providing choice in independent online learning might impact students' motivation to complete assignments as well as increase their overall achievement in the course. As I analyzed various forms of data in this research study, several theme statements emerged that helped organize and express the findings of this study.

Reflection and Student Input

To increase students' motivation when completing independent choice-based algebra assignments, students and the teacher must engage in frequent reflection and group discussions focusing on ways to improve independent learning assignments with opportunities for all to provide input, discuss difficulties, and debate ideas, strategies, and potential improvement options for choice-based assignments.

“Whenever students are involved in planning what they will be doing, it is likely that good teaching is going on” (Haberman, 2010, p.86). One of the most effective strategies for improving student choice-based independent work I identified during this research was to allow for and reflect upon student input. “Those who authentically commit themselves to the people must re-examine

themselves constantly” (Freire, 1970, p.60). While I attempted to provide the most meaningful learning opportunities for students throughout this research, I realized that students’ voices contributed to several important adaptations to the curricular design that I may not have considered had I not allowed for and reflected upon student input. For instance, students suggested holding whole-class introduction days for new content, and whole class review days before quizzes. It was such student input that caused me to engage in important self-reflection on ways I could improve my management of student choice-based work as well as the effectiveness of my instruction. After all, “...reflection – true reflection – leads to action” (Freire, 1970, p.66).

As this research developed, it became clear that I had garnered students’ trust in terms of my commitment to providing meaningful choices based on student feedback and input. According to Freire (1970), “Trust is contingent on the evidence which one party provides the others of his true, concrete intentions; it cannot exist if that party’s words do not coincide with their actions. To say one thing and do another – to take one’s own word lightly – cannot inspire trust” (p. 91). Evidently, trust is earned. One cannot earn the trust of others by simply requesting it. Instead, one must be able to prove trustworthiness by producing evidence that reflects all good intentions and demonstrates a commitment to best experiences of those being asked to give trust. In this research, I not only gave the Choice Improvement Survey (Appendix B, section ii), but I also acted on the

responses that students provided. It was clear that students appreciated my willingness to adjust content based on their input. Furthermore, students appreciated that I shared results to the surveys in this study (Appendix B, sections i-ii), and allowed for follow-up responses and suggestions upon seeing their peers' responses.

I also learned that as a teacher, I can suggest how students should go about learning a topic, but I should not expect that my plan is the best for every student. Instead, I should offer my suggestions with openness to student feedback in order to develop a better learning plan for students. The students are the ones engaged in the learning process, so considering their thoughts and feedback helps shape a more meaningful learning experience for all involved. "The teacher's suggestion is not a mold for a cast-iron result but is a starting point to be developed into a plan through contributions from the experience of all engaged in the learning process. The development occurs through reciprocal give-and-take, the teacher taking but not being afraid to also give" (Dewey, 1938, p.72). To optimize motivation, students needed to provide input in the design of the choice assignments they completed at the independent station. While I provided recommendations like IXL, I also needed to consider students' thoughts. For example, from the survey results and a one-on-one discussion, I learned that one student absolutely hated IXL and would rather spend twice as long on another task because she asserted that she struggled to focus on a computer screen. While

I thought at the time that IXL was the most effective learning activity, I now understand that I cannot assume all students will feel the same way and share my opinion about the best learning materials.

Overall, to design and plan for the best choice-based curriculum, I had to listen to students' suggestions and reflect upon ways I could adapt my curricular design to better suit the needs and desires of my students.

Guidance and Support

To increase students' motivation and achievement when completing independent choice-based algebra assignments, the teacher must provide ongoing support and guidance and help students learn how to make the best academic choices in independent online learning materials.

“The ideal aim of education is creation of power of self-control. But the mere removal of external control is no guarantee for the production of self-control” (Dewey, 1938, p.64). As I learned during research, I cannot provide choices and expect students to figure out how to use them correctly without modeling the procedure. For example, one student experienced a common login issue with CK-12 that I had completely neglected to talk about with the class. Instead, I put it on the checklist and assumed students would be able to figure out the navigational aspect of CK-12. In fact, students can create an account, but they must follow certain steps. However, one student could not figure it out because I did not guide her. Hence, removal of my authority did not lead to self-autonomy

in this instance. Furthermore, CK-12 can be completed without creating an account, but this student was unable to realize this because I did not explain to her or the class how to use the Schoology window when working on CK-12.

Ultimately, I felt so bad that I had to email an apology to this student, and I subsequently vowed to model the checklist choices first before having students select them. This seems so trivially logical, and yet I failed to do this the first time around.

In addition, I learned that in order to provide appropriate guidance and support, the student and teacher must engage in frequent and honest dialogue. Communication, specifically dialogue-based interactions, requires high levels of cognitive application but remains a nonnegotiable component of a genuinely educational experience. “Only dialogue, which requires critical thinking, is also capable of generating critical thinking. Without dialogue there is no communication, and without communication there can be no true education” (Freire, 1970, pp.92-93). Some of my best suggestions for choice-based curricular improvements came from such discussions. For instance, instead of having to complete three choices every round, students decided that obtaining “SmartScores” of 100 on the IXL software choice indicated strong enough content comprehension such that having them complete two additional choices was excessive. I happened to agree with the student, largely because obtaining 100’s (versus required 70’s or above) took a considerable amount of time and

effort, but more importantly, truly required high levels of content comprehension. It would be foolish to make students do another assignment after demonstrating mastery of content. Instead, I wanted students to move ahead through the curriculum and not do work for the sake of doing work. Thus, I made a major change to my choice-based curriculum. This change may never have occurred without these very important conversations and dialogues.

Often times throughout this research, students needed guidance when determining which choices to complete. As students completed assessments at the direct station, there were times that some students displayed little to no understanding of the content being assessed. “When we encounter children in our classes who are not performing, the likely culprit is *not* that they do not have the innate ability or the capacity to accomplish the tasks, the reality is that they have not engaged in sufficient practice” (Delpit, 2012, p.153). Commonly, while these students were working at the independent station, they were working on materials that did not reflect the objectives that were outlined, and hence, did not engage in sufficient practice. As these situations arose, I would redirect and guide students to the choice-based content that allowed for the sufficient practice. Students who received this support performed much better on future assessments and additionally showed more concrete understanding of the content. For instance, one student tried to work on a poster project before he understood how to solve

equations. He did not engage in sufficient practice prior to trying the poster project, so I had to guide him to completing a more meaningful activity first.

In this research, the importance of teacher guidance and support were apparent. Often, students were confused when determining which choices to select. Through conversation and assessment, I was able to better support and guide students to make more meaningful choices based on their levels of understanding in addition to specific content that had or had not been mastered.

Engagement

Student choice in independent algebra learning activities alone does not necessarily increase students' motivation or achievement. Rather, student choice in independent algebra learning is more effective when the choices being provided are engaging and elicit students' likes and interests.

The biggest finding in my research was also the most surprising. I learned that providing students choice in independent online learning was not enough to increase motivation and achievement. "It is not enough to insist upon the necessity of experience, nor even of activity in experience. Everything depends upon the *quality* of the experience which is had" (Dewey, 1938, p.27). For student choice to be effective at increasing motivation and achievement, the choices must be meaningful. This largely reflects the ideas of Kashdan and Silvia (2009), in which there is undoubtedly a connection between curiosity, interest, and

motivation to learn. Hence, one part of making content meaningful is that it must elicit students' curiosity and interests.

In essence, my research shifted towards determining characteristics of engaging online mathematical content. "Mathematics, taught using real-life community problems that clearly affect students' families – and will soon affect students themselves – offers engaging, interesting learning, as well as providing a means for students to feel a part of the school and the mathematics curriculum" (Delpit, 2012, pp.160-161). Involving students' surroundings and communities in mathematical problem-solving is a great way to make instruction and content more engaging, personalized, involved, and interesting for students being taught. When students make connections between what is being taught in school with what they experience in their lives outside of school, they are more likely to be curious about a topic and additionally are more likely to be motivated to continue learning. I learned that I was able to foster greater levels of student engagement and motivation by connecting content to other disciplines as well as concrete, real-world scenarios.

Freire (1970) expresses the importance of relating content to real-world scenarios:

Students, as they are increasingly posed with problems relating to themselves in the world and with the world, will feel increasingly challenged and obliged to respond to that challenge. Because they

apprehend the challenge as interrelated to other problems within total context, not as a theoretical question, the resulting comprehension tends to be increasingly critical and thus constantly less alienated. Their response to the challenge evokes new challenges, followed by new understandings; and gradually the students come to regard themselves as committed. (p. 81).

For instance, by simply adapting a word problem to involve a real-world topic that students were interested in, I witnessed greater motivation to engage in problem-solving when compared to word problems that did not evoke students' interests (see Figure 19 and Figure 20).

Another aspect of making choices meaningful is that they make students think. "There are times when students, overexposed to worksheets and minimal thinking, resist being pushed to think" (Delpit, 2012, p.123). When my students completed activities that required little thinking, such as recording vocabulary words and definitions, it was evident that they did not find such activities meaningful. In fact, many students wrote about their dissatisfaction with vocabulary assignments in their Choice Improvement Surveys. Accordingly, I found alternative approaches when introducing vocabulary terms in order to avoid having students complete activities that required little thinking and were accordingly not meaningful.

Overall, a student's willingness to learn and desire to continue learning increased when he or she found meaning, interest, and application in the content being studied. "The intensity of the desire measures the strength of the efforts that will be put forth" (Dewey, 1938, p.70). As I learned, when students found an activity interesting or desirable, they were certain to exert more effort towards participation in or completion of that activity, and additionally, showed a willingness to continue learning the subsequent content. "The most important attitude that can be formed is that of desire to go on learning" (Dewey, 1938, p.48). When students were uninterested in a topic or activity, they did not exert as much effort towards participation in or completion of that topic or activity, and certainly showed no desire to go on learning.

Management

Student motivation and achievement, in relation to independent choice-based algebra assignments, increases when the teacher effectively monitors student progress, assesses student understanding, and sets mutual objective-based goals with the students such to allow for a personalization of choice-based content.

Similar to providing guidance and support, I learned that the overall management of choice-based assignments including monitoring student progress, assessing student understanding, and goal-setting were critical components to acknowledge in terms of making choice-based assignments effective at increasing

motivation and achievement. Largely, the management aspect of student choice agreed with ideals set by McCombs (2012).

First, to initially organize and manage choice-based assignments I learned that I had to identify clear learning outcomes and performance standards. Early in my research, there were instances when the choice-based assignments did not match with desired outcomes. This was largely due to my failure to identify specific learning goals prior to building the choice-based assignments. When students completed assignments that did not reflect learning outcomes, they became disengaged and less motivated to complete assignments, and rightfully so. From McCombs (2012), and from my personal experiences completing this research, I learned that when setting performance standards, students need to know exactly what is expected of them, how they will be graded, and what supports will be available to them when developing new skills or understandings. Students and I frequently discussed and altered the ways assignments were graded during this research, and additionally, I helped students identify the materials available for additional support. For instance, as research progressed, I shifted the organization of choices to include “Learn it,” materials, such that students could get additional support on a given topic as needed. I also eliminated some collaborative activities to allow for student collaboration on choice-based work, thus providing another realm of support.

In addition, I learned that the online environment, in which students worked, had to be organized and managed effectively. “Above all, they should know how to utilize surroundings, physical and social, that exist so as to extract from them all that they have to contribute to building up experiences that are worth while” (Dewey, 1938, p.40). When developing choice-based content, I thought about the online environment in which students were a part of, and how that virtual space included environmental factors contributing to the experience of the students working on choice assignments. I knew that an unorganized online environment would lead to confusion, and thus, less motivation to engage with the content. Accordingly, I created organized folders for student choice work to better organize and manage the online content.

Having students engage in self-assessment was helpful for managing future choice-based work. Reflecting the ideas of McCombs (2012), by having students monitor their learning process and keep track of their successes, students felt a heightened sense of motivation, ownership, and responsibility for the role they play in these successes. As part of their independent choice-based work, students completed a variety of pre-assessments and self-assessments that helped dictate the management of their future choices. For instance, when students performed well on a pre-assessment, we knew that they should progress to application activities. Meanwhile, when students did not do well on a pre-assessment, they were directed to complete choice-based content that fell into the

“Learn it” category. Overall, self-assessments were helpful for having students manage their own progressions through the choice-based content and materials.

Moreover, monitoring student progress and frequently assessing students enabled me to better manage and organize student choice-based work. In essence, frequent monitoring, assessing, and subsequent individual and group conversations enabled students to take more responsibility for their own learning. “The important thing, from the point of view of libertarian education, is for the people to come to feel like masters of their thinking by discussing the thinking and views of the world explicitly or implicitly manifest in their own suggestions and those of their comrades” (Freire, 1970, p.124). Without frequent assessments at the direct station, students and I alike may not have been able to manage future interactions with choice-based content. These assessments also allowed me to determine which choices were more effective for particular students, and thus, allowed us to set-up better future plans for interactions with choice-based content.

Challenges

When considering the most effective ways to provide and manage student choice in an independent online setting, the teacher must be conscious of common challenges and issues, including student navigational difficulties, inclusion of unnecessary or developmentally inappropriate content, confusing organization of content, content accessibility, and neglecting opportunities for reflection and student input.

Prior to initiating this research, I was aware of several potential logistical concerns related to providing online choice-based work, but many challenges arose during research that I had not accounted for. While I understood the effects of the accessibility of resources, I failed to review login procedures for a particular online assignment. Consequently, one girl felt as though she wasted her time on an assignment in which she could not access.

Another challenge that arose during research was students' self-depreciation. Freire (1970) provides an explanation of self-depreciation:

Self-depreciation is another characteristic of the oppressed, which derives from their internalization of the opinion the oppressors hold of them. So often do they hear that they are good for nothing, know nothing and are incapable of learning anything – that they are sick, lazy, and unproductive – that in the end they become convinced of their own unfitness. (p. 63).

During research, I had to be conscious to avoid labeling a student as unmotivated when in reality they were displaying behaviors of self-depreciation that were often carried along for years.

For instance, during our open-house, I recall one parent state blatantly, “My child is just like me. I could never do math well, so neither can they.”

In addition, there was the case in which one girl asserted daily that she was unable to learn math using a computer, regardless of software or format. She was concrete in her assertion of inability, but I questioned whether her self-

depreciation resulted from the opinions of others, such as a previous teacher or even a parent. While I never got a specific answer, I was able to successfully change this student's thoughts on what she was able to do online. I held a small one-on-one session with her and walked her through various online tools and resources. Since then, she has been much more confident with her online resources. While she will still go the paper and pencil route as much as possible, I am positive that her outlook on her abilities to complete work online has changed. This was quite an accomplishment for both her and me, and something I take particular pride in as I reflect on the situation.

Another challenge when considering students' motivation and achievement with choice-based independent work followed closely to Freire's (1970) self-depreciation discussion. As I learned, there may have been times in which identified an off-task student as unmotivated, when in reality, there was something more going on. Delpit (2012) elaborates on misinterpreting student behavior:

When students doubt their own competence, they typically respond with two behaviors: they either hide (hoods over faces, heads on desks) and try to become invisible, or they act out to prevent a scenario unfolding in which they will not be able to perform and will once again be proved "less than." Teachers frequently misinterpret both of these behaviors, usually inferring that the student is unmotivated, uninterested, or behavior

disordered. (p. 14).

I think back to the misbehaviors of Aaron and Zavier, in which I initially labeled them as unmotivated. However, as I reflected on this situation and wrote about it in my field log, I thought back to the ideas of Delpit (2012). The following quote comes directly from my field log:

In 4A, two students are displaying behaviors that I do not appreciate. Zavier and Aaron are often off-task, talking, walking around, and overall, not being productive. Zavier is pretty good with independent learning, and I don't think his behaviors result from a lack of confidence, but Aaron has not performed as well and at times seems intimidated by the material. During our mini-assessment this week, it was clear that Aaron had no idea what he was doing and he clearly wasn't working on his checklist material. I wonder if his lack of motivation and performance result from an incompetence in his abilities.

Accordingly, I learned that I had to be careful when making assertions about which students were unmotivated, because often times, there was more to the situation than what the students' behaviors tended to look like. As it turned out, both Zavier and Aaron were completely capable of learning the material, and both students showed significant behavioral and academic improvement as research progressed. "If we do not recognize the brilliance before us, we cannot

help but carry on the stereotypic societal views that these children are somehow damaged goods and that they cannot be expected to succeed” (Delpit, 2012, p.5). Towards the latter end of my data collection period, Aaron began performing at a higher rate than his peers and he frequently scored higher than the class average on assessments. He may have felt incompetent in his abilities at first, but we set up a game plan and identified mutually developed goals. The plan and goals were seemingly effective in helping restore his confidence and performance.

Next Steps

“Only through the process of conducting research in the classroom do teachers not only change their practice but also generate important new understandings for themselves and for the profession” (Shosh, 2011, p. 116). By conducting this action research study, I have altered the manner in which I manage and teach my mathematics classes. Specifically, I generated new understandings for how to enhance my students’ learning experiences in an independent online setting with the inclusion of choice-based content. As I learned, choice-based online independent learning was most effective at increasing students’ motivation and achievement in a hybrid mathematics class when the teacher provided ongoing support and guidance, when students were allowed to provide input, and when the learning activities were meaningful or relatable to students.

Throughout this study I continually altered and adapted the manner in which I managed choice-based independent learning content as new revelations came to light. At the end of this study I had time to reflect upon how I could continue to improve choice-based independent learning content, and more generally, how I could continue to improve as a mathematics teacher. A significant area of ongoing focus that emerged from this study involves finding more meaningful content for my students. Along with each school year comes new students, new voices, new interests, new hobbies, etc. Accordingly, what

constitutes a “meaningful,” assignment or activity for students changes frequently and so too should the choice-based assignments. Dewey (1938) explains that it is erroneous to assume that what works one year with a group of students will continue to work in subsequent years with future groups of students:

Responsibility for selecting objective conditions carries with it, then, the responsibility for understanding the needs and capacities of individuals who are learning at a given time. It is not enough that certain materials and methods have proved effective with other individuals at other times. There must be reason for thinking that they will function in generating an experience that has educative quality with particular individuals at a particular time. (pp.45-46).

As I learned in this research, I cannot select high quality activities for students if I do not have an understanding of who they are, where they came from, their strengths and weaknesses as learners, their interests and passions, and their learning styles. Moreover, just because an activity worked well in one class does not entail it will see similar success with a new class of students. It is foolish to assume all kids will be the same from year to year, and I must remain willing and able to adapt to changing populations. It is evident that students need a voice and a platform to share their ideas to ensure the selection of meaningful and relevant content. Accordingly, to ensure I can meet the needs of all students and to ensure that all students have a high quality learning experience, I will continue give

students a chance to openly share their thoughts and facilitate a learning community in which conversation and open discussions are welcomed.

Empowering my students to have a voice and share their thoughts and opinions helps me to understand who they are as individuals. Subsequently, I can use this understanding to increase the quality and meaningfulness of the content and activities I provide to my students. After all, “It is not enough to insist upon the necessity of experience, nor even of activity in experience. Everything depends upon the *quality* of the experience which is had” (Dewey, 1938, p.27).

The next steps in my quest to improve as a teacher and deliverer of choice-based independent mathematics content is to continue to find more meaningful learning activities to be included as choices for my students working at the independent station. This entails that I continue to listen to student voice in my classes, as students’ interests continue to change. Interestingly, these interests can change daily, weekly, monthly, and largely at any given time for a variety of reasons. In making content the most relatable, I learned that monitoring daily events and finding ways to include current debates and issues in the curriculum was an effective way to enhance students’ motivation and engagement. Keeping up to date with the world at large and the community at small can open doors to new algebraic scenarios to be included in choice-based content, and so I continue to search for interesting modern topics and debates that I can use in my curriculum.

Conclusively, I am hopeful that my action research sparks further investigation into the effects of using student choice in independent mathematics content in an online setting on students' motivation and achievement. I am also hopeful that this action research contributes to the discussion of what make content meaningful to students, considering one of the biggest discoveries that emerged in this study was that motivation increases when students find academic content meaningful or interesting. I am thankful for the opportunity to improve my teaching and expand my understandings of how to further support and motivate the students I teach. By carrying the principles of action research and maintaining the will to strive for improvement, I will continue to grow and improve as an educator.

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Appendices

Appendix A: Consent Forms

i. Principal Consent Form

Dear Mr. Bailey,

I am currently working towards a Master's degree in Curriculum and Instruction at Moravian College. A major focus of this program involves teacher action research. During the fall of 2017, I will investigate and implement teaching strategies that research has proven to be most effective. In turn, this will help me to create the best learning experiences for my students.

I am currently finishing my second year as a hybrid teacher. By reflecting on my experiences in a hybrid setting, I was able to identify an aspect of my instruction that I wish to improve. During this study, I will examine the effects of providing student choice in online learning activities in a hybrid high school mathematics course on student achievement and motivation. In the hybrid classroom, I post a list of required online assignments weekly. Often, these assignments are limited to IXL. IXL is absolutely an effective tool for students who are learning algebra online, and moreover, IXL is a great tool for producing meaningful data that can be analyzed by teachers. However, I think I have unintentionally overused this tool in previous classes. I feel that students tend to become disengaged, uninterested, and unmotivated to complete assigned IXL sections when they are the only assignments posted online in a given week. I hypothesize that students will be more engaged and willing to learn new content online when they are given a choice. Obviously, each choice will maintain the rigor of the original IXL's, and specifically, each choice will require students to demonstrate content mastery and/or growth. As a result of various professional developments and my own personal research, I am aware of a surplus of effective online content and activities for learning algebra. In the past, I remember finding great online activities but I would often abandon them, as I feared the content was too difficult for a majority of my students. In turn, I would assign an IXL and "differentiated" by telling my advanced students to reach a higher smart score than what was required. However, I deeply regret not providing these resources to my students, as I think many would have enjoyed a change in pace or at the least, they would appreciate the opportunity for alternative assignment (even if it was more difficult). Therefore, I am excited to put my research into action next fall and I remain confident that my research will have a positive impact on all of my students.

For this research study, I have included a detailed data collection plan. I will be gathering data to support my students through teacher observation, student surveys, student work samples, and both summative and formative assessments to be completed at various times during the study. While all students will be engaged in the online activities, I will only use information collected from students who have parental permission to participate in the study in any written reports of my research. Any work that reveals a student's identity will be altered for their protection. All of the students' names will be kept confidential, as will the name of the school district and any participating faculty members. I am asking for your permission to use the data gathered pertaining to student's involvement. However, this study is voluntary and participation will not affect student grades in any way. Any student may withdraw from the study at any time. If a child is withdrawn, I will not use any information pertaining to him or her in my study.

I am incredibly excited to complete this action research study. The focus of the study was selected in a strategic way, and completion of this study will undoubtedly improve my skills as a mathematics teacher, and specifically as a hybrid mathematics teacher.

Appendix A: Consent Forms

i. Principal Consent Form Continued

If you have any questions or concerns about my action research, please feel free to contact me or my faculty sponsor at Moravian College, Dr. Joseph Shosh. He may be contacted by phone at (610) 861-1482 and by email at shoshj@moravian.edu.

Please sign and date the form to give your consent to move forward with this study. I would appreciate if the form was returned at your earliest convenience. Thank you very much for your cooperation and support.

Sincerely,

Mr. Steven Kapral
High School Mathematics Teacher
(484) 515-6569
skapral@badschools.org

I agree that I am the principal of the teacher conducting this research study, that I have read and understand the consent form, and received a copy. Steven Kapral has my permission to conduct this study in his 9th grade Algebra classes at Liberty High School.

_____ Yes, I give consent to move forward with this action research study.

_____ No, I do not give consent to move forward with this action research study.

Signature

_____/_____/_____
Date

Appendix A: Consent Forms

ii. Parent Consent Form

Dear Parents/ Guardians,

I am currently working towards a Master's degree in Curriculum and Instruction at Moravian College. A major focus of this program involves teacher action research. During the remainder of the academic year, I will investigate and implement teaching strategies that research has proven to be most effective. In turn, this will help me to create the best learning experiences for my students.

For the third straight year, I will be running hybrid classrooms. From my previous experiences in a hybrid setting, I was able to identify an aspect of my course design that I wish to improve and in turn make my hybrid classes more successful. During this study, I will be investigating the effects of providing student choice in online learning activities in a hybrid high school mathematics course on student achievement and motivation. In the hybrid classroom, I plan for independent online activities on a daily basis. However, I observed that many of the online activities I have implemented over the past two years were not leading to desirable levels of engagement and achievement amongst my students. Overall, the purpose of my study is to increase students' engagement and achievement with the online content in my hybrid classes. I hope to achieve this goal by implementing student choice. Documented research suggests that students will be more engaged and willing to learn new content when they are given choice. Hence, I hypothesize that providing students with a choice in online learning activities will increase levels of engagement and achievement in my hybrid classes.

For this research study, I have included a detailed data collection plan. I will be gathering data to support my students through teacher observation, student surveys, student work samples, and both summative and formative assessments to be completed at various times during the study. While all students will be engaged in the independent online activities regardless, I will only use information collected from students who have parental permission to participate in the study in any written reports of my research. Any work that reveals a student's identity will be altered for their protection. All of the students' names will be kept confidential, as will the name of the school district and any participating faculty members. I am asking for your permission to use the data gathered pertaining to student's involvement in order to complete my action research project. However, this study is voluntary and will not affect student grades in any way. Any student may withdraw from the study at any time without penalty by informing me in person or using the contact information below. If a child is withdrawn from the study, I will not use any information pertaining to him or her in my study.

If you have any questions or concerns about my action research, please feel free to contact me or my faculty sponsor at Moravian College, Dr. Joseph Shosh. He may be contacted by phone at (610) 861-1482 and by email at shoshj@moravian.edu.

Please sign and check the appropriate box below. I would appreciate if the form was returned at your earliest convenience. Thank you very much for your cooperation and support. Sincerely,

Mr. Steven Kapral
High School Mathematics Teacher
(484) 515-6569
skapral@basdschools.org

Appendix A: Consent Forms**ii. Parent Consent Form Continued**

I attest that I am the child's legal guardian and that I have received a copy, read, and understand this consent form. Please initial the appropriate space below.

_____ Yes, I am willing to have my child participate in this study

_____ No, I am not willing to have my child participate in this study.

Parent/Guardian Signature: _____

Child's Name: _____

Date: _____

Appendix A: Consent Forms

iii. Student Assent Form

This school year, you are participating in a hybrid algebra course. In the hybrid course, you are required to participate in various independent online learning activities. As your teacher, I am asking you to take part in researching the effects of choice in online algebra activities on your motivation and achievement. The primary goals of this research would be to increase your motivation to complete independent station work and to increase your overall achievement in this course. It is my belief that we can accomplish these goals when you are given a choice of assignments at the independent station. Prior research indicates that student choice does in fact increase motivation and achievement. As your teacher, I want you all to succeed and appreciate the math you will be learning, and so I carefully selected this research topic.

If you agree to be a part of this study, you are giving me permission to analyze your data from motivation surveys and tests/quizzes. Your classwork will not change if you chose to be a part of this study, and choosing to be a part of this study will not affect your grade in any way. If you choose not to be a part of this study, your classwork will not change and your grade will not be affected in any way. There will be no risks associated with this study whether or not you choose to be a part of it. Your name and identity will always be kept anonymous if you choose to participate.

Please talk with your parents prior to making a decision on whether or not to participate in this study. If you choose to be a part of this study, you AND a parent/guardian must give permission. In addition to this sheet, you must also return the parent consent form should you chose to be a part of this study.

Remember, even if your parents give permission, you can still decide not to be a part of this study. If you do not want to participate, you don't have to! Being in this study is up to you and there will be no penalty for deciding not to participate or changing your mind later if you want to stop being a part of the study.

Please feel free to ask me any questions you may have about this study at any time. By signing your name at the bottom, you agree to be in this study. Remember, if you are willing to participate, you will need to sign this form and have a parent or guardian sign the separate parent consent form. If you do not want to participate in this study, DO NOT sign this form!

Thank you, and I look forward to working with you this school year!

Your Signature

Your Printed Name

Date

Appendix A: Consent Forms

iv. HSIRB Form

2014-2015 HUMAN SUBJECTS INTERNAL REVIEW BOARD (HSIRB) PROPOSAL FORM

This form must be completed for any research activity involving human participants. All researchers should review the Moravian College Human Subjects Research Policy found at <p:\hsirb\MoravianCollegeHSIRBPolicy.doc> before designing and submitting their proposals.

Part I: RESEARCHER

1. Proposer: Steven Anthony Kapral	2. Department: Education
3. Mailing address: 712 Edgemont Avenue Palmerton, PA 18071	4. Phone: (484) 515 - 6569
5. E-mail address: skapral@basdschools.org	
6. This is a (please check): <input checked="" type="checkbox"/> New Proposal <input type="checkbox"/> Resubmission of a rejected Proposal <input type="checkbox"/> Renewal <input type="checkbox"/> Request for modification	7. Research Start/End Dates: Make sure you clearly define the start and end dates. Format as month, day, year. Start: August 28, 2017 End: December 4, 2017
7. Title of Proposal: The effects of providing student choice in online learning activities in a hybrid high school mathematics course on student achievement and motivation.	
8. Faculty Advisor: Dr. Joseph Shosh	

Part II: PROPOSAL TYPE

1. This research involves **ONLY** the use of **educational tests** (cognitive, diagnostic, aptitude or achievement).

Yes
 No

2. This research collects interviews or surveys **ONLY** of **elected or appointed public officials** or candidates for such.

Appendix A: Consent Forms

iv. HSIRB Form Continued

Yes
 No

3. This research involves **ONLY** observations of **public behavior**.

Yes
 No

4. This research involves **ONLY** existing data, documents, records or specimens.

Yes
 No

5. List the **research funding sources**, if any.

6. The results of this research will be published.

Yes
 No
 Uncertain

If you marked “yes” or “uncertain”, please provide a brief description of the possible forum of publication (for example, peer-reviewed journal, conference presentation, etc.)

Description of publication forum:

Master’s Thesis will be published on the Moravian Graduate page website.

In this next section, you will provide extensive details about the research project. Please make sure that your explanations/descriptions are clearly written and grammatically correct so that the committee can accurately follow and assess your proposal.

Part III. DETAILS OF THE RESEARCH PROJECT

1. In this section, you have the option of either addressing each of the following subheadings individually or together (since there may be some overlap) in your proposal narrative. If providing a narrative, please make sure that each of the following topics is clearly identified in the narrative.
 - a. **Objectives:** The objective of this research is to improve my instructional practices for the online aspect of my high school hybrid mathematics courses. Specifically, I would

Appendix A: Consent Forms

iv. HSIRB Form Continued

like to provide my students with a more meaningful online learning experience in a hybrid model by providing students with choice in online learning activities with the goals of increasing achievement and motivation.

- b. Design:** Data will be collected during the first two marking periods of the 2017-2018 school year, specifically from August 28, 2017 – December 4, 2017. I will be collecting this data from willing participants through the use of a motivation survey and a student choice survey. I will analyze this data to study the effects of providing student choice in independent online learning activities in a high school hybrid mathematics course on overall achievement and motivation.

- c. Procedures (makes sure you clearly describe what is required of subjects):**

Participating students must first complete an assent form in addition to returning a signed parent/guardian consent form. Students who have given assent and have parent/guardian consent for their data to be collected will answer several survey questions in relation to motivation and student choice. Students will complete these surveys twice during the data collection window. Surveys will be conducted during the first and last week of research. Survey questions will either be asked through an online survey tool or a paper survey. Survey questions are attached at the end of this form.

- d. Outline procedures/steps to reduce risks to subjects:**

All students will be required to participate in the research surveys, but no one is required to participate in the data gathering. Parental/guardian consent and student assent forms must be completed in order for students to participate in the data collection process. Students may opt out of the research study at any time without penalty. No names or identifying descriptions will be used for any participant. The data collection will have neither positive or negative on student grades.

2. This research involves the following GROUP(S) vulnerable to risk. Check all that apply.

- Subjects under the age of 18
 Prisoners
 Pregnant women
 People with mental, cognitive, intellectual, or physical disabilities
 Volunteer sample so vulnerable group membership may be unknown

Research Design Note: *If you are asking for volunteer participants, you will not necessarily know whether or not your participants are under 18, pregnant and/or disabled. In fact, your volunteers may themselves not know whether they fall into one of these categories. Therefore, if you are asking for volunteer participants, you need to think carefully about whether or not your research project could adversely affect someone in any of these categories, and if so, how you might try to either screen out these individuals and/or design the project so that the risk to these individuals is minimized.*

Appendix A: Consent Forms

iv. HSIRB Form Continued

2a. If you checked any or all of the groups identified above, explain why you need to use the group and the methods you will use to minimize risk. If your research design proposes no special risks to these vulnerable individuals even if they happen to be included in your sample, please state why:

As my research focuses on high school mathematics learning, my subjects will be under the age of 18. My research design proposes no special risks to these vulnerable individuals as they will not be required to participate or provide information. Information will only be gathered from participants willing to submit data and who have assented to the collection and use of their data in addition to the submission of a parent/guardian consent form. No names or identifying descriptions will be used for any participant, and participants may withdraw from the research at any time without penalty. The data collection will have no effect on student grades.

3. This research might affect people with special vulnerabilities (for example, pregnant women, people with allergies, people taking some medications, people with cognitive impairments such as ADHD, etc.)

Research Design Note: Think carefully here again about whether or not your research design could negatively affect people with special vulnerabilities. For example, does your research design require so much concentration and/or computation that it might result in considerable stress for someone with a cognitive impairment? Are people completing your instrument in solitude or in a group setting? Might comparative performance result in excessive stress?

Yes
 No

If you checked "Yes", explain the methods you will use to minimize risk to these people.

Not applicable.

4. Describe your subject pool including:
 a. the intended number of subjects
 b. subject characteristics/demographics

The participants will include both male and female student volunteers from 6 algebra classes, ages 14 to 16, who have parental consent and have assented to participate in the research. Participating students will include a variety of social, economic, and ethnic backgrounds.

5. Describe in detail the methods you will use to recruit your subjects.

Before beginning research, I will have a discussion with each of the six classes and ask for volunteers to submit their data for analysis. I will distribute and review the student assent forms as well as the parental consent forms with each of my classes. Assent and consent forms must be obtained prior to completion of the student surveys. Both student and parent/guardian must give permission for data to be included in this study.

6. This research involves **deception** of subjects.

Appendix A: Consent Forms

iv. HSIRB Form Continued

Yes
 No

If you checked "Yes", describe the nature of the deception and your debriefing procedure. You will need to provide the debriefing statement with the full proposal submission. Even if the debriefing will be done orally, you need to submit the text of the verbal statement that will be read to participants.

7. Explain by whom and how the subjects will be informed of the purposes of this research project. (Remember to provide a copy of the informed consent form with this proposal form.)

When I discuss and distribute student assent and parent consent forms, I will introduce students to the purposes of this research study, which are to increase motivation in independent online learning as well as increase overall achievement in the course. In addition to this discussion, both student assent and parent/guardian consent forms clearly outline the purposes of my research project and how collected data will be utilized.

8. This research collects information, which (check all that apply)

deals with **sensitive aspects** from the participant's point of view.
 identifies the subject by **name** or **number codes**.
 might place the subject at **risk of liability** if made public.
 might place the subject's **financial standing or employability** at risk if made public.

Research Design Note: Think carefully about whether or not your research deals with topics that may be sensitive from the participant's point of view. Sometimes it is not obvious to the researcher that the subject of their research may be a sensitive topic for others.

If you checked any or all of the categories above, explain the methods you will use to

- a. safeguard the data you collect (you need to describe this safeguarding procedure in detail, including but not limited to a description of how the data will be protected (for example, in a locked cabinet), whom will have access to the data, and how and when the data will be destroyed)
- b. inform subjects of available support services (If your participants are drawn from the Moravian College community, please provide contact information for the Counseling Center, Campus Safety and the Health Center—contact information available on the HSIRB website. For participants drawn from other communities, please provide the comparable support service information.)
- c. minimize the risk of identification of subjects.

All data will be kept confidential by using a locked cabinet located under my desk. This cabinet is not accessible by students or staff, and only I have the key to access this cabinet. No names or identifying information will be published in my research. After compilation and publication of research data, the data (student surveys) will be

Appendix B: Surveys

i. Pre-and Post-Survey

Independent Learning Choice Survey

1. I think that the math being taught in this class is important:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

2. I can think of ways to use the math being taught in this class outside of school:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

3. I can see myself using the math being taught in this class in a future job or schooling:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

4. I enjoy learning online:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

5. I enjoy working independently on math assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

6. I like having a choice of assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

7. I work harder when I am given a choice of assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

8. I enjoy online learning when I have a choice of assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

9. I am more willing to complete online assignments when given a choice:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

10. It is easier to stay on-task when I have a choice of online assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

11. There is no way I will use the math taught in this class outside of school:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

12. I do not enjoy learning online:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

13. It is difficult to learn math when I have a choice of online assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

14. Having a choice of assignments does not make me work harder:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

Appendix B: Surveys

i. Pre-and Post-Survey Continued

15. I am less likely to stay on-task when I have a choice in online learning assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

16. I am less focused when I have a choice of online assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

17. I cannot learn math by myself:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

18. Having choice has had no impact on whether or not I complete assignments:

Agree	Slightly Agree	Neutral	Slightly Disagree	Disagree
-------	----------------	---------	-------------------	----------

Appendix B: Surveys

ii. Choice Improvement Survey

NAME _____

What suggestions do you have to improve the way in which you are given choices at the independent station? What would make your choices better? If you do not have any suggestions, feel free to write I don't know. Be honest, this is for you, not me!!!!

Appendix C: Checklists

i. Order of Operations

Order of Operations Checklists (due before quiz, date TBA)

Directions: This checklist is worth 10 points. To receive full credit, you must hand this sheet in with the required work complete. Points may be deducted for not following directions. Remember, in order to be eligible for a retest, you must complete certain assignments (see below). Initial and date any and all of the following activities:

Part 1: Mandatory Pretest (5 points)

- Order of Operations Pretest + Reflection (below)
(Schoology Assignments/ Choice folder → Order of Operations folder→ Pretest)

Score: _____ Date Completed: _____ Initials: _____

Reflection:

1. What was most difficult in the pretest?

2. How will you prepare for a quiz on this material?

Part 2: Vocab (5 points)

Directions: In Schoology → Assignments/Choice Folder→ Order of Operations Folder→ Vocabulary Review Folder. Open Order of Operations Vocabulary and Evaluating Expressions Vocabulary. Record all vocabulary words and definitions ON THE BACK of this paper. You should have 12 words altogether. Hint: Use the flashcard study mode method.

- Order of operations (7 words)
- Evaluating Algebraic Expressions (5 words)

Appendix C: Checklists

i. Order of Operations Continued

Part 3: The choices!! (5 points)

Directions: Complete **AT LEAST 3** of the assignments below. Assignments required for a retest are stated in **BOLD**. Check, Initial and date the assignments you have completed. Completing more than 3 assignments will certainly help your grade on this checklist! All assignments are located in Schoology: Assignments/Choice Folder (Order of Operations).

Text Based Review and Notes

Directions: Read both parts and take notes on a separate sheet. (You must submit notes with this checklist).

Initials: _____ Date Completed: _____

Videos

Directions: Watch all videos and take notes on a separate sheet. (You must submit notes with this checklist).

Initials: _____ Date Completed: _____

CK-12 Practice

Directions: Complete all three CK-12 practice sessions. On a separate sheet, answer three questions: What was most difficult? What did you like? Would you use CK-12 again? (You must submit answers with this checklist).

Initials: _____ Date Completed: _____

IXL (Required for Retests) HIGHLY RECOMMENDED!!!!

Directions: Obtain a Smart Score of 70 or above on each section. In order to retest, you **MUST** complete this assignment.

- B2: SmartScore: _____ Initials: _____ Date Completed: _____
- B3: SmartScore: _____ Initials: _____ Date Completed: _____
- B6: SmartScore: _____ Initials: _____ Date Completed: _____
- B7: SmartScore: _____ Initials: _____ Date Completed: _____

Old School Paper and Pencil Practice

Directions: Print or copy all questions from both parts. You must show your work since answers are provided! No credit will be given unless work is shown!! (You must submit this work with checklist).

- Evaluating Algebraic Expressions Practice. Initials: _____ Date Completed: _____
- Order of Operations. Initials: _____ Date Completed: _____

Khan Academy Practice

Directions: Complete both practice sessions. Record problems and show all work. Submit with this checklist.

- Order of Operations: Initials: _____ Date Completed: _____
- Evaluating Expressions: Initials: _____ Date Completed: _____

Appendix C: Checklists

ii. Real Numbers

Real Numbers Checklists (due before quiz, date TBA)

Directions: This checklist is worth 25 points. To receive full credit, you must hand this sheet in with the required work complete. Points may be deducted for not following directions. Initial and date any and all of the following activities:

Part 1: Vocabulary (5 points) Initials: _____ Date Completed: _____

Directions: In Schoology → Assignments/Choice Folder → Real Numbers Folder → Vocabulary Review Folder. Record the definitions of the following words...

1. Real Numbers- _____

2. Rational Numbers- _____

3. Irrational Numbers- _____

4. Natural Numbers- _____

5. Whole Numbers- _____

6. Integers- _____

7. Opposites- _____

8. Absolute Value- _____

9. Inequality- _____
|

Appendix C: Checklists

ii. Real Numbers Continued

□ **Part 2: Properties of Numbers Table (5 points)**

Initials: _____ Date Completed: _____

Directions: In Schoology → Assignments/Choice Folder → Real Numbers Folder → Properties of Real Numbers. Complete the missing information in the following table.

Properties of Real Numbers	
For every real number, a , b , and c ,	
Commutative Property of Addition	Example:
Commutative Property of Multiplication	Example:
	Example: $(1 + 2) + 3 = 1 + (2 + 3)$
	Example: $(1 \times 2) \times 3 = 1 \times (2 \times 3)$
Identity Property of Addition	Example:
	Example: $2 \times 1 = 2$
Inverse Property of Addition For every a there is an additive inverse $-a$ such that $a + (-a) = 0$.	Example:
	Example: $3 \times (1/3) = 1$
	Example: $2 \times 3 = 6$, so $6 = 2 \times 3$
Distributive Property $a(b + c) = ab + ac$ $a(b - c) = ab - ac$	Examples:
	Example: $-2 \times 0 = 0$
Multiplication Property of -1 For every real number n , $-1 \times n = -n$.	Examples:

Appendix C: Checklists

ii. Real Numbers Continued

Part 3: The choices!! (15 points)

Directions: Complete AT LEAST 3 of the assignments below. OR obtain a Smartscore of 100 on ALL IXLs and complete just one other assignment.

IXL (Required for Retests) HIGHLY RECOMMENDED!!!!

Directions: Obtain a Smart Score of 70 or above on each section. In order to retest, you MUST complete this assignment. If you get to 100 on each of the IXLs, then complete just one other assignment.

- A1: SmartScore: _____ Initials: _____ Date Completed: _____
- A8: SmartScore: _____ Initials: _____ Date Completed: _____
- H1: SmartScore: _____ Initials: _____ Date Completed: _____
- H2: SmartScore: _____ Initials: _____ Date Completed: _____
- H4: SmartScore: _____ Initials: _____ Date Completed: _____
- i2: SmartScore: _____ Initials: _____ Date Completed: _____

Videos

Directions: Watch all 4 videos and take notes on a separate sheet. (You must submit notes with this checklist).

- Video 1: Initials: _____ Date Completed: _____
- Video 2: Initials: _____ Date Completed: _____
- Video 3: Initials: _____ Date Completed: _____
- Video 4: Initials: _____ Date Completed: _____

Practice Quizzes

Directions: Complete each practice test on a separate sheet and record your score. You must submit ALL work including each question and your solution/steps.

- Quiz 1: Score: _____ Date Completed: _____ Initials: _____
- Quiz 2: Score: _____ Date Completed: _____ Initials: _____
- Quiz 3: Score: _____ Date Completed: _____ Initials: _____

CK-12 Practice

Directions: Complete all four CK-12 practice sessions. On a separate sheet, write ALL work completed AND answer three questions: What was most difficult? What did you like? Would you use CK-12 again? (You must submit answers with this checklist).

- Real Numbers Practice: Initials: _____ Date Completed: _____
- Ordering Real Numbers Practice: Initials: _____ Date Completed: _____
- Properties of Real Numbers Practice: Initials: _____ Date Completed: _____
- Simplifying Algebraic Expressions Practice: Initials: _____ Date Completed: _____

Old School Paper and Pencil Practice

Directions: Print or copy all questions from both parts. You must SHOW ALL WORK! No credit will be given unless work is shown!!! (You must submit this work with checklist).

- Classifying Real Numbers. Initials: _____ Date Completed: _____
- Ordering Real Numbers. Initials: _____ Date Completed: _____
- Prop. or Real Numbers. Initials: _____ Date Completed: _____
- Like Terms. Initials: _____ Date Completed: _____

Appendix C: Checklists

iii. Equations

Solving Equations Independent Choice Work

Oh Gee Golly, the CHOICES!!!!

Directions: There are many, many resources to help you learn solving equations. Remember, if you do not do well on the quiz, you must complete the IXLs for a retest. Complete at least three of the following, or get 100's on IXLs and complete just one other choice assignment. **Set daily goals. If you need help, see Mr. Kapral. Do not wait until the due date to work on this!!!!**

DUE DATE: _____

IXL LEVEL K (Required for Retests) HIGHLY RECOMMENDED!!!!

Directions: Obtain a Smart Score of 70 or above on each section. In order to retest, you MUST complete this assignment. If you get to 100 on each of the IXLs, then complete just one other assignment.

- J.3: Solve one-step linear equations:
SmartScore: _____ Date Completed: _____
- J.4: Solve two-step linear equations:
SmartScore: _____ Date Completed: _____
- J.5: Solve advanced linear equations:
SmartScore: _____ Date Completed: _____
- J.6: Solve equations with variables on both sides:
SmartScore: _____ Date Completed: _____
- J.8: Find the number of solutions:
SmartScore: _____ Date Completed: _____
- J.11: Solve linear equations: mixed review:
SmartScore: _____ Date Completed: _____

Practice Quizzes

Directions: Complete each practice test on a separate sheet and record your score. You must submit ALL work including each question and your solution/steps. In addition, please complete the reflection questions after completing each practice quiz. You need to answer all reflection questions for each quiz on a separate sheet of paper.

- One-Step Equations Quiz: Score: _____ Date Completed: _____
- Two-Step Equations Quiz: Score: _____ Date Completed: _____
- Multi-Step Equations Quiz: Score: _____ Date Completed: _____
- Variables on Both Sides Quiz: Score: _____ Date Completed: _____

Reflection Questions (Complete for each quiz)

1. What problems did you get wrong and what did you do wrong?
2. What is the correct solution to each problem you got incorrect? (SHOW WORK!)
3. What can you do to better prepare for such a quiz?

Old School Paper and Pencil Practice

Directions: See Mr. Kapral for worksheets. You must SHOW ALL WORK! No credit will be given unless work is shown!!! (You must submit work with checklist).

- Practice 3-1. Date Completed: _____
- Practice 3-2. Date Completed: _____
- Practice 3-3. Date Completed: _____

Appendix C: Checklists

iii. Equations Continued

Videos + Guided Notes (NEW)

Directions: Watch all videos and take notes on the accompanying guided notes pages. There are three guided notes pages, with seven total videos. **Submit completed guided notes along with this checklist for credit!!!**

- [One and Two-Step Equations Guided Notes](#) (3 videos):
Date Completed: _____
- [Multi-Step Equations Guided Notes](#) (2 videos):
Date Completed: _____
- [Variables on Both Sides Guided Notes](#) (2 videos):
Date Completed: _____

Reading Assignments + Notes

Directions: There are three parts to this reading assignment. In each part, you will read through the texts and take notes on the corresponding notetaking guides. **YOU MUST TURN IN YOUR NOTES WITH THIS CHECKLIST TO RECEIVE CREDIT!!**

- [One and Two-Step Equations Notes](#)
Date Completed: _____
- [Multi-Step Equations Notes:](#)
Date Completed: _____
- [Variables on Both Sides Notes:](#)
Date Completed: _____

Story Problems Poster Project (NEW!)

Directions: In Schoology (Equations Folder), click on the Story Problems Poster Project folder. Read the directions and be sure to follow the rubric. If you choose to do this project, you only need to complete one other choice assignment! Remember, make your poster look nice!!!!

Date Completed: _____

Envision Textbook Readings + Practice Problems (NEW!)

Directions: Grab an Envision book in the classroom. You may not take the book home unfortunately, so need be you may take a picture of the following pages to complete this assignment at home.

- Part 1: **Read pages 11-15. Complete problems 1-9 on page 15 AND problems 16-38 on page 16.** Turn in all problems with this checklist.
Date Completed: _____
- Part 2: **Read pages 18-21. Complete problems 1-9 on page 21 AND problems 16-41 on page 22.** Turn in all problems with this checklist.
Date Completed: _____

Appendix C: Checklists

iv. Managing the Equations Checklist

Equations Checklist Navigation + Goals

One-and Two-Step Equations	Multi-Step Equations	Variables on Both Sides
<p>Pre-Assess....</p> <ul style="list-style-type: none"> One-Step Equations Quiz Two-Step Equations Quiz <p>Did you do well(85% or better)? Answer the reflection questions (from checklist) then Go on to Apply it.</p> <p>Did you do poor? Go on to learn it, then answer the reflection questions (See checklist)</p>	<p>Pre-Assess....</p> <ul style="list-style-type: none"> Multi-Step Equations Quiz <p>Did you do well(85% or better)? Answer the reflection questions (from checklist) then Go on to Apply it.</p> <p>Did you do poor? Go on to learn it, then answer the reflection questions (See checklist)</p>	<p>Pre-Assess....</p> <ul style="list-style-type: none"> Variables on Both Sides Quiz <p>Did you do well (85% or better)? Answer the reflection questions (from checklist) then Go on to Apply it.</p> <p>Did you do poor? Go on to learn it, then answer the reflection questions (See checklist)</p>
<p>Learn It....</p> <ul style="list-style-type: none"> Videos + One and Two-Step Equations Guided Notes (3 videos): Readings + One and Two-Step Equations Notes 	<p>Learn it....</p> <ul style="list-style-type: none"> Videos + Multi-Step Equations Guided Notes (2 videos) Readings + Multi-Step Equations Notes: 	<p>Learn it....</p> <ul style="list-style-type: none"> Videos + Variables on Both Sides Guided Notes (2 videos): Readings + Variables on Both Sides Notes:
<p>Apply it...</p> <ul style="list-style-type: none"> Old School: Practice 3-1. IXL: 1.3: Solve one-step linear equations AND 1.4: Solve two-step linear equations 	<p>Apply it...</p> <ul style="list-style-type: none"> Envision Textbook Part 1: Read pages 11-15. Complete problems 1-9 on page 15. AND problems 16-38 on page 16. Old School: Practice 3-2. IXL: 1.5: Solve advanced linear equations: 	<p>Apply it...</p> <ul style="list-style-type: none"> Envision Textbook Part 2: Read pages 18-21. Complete problems 1-9 on page 21 AND problems 16-41 on page 22. Old School: Practice 3-3. IXL: 1.6: Solve equations with variables on both sides: IXL: 1.8: Find the number of solutions:
Goal: October 17th	Goal: October 23rd	Goal: October 30th

Mixed Review: Goal: October 30th

- IXL: [1.11: Solve linear equations: mixed review](#)
- Story Problems Poster Project (NEW!)

Appendix C: Checklists

v. Rates, Proportions, Unit Analysis

Rates, Ratios, Proportions, Unit Analysis Checklist (ALL ITEMS LOCATED IN SCHOLOGY)

Part 1: Rates and Ratios

Begin with a Learn it Activity (Pick at least one, but I'd recommend viewing everything, especially before the quiz!) Following that, go on to "Apply it..." The more practice the better. I'd recommend IXL, but if you do Paper and Pencil, be sure to check your answers and ask questions at the direct station!!!!

Learn it.... (Pick one below. I'd recommend you complete both!!!)

- **Video (1) Ratios and Rates Notes:** Watch the video and fill in notes on the video [notetaking guide](#) (pages 1-2).
- **Readings: (A) Introduction and Unit Rates:** Read part (A) and fill in the Readings notetaking guide (pages 1-2).

Apply it... (Complete either IXL or Old School. I recommend both, the more practice the better!!!!)

- **IXL: (Complete all of the following with a SmartScore of 70 or above)**
 - **C.1: Identify equivalent ratios**
 - **C.2: Write an equivalent ratio**
 - **C.3: Unit rates**
 - **C.4: Unit prices**
- **Old School Paper and Pencil: (Complete all of the following and SHOW ALL WORK!)**
 - 3.4 Book Problems (1-8)
 - Practice 3-4 (1-6)
 - Rates Word Problems WS

Goal: November 10th (Subject to change!)

Part 2: Unit Analysis

Begin with a Learn it Activity (Pick at least one, but I'd recommend viewing everything, especially before the quiz!) When done, complete either the IXLs or some paper and pencil practice under "Apply it". THE MORE PRACTICE THE BETTER!!!!

Learn it.... (Pick one below. I'd recommend you complete both!!!)

- **Video (2) Unit Analysis Examples:** Watch the video and fill in notes on the video [notetaking guide](#) (page 3).
- **Readings: (B) Converting Rates:** Read part (B) and fill in Readings notetaking guide (pages 3-4)

Apply it... (Complete either IXL or Old School. I recommend both, the more practice the better!!!!)

- **IXL: (Complete all of the following with a SmartScore of 70 or above)**
 - **E.1: Convert rates and measurements: customary units**
 - **E.2: Convert rates and measurements: metric units**
 - **E.3: Unit prices with unit conversions**
- **Old School Paper and Pencil: (Complete all of the following and SHOW ALL WORK!)**
 - 3.4 Book Problems (9-15)
 - Unit Analysis Worksheet

Goal: November 17th (Subject to Change!)

Appendix C: Checklists

v. Rates, Proportions, Unit Analysis Continued

Part 3: Proportions

Begin with a Learn it Activity (Pick at least one, but I'd recommend viewing everything, especially before the quiz!) When done, complete either the IXLs or some paper and pencil practice under "Apply it". THE MORE PRACTICE THE BETTER!!!!

Learn it.... (Pick one below. I'd recommend you complete both!!!)

- **Video (3) Proportions AND Video (4) Solving Proportions: Easy, Medium, and Hard Examples:** Watch BOTH videos and fill in notes on the video [notetaking guide](#) (pages 3 - 6).
- **Readings (C) Proportions and Cross Products AND (D) Cross Products with the Distributive Property:** Read parts C and D and record notes on the Readings notetaking guide (pages 5-6)

Apply it... (Complete either IXL or Old School. I recommend both, the more practice the better!!!!)

- **IXL: (Complete all of the following with a SmartScore of 70 or above)**
 - **C.5: Solve proportions**
 - **C.6: Solve proportions: word problems**
 - **C.7: Scale drawings: word problems**
- **Old School Paper and Pencil: (Complete all of the following and SHOW ALL WORK!)**
 - 3.4 Book Problems (16-31)
 - Practice 3-4 (12-45)
 - KUTA: Solving Proportions Worksheet

Goal: November 30th (Subject to change!)

Mixed Review: Practice Quiz (Schoology): Save this for last!!!

Goal: December 1st (Subject to Change!)

Appendix C: Checklists

vi. Inequalities

Inequalities Checklist (ALL ITEMS LOCATED IN SCHOOLOGY)

Part 1: Inequalities and Their Graphs

Pick (1): Either complete all IXLs or complete all of Practice 4-1. Remember to fill out your Accountability Log!

- **IXL:** (Complete all of the following with a SmartScore of 70 or above)
 - [K.1: Graph inequalities](#)
 - [K.2: Write inequalities from graphs](#)
 - [K.3: Identify solutions to inequalities](#)
- **Old School Paper and Pencil:** (Complete all of the following and SHOW ALL WORK!)
 - Practice 4-1 (ALL!) (Classroom Document)

NEED HELP!? Check out the following resources to help you complete one of the assignments above:

- **Videos** (Located in Schoology -> Inequalities Folder-> Part 1: Inequalities and Their Graphs Resources)
 - (1) Inequalities Introduction: How to Read the Symbols and How to Graph
 - (2) More about Inequalities
- **Readings** (Located in Schoology -> Inequalities Folder-> Part 1: Inequalities and Their Graphs Resources)
 - (1) Inequalities and Their Graphs Reading Assignment

Self Assess....(Recommended!)

Are you ready for a quiz on this material? Test your skills and complete the practice quiz for part 1!

- Inequalities and their Graphs: Self-Assessment (LOCATED IN SCHOOLOGY PART 1 FOLDER for INEQUALITIES!)

Goal: (Subject to change!)

Part 2: Solving One-Step Inequalities

Pick (1): Either complete all IXLs or complete all of Practice 4-2 AND 4-3. Remember to fill out your Accountability Log!

- **IXL:** (Complete all of the following with a SmartScore of 70 or above)
 - [K.4: Solve one-step linear inequalities: addition and subtraction](#)
 - [K.5: Solve one-step linear inequalities: multiplication and division](#)
 - [K.6: Solve one-step linear inequalities](#)
 - [K.7: Graph solutions to one-step linear inequalities](#)
- **Old School Paper and Pencil:** (Complete all of the following and SHOW ALL WORK!)
 - Practice 4-2 (ALL!) AND
 - Practice 4-3 (ALL!)

NEED HELP!? Check out the following resources to help you complete one of the assignments above:

- **Videos:** (Located in Schoology -> Inequalities Folder-> Part 2: Solving One-Step Inequalities Resources)
 - (1) Solving Inequalities with Addition and Subtraction
 - (2) Solving Inequalities with Multiplication and Division
- **Readings:** (Located in Schoology -> Inequalities Folder-> Part 2: Solving One-Step Inequalities Resources)
 - (1) One-Step Inequalities Reading Assignment

Self Assess....(Recommended!)

Are you ready for a quiz on this material? Test your skills and complete the 2 practice quizzes for part 2!

- Solving One-Step Inequalities (Addition and Subtraction): Self Assessment (LOCATED IN SCHOOLOGY)
- Solving One-Step Inequalities (Multiplication and Division): Self Assessment (LOCATED IN SCHOOLOGY)

Goal: (Subject to change!)

Appendix C: Checklists

vi. Inequalities Continued

Part 3: Multi-Step Inequalities

Pick (1): Either complete all IXLs or complete all of Practice 4-4. Remember to fill out your Accountability Log!

- **IXL:** (Complete all of the following with a SmartScore of 70 or above)
 - [K.8: Solve two-step linear inequalities](#)
 - [K.9: Graph solutions to two-step linear inequalities](#)
 - [K.10: Solve advanced linear inequalities](#)
 - [K.11: Graph solutions to advanced linear inequalities](#)
- **Old School Paper and Pencil:** (Complete all of the following and SHOW ALL WORK!)
 - Practice 4-4 (ALL!)

NEED HELP!? Check out the following resources to help you complete one of the assignments above:

- **Videos:** (Located in Schoology -> Inequalities Folder-> Part 3: Solving Multi-Step Inequalities Resources)
 - (1) Solving Multi-Step Inequalities
- **Readings:** (Located in Schoology -> Inequalities Folder-> Part 3: Solving Multi-Step Inequalities Resources)
 - (1) Solving Multi-Step Inequalities Readings

Self Assess....(Recommended!)

Are you ready for a quiz on this material? Test your skills and complete the practice quiz for part 3!

- Solving Multi-Step Inequalities: Self Assessment (LOCATED IN SCHOOLGY)

Goal: (Subject to change!)

Part 4: Compound Inequalities

Pick (1): Either complete all IXLs or complete all of Practice 4-5. Remember to fill out your Accountability Log!

- **IXL:** (Complete all of the following with a SmartScore of 70 or above)
 - [K.12: Graph compound inequalities](#)
 - [K.13: Write compound inequalities from graphs](#)
 - [K.14: Solve compound inequalities](#)
 - [K.15: Graph solutions to compound inequalities](#)
- **Old School Paper and Pencil:** (Complete all of the following and SHOW ALL WORK!)
 - Practice 4-5 (ALL!)

NEED HELP!? Check out the following resources to help you complete one of the assignments above:

- **Videos:** (Located in Schoology -> Inequalities Folder-> Part 3: Solving Compound Inequalities Resources)
 - (1) Compound Inequalities and their Graphs
 - (2) Solving a Compound Inequality: "And" Example
 - (3) Solving a Compound Inequality: "Or" Example
- **Readings:** (Located in Schoology -> Inequalities Folder-> Part 3: Solving Compound Inequalities Resources)
 - (1) Compound Inequalities Reading Assignment

Self Assess....(Recommended!)

Are you ready for a quiz on this material? Test your skills and complete the practice quiz for part 4!

- Solving Compound Inequalities: Self Assessment (LOCATED IN SCHOOLGY)

Goal: (Subject to change!)

Appendix D: Assessments and Scoring Rubrics
ii. Multi-Step Equation Assessment Item and Scoring Rubric

1. Solve the following equation by showing your steps and identifying the reason for each step:

$$3(7x - 10) = 54$$

- A. Fill in the table below with your steps and reasons.

Equation	$3(7x - 10) = 54$	Reason
Step 1		
Step 2		
Step 3		

- B. Check your solution. Show your work.

Appendix D: Assessments and Scoring Rubrics
ii. Multi-Step Equation Assessment Item and Scoring Rubric Continued

Grading Guidelines

Equation	$3(7x - 10) = 54$	Reason
Step 1	$21x - 30 = 54$ or $7x - 10 = 18$	Distributive Property Or Division Property of Equality
Step 2	$21x = 84$ or $7x = 28$	Addition Property of Equality 0.5 pt.
Step 3	$x = 4$	Division Property of Equality 0.5 pt.

B. Check your solution. Show your work.

$$3(7(4) - 10) = 54$$

$$3(28 - 10) = 54$$

$$3(18) = 54$$

$$54 = 54$$

1 pt.

Appendix D: Assessments and Scoring Rubrics
iii. Word Problem Assessment Item and Scoring Rubric

Anthony is 15 years older than twice Alicia's age. The sum of their ages is 66.

A. If Alicia's age is represented by x , write an expression for Anthony's age in terms of Alicia's age.

B. Write an equation that you can use to find the ages of both Alicia and Anthony.

C. Solve the equation. Show your work.

Solution: _____

D. Alicia's age: _____ Anthony's age: _____

Appendix D: Assessments and Scoring Rubrics
iii. Word Problem Assessment Item and Scoring Rubric Continued

Grading Guidelines

A. If Alicia's age is represented by x , write an expression for Anthony's age in terms of Alicia's age.

$$\underline{\hspace{10em} 2x + 15 \hspace{10em}} \\ \text{1 pt.}$$

B. Write an equation that you can use to find the ages of both Anthony and Alicia.

$$\underline{\hspace{10em} 2x + 15 + x = 66 \hspace{10em}} \\ \text{1 pt.}$$

C. Solve the equation. Show your work.

$$\begin{aligned} 2x + 15 + x &= 66 \\ 3x + 15 &= 66 \\ 3x &= 51 \\ x &= 17 \end{aligned}$$

$$\text{Solution: } \underline{\hspace{10em} x = 17 \hspace{10em}} \\ \text{1 pt.}$$

$$\text{D. Alicia's age: } \underline{\hspace{10em} 17 \hspace{10em}} \qquad \text{Anthony's age: } \underline{\hspace{10em} 49 \hspace{10em}} \\ \text{0.5 pt.} \qquad \qquad \qquad \text{0.5 pt.}$$

Appendix E: Student Accountability Slips**Accountability Log (Weekly Grade)****WHAT DID YOU DO THIS WEEK AT THE INDEPENDENT STATION?**

Date	Work Completed at Independent Station