A Comparative Study of Student Achievement in Virtual and Traditional Models of Instruction

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Abstract

Reading and mathematics scores from the 2020-21 school year when students were participating in instruction fully virtually were compared to baseline scores from the 2019-20 school year when students were participating fully in a traditional model of in-person instruction to establish whether or not student achievement in the areas of reading and mathematics changed from in-person learning to virtual learning. A quasi-experimental methodology was used to examine whether a difference exists from in-person learning to virtual learning. The population and sample included students in an urban Midwestern school district. The sampling procedure was purposive. The sample included students in grades six, seven, and eight attending the school during the 2019-20 and 2020-21 school years. English language arts scores and mathematics scores from Catapult Evaluate ELA and Mathematics assessments and reading growth and mathematics growth as defined by STAR Reading and STAR Math were compared. The data yielded evidence that there was a difference in student achievement from in-person instruction to virtual instruction. The decreases in mean ELA scores, reading growth, and mathematics growth were found to be statistically significant with small-to-medium effect sizes. There was a difference in mean mathematics scores, but it was not statistically significant.

Dedication

This dissertation is dedicated to my mother, who believed in and encouraged me in my most challenging moments. While I worked toward my undergraduate degree, she set an example as the first member of our family to attend and graduate college**,** inspiring me to pursue my academic goals and dreams to complete a doctorate degree.

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Chapter 1

Introduction

Doctors confirmed the first case of the novel Coronavirus in the United States on January 21, 2020. On January 30, the World Health Organization (WHO) declared a "public health emergency of international concern" (Hauck, Gelles, Bravo, and Thorson, 2020, p. 11). On the same day, officials reported the first case of person-to-person contact in the U.S. (Hauck, Gelles, Bravo, and Thorson, 2020). On January 31, officials set quarantines for Americans who had traveled to regions of China. The Centers for Disease Control (CDC) reported that this was the first time in over 50 years the federal government had issued a quarantine order. On March 13, President Donald Trump declared the coronavirus pandemic to be a national emergency (Hauck, Gelles, Bravo, and Thorson, 2020). This crisis forced districts across America to close their school buildings and adopt a new teaching model. This new teaching model, which has come to be known as virtual learning, has created a new area of interest for researchers and a tremendous challenge for educators.

In Missouri, Governor Mike Parson declared a state of emergency on March 13, and on March 21, directed Dr. Randall Williams, Missouri Department of Health and Senior Services Director, to order social distancing statewide. He requested that President Trump approve a major disaster declaration on March 24, 2020 (Office of Governor Michal L. Parson, 2020). Governor Parson stated that “There is an urgent need for federal assistance to help Missouri families meet today’s challenges and the many more that we will face” (Office of Governor Michael L. Parson, 2020, p. 1). Because of the governor's action, schools across Missouri were forced to change their model of instruction.

In March 2020, leaders across the United States, including the mayor of the city where Charter School H is located, proclaimed a state of emergency (Lucas, 2020). On March 13, students at Charter School H attended their last day of school before Spring Break, anticipating a return on March 23. However, on March 21, the mayor issued a "Stay at Home" order in which he ordered residents to leave their homes only to perform "essential duties" (Lucas, 2020, p. 1). Students did not return to the school building for the remainder of the 2019-20 school year. As a result of the mayor's actions, the city's schools shifted into virtual learning mode without sufficient planning or preparation time. “They had to figure out how to adapt, figuring out the technology, putting lessons and more on platforms, and communicating with parents to make sure their children had everything they needed” (Paris, 2020, p.1). Educators often refer to this as "crisis learning" (Parris, 2020, p.1).

While virtual and blended schools make up a small portion of schooling options, they are among the fastest-growing options (Miron, Shank, & Davidson, 2018). From 2005 to 2016, enrollment in full-time virtual schools increased nationally from approximately 50,000 to 300,000 students. Meanwhile, enrollment in full-time blended schools increased from 10,000 students nationally to nearly 120,000 (Miron, Shank, & Davidson, 2018). Due to the onset of the Covid-19 pandemic during the spring of 2020, school closures substantially increased student participation in virtual and blended schools in the U.S. during the 2020-21 school year.

Background

According to National Center for Education Statistics, in the United States, during the fall of 2017, 50.7 million students were enrolled in K-12 schools (2021). The enrollment of Black students consisted of approximately 15.2% of the total student population. Hispanic students comprised approximately 26.8% of the nation’s students. American Indian/Alaskan Native

students were 1% of the nation's students. Asian students comprised 4.8% of the students in the United States. Pacific Islander students were 0.4% of the nation's student population. White student enrollment was the largest of all student groups, with 48% of United States students being in this category. In the United States, 52.11% of students receive free and reduced lunch (NCES, 2021). According to a May 2018 study by Miron, Shank, and Davidson, 295,518 students were enrolled in 429 full-time virtual schools, and 116,716 students were enrolled in 296 full-time blended schools.

In Missouri, during the 2019-20 school year, nearly 900,000 students were enrolled in schools across the state. The enrollment of Black students comprised 15.7 % of the student population, and Hispanic students comprised 6.7% of the state's students. White student enrollment was 70.7% of the state's student population. American Indian/Alaskan Native students made up 0.4% of Missouri's students. In the state of Missouri, 50.0% of students receive free and reduced lunch (Missouri, 2020. According to one estimate by Common Sense Media, "36% of

Missouri students don't have adequate internet access for virtual learning" (Moxley, 2020, p. 1).

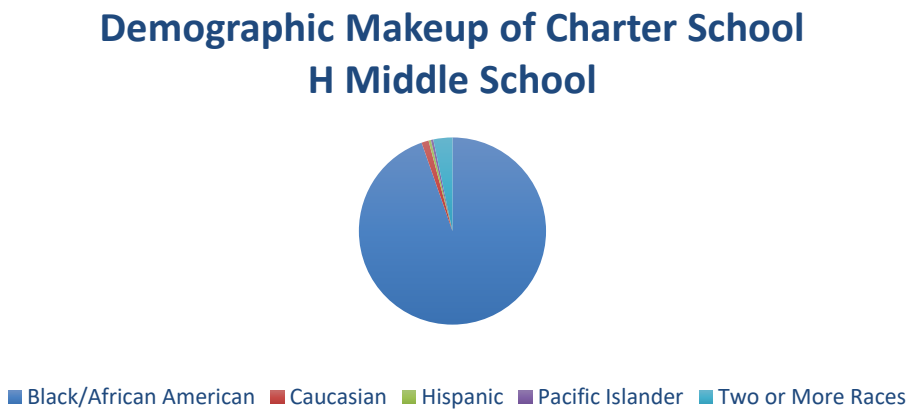

Figure 1: Demographic makeup of Charter School H Middle School

The study took place in a Midwestern urban charter school system, referred to as Charter School H. Charter School H has one elementary building, one middle school building, and one high school building. The charter school system operates within the boundaries of a large public school district. Families residing within the school district's boundaries can enroll their student in one of the district's schools, or any of the 39 charter schools operated by 20 Local Education Agencies (LEAs) (DESE, 2020). According to the United States Census (2010), the district boundaries encompass approximately 66 square miles. The community had a population of 194,122. Caucasians comprised 67% of the population, followed by 25% African-American, and 7% other, including American Indian, Asian, Hawaiian, and Hispanic populations. This study was conducted using data from the middle school in that district. At that time, 251 students were enrolled in grades six through eight. Of those students, 93% were reported as Black/African American, 2% Hispanic, 1.1% White/Caucasian, 0.3% Pacific Islander, and 3.6% reported two or more races. Male students make up 53% of students, and 47% are female. Sixth graders make up 19% of the student population, 38% of students are enrolled in seventh grade, and 43% are enrolled in eighth grade. At Charter School H, 100% of students qualify for free breakfast and lunch, and the charter school system is classified as a "Highest Poverty LEA" by the department of education in the state in which it operates (DESE, 2021).

Figure 2: Male and Female

Statement of the Problem

Due to the Coronavirus (COVID-19) pandemic, schools across the United States began closing their buildings in March of 2020. Schools continued to provide learning in various ways, meaning an abrupt change of setting and learning structure for students, families, and educators (Farlazzo, 2020). There is evidence indicating that students who experience poverty face more significant challenges than their suburban counterparts (Kincheloe & Hayes, 2007). For example, students who are raised in poverty are more likely to experience social-emotional challenges, mental health issues, chronic stress, and cognitive lags (McKenzie, 2019). These challenges result in academic and behavioral issues in school, and students in poverty have a higher level of absenteeism, struggle with focus and concentration, have significantly more difficulty in comprehension and memory, and struggle with motivation (Jensen, 2009). This may make virtual learning a greater challenge, thus impacting student achievement. For example, billing and data usage present challenges for students who may be accessing learning from tablets and smartphones. Although many internet providers advertised free internet, with their specific terms (e.g., focus on new subscribers, 60-day trials), internet may still be unaffordable for families with unstable incomes (Fleming, Ford, & King, 2020). For families who do have internet access, the connection can be slow or unreliable, making virtual learning a challenge (Fleming, Ford, & King, 2020). If students who experience poverty already face greater challenges impacting their learning (Jansen, 2009), the additional challenges of virtual learning (Fleming, Ford, & King, 2020) could further negatively impact their academic achievement. However, students who experience poverty are underrepresented in virtual schools (Molnar, Miron, Elgeberi, Barbour, Huerta, Shafer, & Rice, 2019), and little research exists that studied the experience of a single group of urban students who participated in both in-person and virtual

learning. This study sought to examine the effect of in-person instruction and virtual instruction on student academic achievement for one group of students in a high-poverty urban middle school.

Purpose of the Study

The purpose of this study was to examine if participation in virtual learning may have an effect on the reading and mathematics achievement of students in a high poverty urban middle school between the 2019-20 school year and 2020-21 school year. Reading and mathematics scores from the 2020-21 school year were compared to baseline scores from the 2019-20 school year to establish whether or not student achievement in the areas of reading and mathematics changed from in-person learning to virtual learning.

Significance of the Study

This study may add to the literature about the impact of virtual leaning on student achievement for low-income students, which is an understudied population on this topic. For the purpose of this study, any student who qualifies to receive free lunch is classified as "low-income". Molnar et al. (2019) found that virtual schools "enrolled substantially fewer" low-income students when compared with national enrollment public schools. Similarly, Mislevy and associates (2020) found that students enrolled in fully online learning were "less likely than their face-to-face course peers to be economically disadvantaged" (p. 8). Therefore, it seems that low-income students have previously been underrepresented in virtual schools, so an examination of the impact of virtual learning on this specific group of students would be interesting. More specifically, the 2019-20 instructional plan for Charter School H was comprised of a traditional in-person approach, and the 2020-21 instructional plan included fully-virtual instruction. The current study attempted to extend the literature by examining the

academic achievement of low-income students in an urban school who participated in both instructional approaches.

When schools reopen, school leaders will have many decisions to make regarding how to best meet the instructional needs of students. This study may have important practical significance in influencing the resources a school should dedicate to instructional strategies for students in high-poverty, urban middle schools. School leaders may glean insights to help guide their decision-making about virtual learning when school buildings must be closed for extended periods of time. Urban school districts and policymakers may gain useful information from this study that may help them understand how selecting a virtual or in-person learning model may impact academic achievement for students in high-poverty urban middle schools.

Delimitations

According to Lunenburg and Irby (2008), "delimitations are self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). The following delimitations were made to complete the study.

1. This study was conducted using only reading and mathematics scores to measure academic achievement. This study's results cannot be generalized to other content areas.
2. This study was conducted during the 2019-20 and 2020-21 school years. This study's results cannot be generalized to other time frames.
3. This study was conducted using data from one urban Missouri middle school, including only grades six through eight students.

Assumptions

As stated by Lunenburg and Irby (2008), "assumptions are referred to as the postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). The following assumptions were made to complete the study.

1. The archival school data for the school district are accurate and complete.
2. Students participated in virtual and in-person learning to the best of their ability.

Research Questions

Roberts (2004) stated research questions guide the study and provide the structure for presenting the results of the research. The researcher asked the following questions to examine the effect of in-person instruction and virtual instruction on student academic achievement.

RQ1. Is there a difference in ELA scores for low-income, urban students between in-person learning and virtual learning?

RQ2. Is there a difference in mathematics scores for low-income, urban students between in-person learning and virtual learning?

RQ3. Is there a difference in reading growth for low-income, urban students between in-person learning and virtual learning?

RQ4. Is there a difference in mathematics growth for low-income, urban students between in-person learning and virtual learning?

Definition of Terms

Asynchronous learning. "Communication exchanges which occur in elapsed time between two or more people. Examples are email, online discussion forums, message boards, blogs, podcasts, etc." (iNACOL, 2011, p. 1).

Attendance. "Number of students actively participating in a course, school, or scheduled session" (iNACOL, 2011, p. 1).

Blended Learning. "A program in which instruction occurs through a combination of face-to-face instruction and online learning. The online learning component frequently uses proprietary, online, adaptive software." (Brodersen & Melluzzo, 2017, p.3).

Brick and mortar schools. "Refers to traditional school or traditional school building, as contrasted with an online school" (iNACOL, 2011, p. 3).

Charter school. Missouri's Department of Elementary and Secondary Education (DESE) defines charter schools as independent public schools free from some rules and regulations that apply to traditional public school districts as identified explicitly in charter school law. In exchange for flexibility, charter school sponsors are to hold the schools accountable for results. Charter schools are non-sectarian, do not discriminate in their admission policies, and may not charge tuition or fees (Missouri, Charter Schools).

Cyber School. A formally constituted organization (public, private, state, charter, etc.) that offers full-time education delivered primarily over the Internet; term used synonymously with the terms "virtual school," "eSchool," and "online school" (Molnar, 2019).

Distance Learning/Distance Education Classes. "General term for any type of educational activity in which the participants are at a distance from each other--in other words, are separated in space. They may or may not be separated in time (asynchronous vs. synchronous)" (iNACOL, 2011, p. 5).

Face-to-Face. "When two or more people meet in person" (iNACOL, 2011, p. 5).

Highest-Poverty Local Education Agency. "Those LEAs that serve at least 20 percent

of the state's enrollment when ranked by the percentage of students in poverty, based on [Small Area Income and Poverty Estimates] data" (DESE, 2021).

Highly-Qualified Teacher. "The current Federal definition of a 'highly qualified teacher' is one who is fully certified and/or licensed by the state; holds at least a Bachelor's degree from a four-year institution; and demonstrates competence in each core academic subject area in which he or she teaches" (iNACOL, 2011, p. 6).

Home schools/Homeschooling. "The formal instruction of children in their homes instead of in a school (Unger, 1996). The differences between home schooling and full-time virtual schooling include: 1) Virtual schools' students may be at home, but the students are enrolled in a public school that follows the state mandated academic standards (home school students choose whichever standards they wish); 2) Virtual school students must take all federal and state mandated tests, as they are public school students with accountability requirements (home school students need not take any state or federal tests); 3) Virtual school students have a highly qualified teacher licensed teaching them online and interact with the teacher on instruction and assessments via Internet technology (home school students do not have to have licensed teachers providing instruction, or follow any mandated by state or federal highly qualified teacher requirements)" (iNACOL, 2011, p. 6).

Hybrid learning. See "Blended learning."

In-person Learning. Traditional face-to-face instruction is directed by a teacher (Van Beek, 2011).

Local Education Agency (LEA). A public board of education or other public authority within a state that maintains administrative control of public elementary or secondary schools in

a city, county, township, school district, or other political subdivision of a state. School districts and county offices of education are both LEAs (EdSource, 2021).

Online course. "Any course offered over the Internet" (iNACOL, 2011, p. 7).

Online Learning.

"Education in which instruction and content are delivered primarily over the Internet (Watson & Kalmon, 2005). The term does not include printed-based correspondence education, broadcast television or radio, videocassettes, and stand-alone educational software programs that do not have a significant Internet-based instructional component (U.S. Department of Education Office of Planning, Evaluation, and Policy Development Policy and Program Studies Service, 2010). Used interchangeably with Virtual learning, Cyber learning, e-learning" (iNACOL, 2011), p. 7.

State-led Virtual School. According to Fernandez, Ferdig, Thompson, Schottke, and Black, these are virtual schools associated with state Departments of Education.

Synchronous Learning. In a synchronous learning environment, students and teachers participate simultaneously (Molnar, 2019).

Teacher-student ratio. DESE defines the ratio of students to classroom teachers as "The ratio of students in grades K-12 to regular classroom teachers . . . excluding special education, remedial reading, Title I and vocational teachers."

Virtual Learning. The use of computer software, the internet, or both to deliver instruction to students (Van Beek, 2011).

Organization of the Study

This study is presented in five chapters. Chapter 1 includes the background, statement of the problem, significance, purpose statement, delimitations, assumptions, research question, the

definition of terms, and organization of the study. Chapter 2 is a review of the literature as it relates to virtual learning. The discussion explores student enrollment, achievement, and other considerations of virtual and blended learning. Chapter 3 presents the design and methodology of the study. This chapter includes a description of the population and sample, instrumentation, measurement, data collection procedures, data analysis, hypothesis testing, and study limitations. Chapter 4 provides an analysis of the data and a discussion of the findings. Chapter 5 includes the summary of the findings, surprises discovered, implications for actions, the conclusion, and recommendations for future studies related to virtual learning.

Chapter 2

Review of the Literature

This chapter addresses existing research associated with key elements of virtual schooling. Elements highlighted are the history of virtual schools, school closure, student motivation to participate in virtual learning, types of virtual schools, student demographics, achievement, benefits, and concerns of virtual schools.

Although school closure from the COVID-19 pandemic led to a shift to online instruction for many students in the spring of 2020 (Gabrieli & Beaudoin, 2020), student enrollment in virtual learning first began as early as 1986 (Archambault, Kennedy, & Bender, 2013). The Quantum Link Community College project in New Hampshire is the earliest online learning experience outlined in the body of research (Archambault, Kennedy, & Bender, 2013). By 2018, enrollment in fully virtual schools reached nearly 300,000 students while enrollment in full-time blended school reached almost 120,000 students, making online learning one of the fastest growing schooling options (Miron, Shank, & Davidson, 2018).

However, despite the rapid growth of online options for instruction, traditional in-person school systems seemed to resist embracing that growing trend. Davis and Ash described recommendations to consider online instruction in the event of school closures in a 2009 article while *American Nurse* cautioned that schools were unprepared to address school pandemic-related closures in 2015. School closures became widespread in 2020 due to the COVID-19 pandemic (Hauch, Gelles, Bravo, & Torson, 2020). These factors forced educators to embrace a new teaching model.

Although virtual learning has been in practice for over 30 years, there is no clear connection between student achievement and enrollment in virtual learning. A large study by

Molnar, Miron, Elgeberi, Barbour, and Huerta found that in-person schools outperformed virtual schools (2019). However, other studies found more favorable outcomes for virtual schools. There are many variables at play in the body of research, which can make comparisons unclear. For example, one study found that students in one large cyber school were not representative of the demographics of the state (Lueken, Ritter & Beck, 2015). The school enrolled a higher percentage of white students and a lower percentage of minority students than that state overall. Another study found that students enrolled in online schools were more likely to be classified as gifted (Mislevy, Schmidt, Puma, Ezekoye & Saucedo, 2020). Other variables in virtual school student achievement might include a student's reason for enrollment in virtual learning. Common responses in one study when participants were asked why students selected virtual learning included health concerns or making up a class (Fernandez, Ferdig, Thompson, Schottke, & Black, 2016). If students enrolled were prone to absence due to illness, or historically had lower achievement levels, comparisons between virtual and in-person learning may have been unclear.

The History of Virtual Schools

Students have been engaged in virtual learning since as early as 1986 when participation in the Quantum Link Community College project began in New Hampshire (Archambault, Kennedy, & Bender, 2013). The first virtual school, Laurel Springs, opened in 1991 and as of 2011, a virtual school operated in every state in the United States and in the District of Columbia (Archambault, Kennedy, & Bender, 2013). As technological competency has become increasingly more important, several states have made online courses or learning experiences requirements for graduation including Michigan, New Mexico, Alabama, and Virginia (Archambault, Kennedy, & Bender, 2013).

School Closure

The Swine Flu pandemic that occurred during the 2008-09 school year brought student and staff absences, as well as short-term school closures prompting early recommendations to consider online learning as a tool to minimize disruptions to instruction (Davis & Ash, 2009). At that time, the U.S. Department of Education provided guidance for districts to prepare for long-term closures, including making e-learning part of districts' emergency protocols (Davis & Ash, 2009).

A 2015 article in *American Nurse* foreshadows: "Missouri schools are no more prepared to respond to pandemics, natural disasters, and bioterrorism attacks than they were in 2011" (p. 6). Students experienced this reality in 2020 when U.S. school closures came about as a result of the global COVID-19 pandemic (Hauch, Gelles, Bravo, & Torson, 2020). However, school closures are not unheard of in education. Many reasons for school closure have been recorded, including weather incidents, natural disasters, school facilities issues, violence, illness, environmental problems, teacher strike, and student or staff death (Wong K.K., Shi J., Gao H, Zheteyeva Y.A., & Lane K., 2014). During the two school years between August 2011 and June 2013, there were 20,723 school closure events recorded in the US in 39% of schools in the National Center for Educational Statistics (NCES) database (Wong, et al., 2014). The most common reasons for school closures during that two-year period were weather and natural disasters, which accounted for 93% of the closure events. Closures related to illness accounted for 3% (Wong, et al., 2014). Of the illness-related closures, respiratory illness was the most common cause for closure. During the 2011-12 school year, 11 states reported closures in schools due to respiratory illness resulting in 14,357 student days lost, and 18 states reported closure for that reason during the 2012-13 school year resulting in 59,366 student days lost

(Wong, et al., 2014). School closures of four days or less were most common. In fact, the median number of closure days during the study of the 2011-12 and 2012-13 school years was just one (Wong, et al., 2014).

That data represents a stark contrast to the impact of the COVID-19 pandemic, which resulted in the closure of at least 124,000 school buildings and displaced more than 55 million children from in-person learning beginning in March 2020 (Harold, 2020). All schools ultimately remained closed for the remainder of the school year (Exstrom, 2020). School closures forced education leaders to consider how to move instruction online in the blink of an eye. Almost 75% of teachers surveyed reported that they were still delivering instruction to students in some capacity (Harold, 2020), yet not all teachers are trained in remote learning practices (Exstrom, 2020). The sudden shift of learning to virtual settings highlighted a major gap. Millions of low-income and rural families in the US were without internet, and many schools do not have enough devices to serve all their students, nor a plan for the distribution of devices (Harold, 2020).

Why Virtual Learning?

Gabrieli and Beaudoin's 2020 work identifies learning that educators can take from the shift to online instruction caused by school closures. Their article in *Educational Leadership*, which addressed time spent on learning, explained that the traditional 180-day, 6.5-hour schooling model has been increasingly viewed as insufficient in meeting the learning needs of today's students (2020). Examples supporting that view include many charter schools which attribute their success to extended learning time, and summer learning programs that boast improved academic outcomes due to time spent on learning outside of the traditional school year (2020) However, the authors point out that the COVID-19 pandemic has created the opportunity

for us to re-evaluate the belief that our students need more time in class. American students have followed nearly the same model, which is based on being present in school for an allotted period, for nearly 100 years. Because the closure of schools due to the COVID-19 pandemic led students to participate in learning from home, they have had access to learning at all times as well as the ability to participate in learning as little or as much as they choose (2020).

Historically, a student's education could be interrupted for several reasons. Gabrieli and Beaudoin explain that by learning to engage in effective online teaching and learning, teachers can provide students improved continuity in their academic experience (2020). Online tools can also allow for improved personalization of learning, whether in a brick-and-mortar school or elsewhere (2020). The authors tell us "this is the moment to take a leap forward on how we allocate and use learning time, moving from an assembly line model to a mastery-based approach" (Gabrieli & Beaudoin, 2020, p. 16).

At the height of the 2009 Swine Flu pandemic in the United States, an *Education Week* article by Ash and Davis explained that public schools receiving certain federal funds were required to have an emergency plan, but federal law at that time did not lay out specific requirements for such a plan. The article went on to explain that a study one year earlier by the U.S. Government Accountability Office found that although 95% of schools had emergency plans, they might not include contingencies for continuing education when schools close for extended periods (2009). Several recommendations were made which educators could consider in the event of a pandemic-related closure. One such recommendation was for districts to have students use home computers to complete online lessons, or to provide copies of work for students to complete at home. Another suggestion was for districts to ensure preparedness for emergency school closings by having students take materials home or providing district contact

information (Ash & Davis, 2009). While that may have been suitable at the time of that article's publication, other options are available to today's students.

Eleven years later, a more widespread use of technology means we can think about continuous education in more impactful ways. Gabrieli and Beaudoin make several recommendations regarding the use of virtual learning. First, they suggest continuing distance learning throughout the summer leading into the next school year. They point out that with the ability to "support the most challenged students and challenge the most advanced," educators can think outside of traditional time constraints to continue to support students (Gabrieli & Beaudoin, 2020, p. 16). Though the summer break between one school year and the next is historically a time for family vacations and school building maintenance, virtual learning experiences can be used to support the idea of continuous learning during that time. Gabrieli and Beaudoin also suggest permanently moving to mastery learning, aided by distance learning. They point out that students can benefit from leaving behind the "assembly-line model" in favor of taking the time each student needs to master academic content, and through the use of distance learning technology, students can move at the pace that is right for each of them (2020). The research outlined in this chapter will explore components of virtual schooling to provide additional context for its impact and implications.

Types of Virtual Schooling

Students currently participate in a wide variety of virtual schooling options. These options include fully virtual schooling, meaning all of a student's instruction is delivered through a computer or online program, as well as blended approaches to instruction. Blended learning can range from mostly online learning with little in-person support to mostly in-person learning, with a majority of instruction being delivered by a teacher while attending a brick-and-mortar

school (Miron, Shank, & Davidson, 2018). Some states allow a student who attends a fully-virtual school to participate in extra-curricular activities at a traditional in-person school site (Hasler-Waters, L., Barbour, M.-K., & Menchaca, M.-P., 2014). In some virtual school options, parents deliver instruction while trained teachers administer assessments (Hasler-Waters, et al., 2014). Virtual options for schooling include supplemental programs that support traditional in-person learning as well as stand-alone schooling options that provide all of a student's instruction and assessment.

Online learning is referred to by many terms including virtual schools, cyber schools, online schools, artificial intelligence (AI), technology-based distance education, and distance learning. Instruction can be delivered synchronously, meaning at the same time even when students are in different locations or asynchronously, meaning at different times (Davidson-Shivers, Muilenburg, & Tanner, 2001). Whether instruction is delivered synchronously or asynchronously, teachers can interact with students using a variety of methods including text-based chat rooms, video-based chat rooms, email, or online presentation applications (Hasler-Waters, et al., 2014).

In some virtual schools, a third-party vendor can provide curriculum and management, and will supply curriculum-related materials like textbooks and manipulatives, a computer, and a printer, headset, or microphone. Some virtual schools even cover a portion of internet costs (Hasler-Waters, et al., 2014).

Reasons for Enrollment in Virtual School

According to one analysis of online charter schools, reasons for enrollment in virtual schools can include increased learning opportunities, more flexibility in schedules, or the ability for students in rural or isolated areas to access school more easily (Hasler-Waters, et al., 2014).

One study of online education in Virginia found that students enrolled in the virtual school were more likely than their in-person counterparts to live in a rural area (Mislevy, et al., 2020).

In 2016, Fernandez, Ferdig, Thompson, Schottke, and Black, surveyed 5,855 parents of students enrolled in four state-led virtual schools. The responses indicated four major reasons for participating in virtual education. The greatest number of responses came from families homeschooling their students, with 38.9% of the results. The second most popular reason for enrolling in virtual school, with 31.9% of responses was that the student needed to take a class again. Less frequent responses included health concerns at 10.4% and class not offered or scheduling concerns with 11.9%. Less than 5% of respondents in that study selected "other" (Fernandez, Ferdig, Thompson, Schottke, & Black, 2016).

Scope and Growth of Virtual and Blended Schools

According to a study by Miron, et al. (2018), 295,518 students were enrolled in 429 full-time virtual schools and 116,716 students were enrolled in 296 full-time blended schools. They explain that while virtual and blended schools make up a small portion of schooling options, they are among the fastest-growing options, alongside homeschooling and charter schools (2018). The study found that "blended learning schools have grown remarkably in the past year, both in overall number of schools and average size" (page 9). With around 50,000 students enrolled in full-time virtual schools in 2005, and nearly 300,000 students enrolled in full-time virtual schools in 2016, full-time virtual school is becoming an increasingly popular option for students (Miron, et al., 2018). Full-time blended schools have experienced even steeper enrollment growth. With around 10,000 students enrolled in these schools in 2011, and nearly 120,000 enrolled in full time-blended schools during the 2016-17 school year, these schools are gaining in popularity as well. The most significant increase occurred between 2015 and the 2016-17

school year, when enrollment tripled, from around 40,000 to nearly 120,000 students (Miron, et al., 2018).

National Center for Education Statistics (NCES) data indicates that not only are more public schools offering technology-based distance education classes, but that use of these classes is becoming more widespread. During the 2002-03 school year, 36% of school districts offered technology-based distance education classes, enrolling 317,070 students. Just two years later, during the 2004-05 school year, while the number of districts enrolling students in these virtual courses increased by just one percent to 37%, the total number of students enrolled increased by nearly 60% to 506,950. By the 2009-10 academic year, the number of districts with these online offerings increased to 55%, and the total number of students enrolled reached 1,816,390 – an increase of more than 500% over a period of seven years (NCES, 2018). A possible cause for the significant increase could be related to the challenges of hiring qualified teachers, a concern that will be addressed later in this chapter (Perry & Lee, 2019). Another 2019 report published by Western Michigan University explained that there is evidence that the growth of virtual schools may be slowing or plateauing, but that the size of those schools is increasing, resulting in increased enrollment in both fully virtual schools and blended schools (Molnar, et al.).

Student Demographics

Grade level. A 2012 study by Miron and Urschel analyzed student characteristics, finance, and school performance of K12 Inc., the private education management company which enrolled the greatest number of students that year (2012). Their work found disproportionality in the number of middle school students served by K12. In grades seven and eight, the proportion of K12 students is approximately 2% and 3% higher respectively than the US national average. However, in kindergarten through grade four, and grades 11 and 12, the proportion of students

enrolled in K12 schools is lower than the national average (p.14). There is a sharp increase in K12's enrollment from grade five through eight, and a sharp decrease in enrollment between grades eight and 12, with the greatest decrease between grades 11 and 12 (p. 14). This drop may be attributed to students returning to traditional in-person schools or students dropping out of school altogether (Miron & Urschel, 2012).

Race and ethnicity. A study by Lueken, Ritter, and Beck found that students in one cyber school, referred to as SVA, operating in a state in the Southern United States were not representative of the demographics of the state. Their 2015 study found that the school enrolled a higher percentage of white students and a lower percentage of minority students than that state overall. While the state's student population was 20.2% Black, the cyber school's enrollment of that subgroup was 4.5%. Hispanic students made up 9.4% of the state's student population and the cyber school's enrollment of that subgroup was 2.2%. Asian and Native American student populations each hovered around 1% statewide, and the cyber school's enrollment was similar for those two subgroups. While white students made up 62.1% of that state's student population, the cyber school's population was comprised of 86.8% of that subgroup (2015).

Fernandez, Ferdig, Thompson, Schottke, and Black found that of the 5,855 parents of virtual school students surveyed in their study, 70.9% reported having a White student enrolled in virtual school, while for the traditional in-person schools, White students made up 45.9% of the population. They also found that the proportion of African-American and Hispanic students enrolled in virtual schools was lower than in traditional schools. African-American students made up 7.5% of student enrollment in the virtual schools in the study compared to 23.1% of in-person enrollment and Hispanic students made up 10.7% of the population of virtual schools compared to 24.7% of in-person schools (2016, p. 69).

Similarly, Gulosino and Miron's 2017 work later explains that although enrollment of minority students into virtual schools has increased a few percentage points over a period of a few years, the number of minority students enrolled in full-time virtual schooling is significantly lower than national averages for race and ethnicity of students (2017). During the 2013-14 school year, 22.5% of students in the US were Black, whereas Black students made up 12.8% of virtual school enrollment. Hispanic students made up 15.5% of students in the U.S. yet made up 10% of the population of students enrolled in virtual schools. While 4.8% of U.S students were Asian, 1.8% of students in virtual schools were Asian. During the same school year, White students were overrepresented in full-time virtual schools. While White students comprised 49.8% of all students in the U.S., that subgroup made up 69.9% of full-time virtual school enrollment (Gulosino & Miron, 2017).

A 2019 report published by Western Michigan University, also in line with the above research, found that virtual schools enrolled "substantially fewer minority students" in comparison to traditional public schools nationally (Molnar, et al.).

A 2020 study comparing virtual and face-to-face learning in Virginia had similar findings. Students who were enrolled in virtual learning were more likely to be White and more likely to be gifted than their peers in brick-and-mortar schools. They were less likely to be Black or Hispanic (Mislevy, et al., 2020).

Socioeconomic status. Many schools utilize technology-based distance education courses as part of their instructional program. These can differ from virtual schools in that they are part of a school's in-person instructional model, but the instruction is provided by a computer-based online program (Davis & Wright, 2018). According to a data set from the National Center for Education Statistics, high- and medium-poverty school districts saw a greater

increase in enrollment in technology-based distance education courses than low-poverty districts from the 2002-03 school year to the 2009-10 school year. During the 2002-03 school year, 42% of high-poverty school districts (serving populations with more than 20 % of students in poverty) enrolled a total of 86,110 students, and 42% of medium-poverty districts (serving populations with 10 to 19% of students in poverty) enrolled a total of 95,510 in those courses. Of school districts with low-poverty (less than 10%), 33% enrolled a total of 75,740 students in technology-based distance education courses (NCES, 2018).

During the 2009-10 school year, although the percent of low-poverty districts participating in distance learning increased from 33% to 54%, the number of students in those districts who were enrolled in distance learning programs did not increase as significantly as in high- and medium-poverty districts. The total number of students in high-poverty districts who were enrolled in these classes increased six-fold to 519,420, and the number of students in schools with medium poverty levels increased enrollment in virtual programs by ten times to 1,009,290. Enrollment of students into technology-based distance education courses in low-poverty schools increased by about 3.8 times to 519,420 (NCES, 2018).

On the surface, these data may appear to be a leveling of the playing field for our nation's students in poverty, as it could indicate increased access to technology. However, a September 2019 article by Perry and Lee references an overreliance on artificial intelligence to educate our low-income and minority students with technology when certified teachers are not available. They point out that in areas where it is increasingly more challenging to hire qualified teachers:

> The spread of AI technology can also tempt districts to replace human teachers with software, as is already happening in such places as the Mississippi Delta. Faced with a teaching shortage, districts there have turned to online platforms.

> But students have struggled without trained human teachers who not only know the subject matter but know and care about the students. (p. 3)

The significant increase in enrollment of students in technology-based distance education courses in high- and medium-poverty schools may be related to the challenge of hiring qualified teachers in those schools. More research is needed on this topic.

The 2019 research by Molnar, et al. found that virtual schools "enrolled substantially fewer" (page 23) low-income students when compared with national enrollment public schools. This may be due to limited access to technology. However, many virtual schools often loan computers and pay for internet access (2019). The same research found that enrollment of low-income students in blended schools was in line with the national average (page 8). Mislevy, et al.'s 2020 study on virtual and in-person learning in Virginia found that students enrolled in fully online learning were "less likely than their face-to-face course peers to be economically disadvantaged" (p. 8).

Students with special needs. Miron and Urschel's 2012 study found that enrollment of special education students was 3.7% lower than the U.S. national average, as 9.4% of students enrolled with K12 were classified as special education compared to 13.1% nationally (pp. 12-13). For a student to be classified as special education, the student had a diagnosed disability and an Individualized Education Plan (IEP) on record (p. 12). However, at that time, the authors pointed out that K12 has been serving increasingly more students with disabilities, but that "it spends less than half as much per pupil as charter schools on special education instruction and a third of what districts spend on special education instruction" (Miron & Urschel, 2012, p. iv). The study also reports that past research found that charter schools generally have a larger

proportion of students with mild disabilities while public districts tend to have more students enrolled with moderate or severe disabilities (2012).

Lueken, Ritter and Beck's study of SVA found that schools enrolled a higher proportion of students with special needs than the average for the state in which that school operated. Students with special needs made up 9.4% of the state's student body. Meanwhile, 14.4% of SVA's population had special needs (2015).

Two 2016 studies by Fernandez, Ferdig, Thompson, Schottke, and Black found that 24.6% of respondents in four virtual schools indicated that their students had special needs or health concerns (2016). This may be higher than the data reported in Miron and Urschel's study because their data included only students with a diagnosed disability and IEP while Fernandez, et al.'s study also included students identified by parents as having health care needs (2016, p. 70).

In a national study of virtual and blended schools, of schools with special education data available, virtual schools enrolled slightly more special education students compared to the national average and blended schools enrolled proportionally fewer students than the national average (Molnar, et al., 2019).

English learners. Miron and Urschel's work analyzing K12 Inc. found that their schools were made up of 0.3% of English Language Learners (ELL) while the states that K12 served had 13.8% of students classified as ELL (Miron & Urschel, 2012). SVA did not enroll any English language learners, yet 6.9% of the state's students identified as belonging to that subgroup (Lueken, Ritter & Beck, 2015). This was similar to data for virtual schools nationally. Of all virtual schools operating in the US, ELL students made up 0.9% of fully-virtual learners, and 5.8% of learners participating in blended schools. Meanwhile, 9.6% of the nation's students identified as ELL (Molnar, et al., 2019). Mislevy, et al.'s 2020 study on virtual and in-person

learning in Virginia found that students enrolled in online learning were less likely to be English learner students than their counterparts who attended school in face-to-face settings (2020).

Gender. Fernandez, et al. conducted a study of students with health needs enrolled in virtual learning. Their study found that of the 5,855 participants surveyed, 57.9% reported having a female student enrolled in virtual school (2016).

Achievement

Overall achievement data. There is some evidence that suggests online schools are improving with their age. The study of SVA, a cyber-school in the southern United States, found that in 2010, students' scores on criterion-referenced tests were 0.14 and 0.15 standard deviations lower in literacy and mathematics growth, respectively, than students who did not attend SVA. However, "these gaps shrunk and became statistically indistinguishable for mathematics in 2011 and 2012 and literacy in 2011. In 2012, the coefficient on literacy became positive and statistically significant" (Lueken, Ritter & Beck, 2015, p. 318). Their research also indicated that not only did students catch up with their counterparts in the state by the end of their second year of enrollment but that the school's overall student performance improved by the end of a three-year period.

A 2012 dissertation written by Carnahan, studied 97 seventh grade students engaged in both virtual learning and traditional in-person methods. The instructional design, delivery process, and instructor were nearly identical in both the virtual and traditional environments, so the study was effective in examining the role of the virtual environment (2012). The topic selected for the virtual learning experience was one that had presented challenges for learners in the past (2012). This study found that there was no significant difference in student achievement between virtual and traditional lessons (2012).

A 2016 study of 495 middle school students by Pace and Mellard found that online completion/pass rates are lower for students enrolled in online learning. In 2013-14, 57% of online enrollments were designated as “completed/passed,” which was a 3% decrease from the previous year. Meanwhile, the same students had completed/passed rates of 71% in their in-person courses. Pace and Mallard also found a statistically significant drop in MAP reading percentile rank between assessments administered in January and May for students enrolled in blended learning programs (2016).

The research by Stratton, Chitiyo, Mathende and Davis (2019) found no significant differences in achievement between traditional learning and blended learning. A flipped classroom model was used in their research. They concluded that "flipped instruction is at least as effective as face-to-face instruction" (page 138). That study included a sample size of 154 students, 81 of whom participated in face-to-face instruction while 73 received a blended approach.

Molnar, et al.’s research focused on 18,501 fully-virtual and 300 blended public elementary and secondary schools in the US (2019). The study found that virtual and blended schools continued to demonstrate low performance, although “the proportion of schools with acceptable ratings was higher than reported in the previous year” (p. 9). That supports the assertion that virtual schools may be improving over time. Of virtual schools, 48.5% received acceptable ratings, while 44.6% of blended schools received acceptable ratings. This is an increase over early national data reported in the same research when in 2012, 27% of virtual schools met adequate yearly progress. Meanwhile, about 54% of brick-and-mortar schools did meet adequate yearly progress (Molnar, et al, 2019). The same report found that of schools reporting data, virtual and blended schools fell short of the national on-time graduation average.

Virtual schools had an on-time graduation rate of 50.1% while that of blended schools was 61.5%. Meanwhile, the national public-school average on-time graduation rate was 84%.

A study of 3,800 students enrolled in virtual learning and 1.14 million students enrolled in face-to-face learning in Virginia found students who were enrolled in virtual schools in their 8th-grade year scored higher on average in English Language Arts and Science Standards of Learning (SOL) exams. They scored lower on average on their mathematics SOL exams than their peers who attended face-to-face schools (Mislevy, et al., 2020). The students enrolled in virtual learning also took lower-level mathematics courses than their peers who attended school in-person (Mislevy, et al., 2020). Other than in language arts, students enrolled in virtual learning were less likely to earn a proficient score on end-of-course SOL exams (Mislevy, et al., 2020).

Race/ethnicity. In 2016, Fernandez, et al., completed two research studies to address three goals: to establish a baseline understanding of the epidemiology of K-12 students enrolled in virtual schools, to determine the scope of enrollment of students of certain demographics, and how those students performed in virtual learning compared to their previous experiences in brick-and-mortar schools (2016). The first study, which focused on three state-led virtual schools, found that African-American students scored significantly lower in their virtual classes than their peers did and also scored significantly lower in their classes in virtual school than in their classes in brick-and-mortar schools (2016). However, in the second study, which focused on one large state-led virtual school, this difference did not appear (2016).

Poverty level. Seage and Turgeon's 2020 study of the effects of blended learning on Science, Technology, Engineering, and Mathematics (STEM) achievement of elementary school students provided 129 third, fourth, and fifth graders with eight weeks of face-to-face instruction as well as independent online learning. Data collected from classroom assessments in the ninth

week indicated that “students from low socioeconomic backgrounds tend to achieve higher STEM scores when placed in a blended learning environment” (p.139).

Gender. Carnahan’s 2012 dissertation found that there was no significant difference in student achievement by gender (2012). The two studies in 2016 by Fernandez, et al. also addressed gender. The first study found that boys scored significantly lower in their virtual classes than their peers did (2016). However, in the second study, this difference did not appear (Fernandez, et al., 2016).

Students with special needs. The research on achievement levels of students with disabilities in online instruction was mixed. Lueken, Ritter, and Beck’s study of SVA, found that students with disabilities who were enrolled in that online school may have made greater achievement gains than their counterparts statewide, particularly in literacy (2015). In an interview of five administrators of blended learning programs by Franklin, Rice, East, and Mellard, survey data indicated that students with disabilities enrolled in those programs were outperforming their peers without disabilities in terms of academic growth (2015).

However, data from one study does not support that students with disabilities in virtual learning outperform their peers. For example, a larger 2015 study of fully online learning in charter schools in 18 states by Woodworth, Raymond, Chirbas, Gonzales, Negassi, Snow, and Van Donge, concluded that students with disabilities who were enrolled in fully online schools had weaker outcomes compared with those in traditional schools.

In Pace and Mellard’s study of online learning programs, scores of female students in the special education programs remained level, a better outcome than both males and females enrolled in general education classes, whose scores declined. Meanwhile, scores for male students in the special education programs declined, but not significantly (2016).

The two studies of virtual schools in 2016 by Fernandez, et al. also analyzed the performance of students with health needs. The first study found that students with health needs scored significantly lower in their virtual classes than their peers did and also scored significantly lower in their classes in virtual school than they did in their traditional classes. However, in the second study, this difference was not present in the results (Fernandez, et al., 2016).

School size. Waddell's 2017 study of the relationship between school size and student achievement studied four virtual schools operating in Texas (2017). Student achievement was defined as achieving a minimum score on that state's assessment, the State of Texas Assessment of Academic Readiness (STAAR) in the areas of English language arts/reading in Grades 5 and 8, mathematics in Grades 5 and 8, English I, English II, and Algebra I (2017). The study found that the small virtual schools significantly outperformed the large virtual schools. Students in the small schools performed better than students in large schools in all testing categories (Waddell, 2017).

Results from Fernandez, et al. 2016 studies do not align with Waddell's research when three specific subgroups are considered. The first of Fernandez, et al.'s two studies analyzed data from 1,971 respondents from three virtual schools. Their second study analyzed data from 3,884 participants in one large virtual school. In the study of the smaller schools, "boys, African-American students, and students with health needs scored significantly lower in their virtual courses than other students. Additionally, African-American children and students with special health care needs scored significantly lower in virtual school classes than their traditional classes" (p. 72). However, those findings did not appear in their study of the large virtual school (Fernandez, et al., 2016).

Teacher-student ratio. Miron and Urschel's 2012 analysis of K12 Inc. found that K12 had "three times as many students per teacher compared to traditional or charter brick-and-mortar schools." (p. 39). The average is 61.4 students per full-time equivalent teacher. Similarly, Molnar, et al.'s research in 2019 found that virtual schools have 2.7 times as many students per teacher as the nation's public schools and blended schools have about double. On average, fully virtual schools have 44 students per teacher, while blended schools have 34 students per teacher and traditional public schools have about 16 students per teacher (2012).

One study of the relationship between class size and student grades in an online self-paced high school found that when all subjects were considered, learning outcomes increased as class size increased until class size reached 45. After that point, increasing class size had a negative effect. However, the optimal class size was different in each content area. In English classes, there was no impact of class size on student grades. Foreign language classes benefitted most from smaller class sizes. In those classes, the achievement was highest when the class size was 15. As class sizes increased in foreign language classes, student achievement decreased. In other content areas, student rosters could reach more than double that number before achievement declined. In science classes, student grades statistically significantly decreased in class sizes of greater than 35. In mathematics, class sizes increased to 38 before a decrease in achievement was observed. In social science classes, achievement decreased when class sizes reached 42 (Lin, Kwon, & Zhang, 2019).

Benefits of Online Learning

Improved communication and participation may be one benefit of online learning. According to Carnahan's 2012 work, students were better able "to communicate with their instructor as in a classroom only one student may participate with the instructor at a given point.

Online chat messages allowed more students to engage the teacher and respond at a given time" (p. 73). This work also found that students began to form competitions, and think of the work as a game, even though much of the online learning was presented in a lecture format with information disseminated in slideshow presentations. It is also important to note that the teachers and researchers did not use the term "game" during the course of the research. However, although students reported higher interest in virtual learning, this did not translate to higher achievement. This study also found that incidental learning, or learning other than what was in the teacher's plan occurred. Students enjoyed communicating virtually with their peers and learning from their examples. They also experienced less risk of embarrassment when answering a question incorrectly (2012).

There is one other potential benefit of virtual learning. For districts struggling to hire qualified teachers, there are online programs which utilize certified teacher to deliver instruction. One example of such a program is called Edgenuity. "Using a program like Edgenuity can help districts avoid being put on probation or risk a state takeover when teacher numbers sink" (Davis & Wright, 2018, p. 3). However, concerns related to the use of online learning in this way are addressed below.

Concerns About Online Learning

One rising concern about online learning is the overutilization of that tool in underserved schools in the United States instead of employing qualified teaching staff. According to an article in *The Hechinger Report* by Davis and Wright (2019), districts like West Bolivar Consolidated in Mississippi's Delta region are facing significant teacher shortages and are reliant upon an online learning platform called Edgenuity to meet students' needs. In that district, 22% of teachers were not certified, and at West Bolivar High School, only four teachers were

certified. The school used Edgenuity to deliver instruction to students. When brick-and-mortar schools like those in West Bolivar rely on an online platform during the regular school day, the schools often provide facilitators to manage the classroom environment. At West Bolivar High School, an effort is made to hire staff who have at least 18 hours of college credit in the subject being taught, but sometimes that is not possible. This means the individual overseeing the classroom is not always able to answer questions, and as Davis and Wright explained, Lucas Rapisarda, the Director of Operations of Rosedale Freedom Project reported that there is not always clear guidance on how to complete assignments (Davis & Wright, 2018). Rapisarda also shared an anecdote about a student, telling *The Hechinger Report* staff "he told me that his grade in Edgenuity was perfect because he was cheating the whole time." (*The Hechinger Report*, 2019, p. 4).

Another concern about online learning is that legislators and policymakers have consistently failed to pass bills or create regulations to provide added oversight and accountability to online and blended schools (Molnar, et al., 2019). Where oversight does exist in virtual schools, it can be bureaucratic imposition of non-essential requirements that can distract schools from educating students (Lin, 2011). Worse still, attempts at oversight can be "less telling" because teachers are not in the same building at the same time as the students (Lin, 2011, p. 2).

A 2014 study of virtual charter schools by Hasler-Waters, et al. states:

> Results from empirical studies, state audits, investigative reports, and dissertations have presented concerning evidence that these schools are still troubled by (a) lack of oversight/accountability, (b) improper use of public funds, (c) failing grades, and (d) dropout rates that are higher than their traditional school counterparts. (p.383)

While there are positive outcomes of online learning, the financial cost may exceed the benefits. Carnahan's 2012 research, found an increased interest in learning when an online platform is used, but found similar academic outcomes to those in in-person learning, and stated that "the cost of the software and time and effort for teachers and staff would likely be higher than the gain in student motivation and achievement" (p. 80). However, 2019 findings by Molnar, et al. indicated that online learning could reduce costs.

Summary

Virtual learning options have increased significantly since their first appearance in the mid-1980s. The rise in online schools was most rapid between 2015 and 2017. While the number of online schools may be leveling off, the number of students enrolling in these schools continues to increase.

The existing body of research indicates that White students are overrepresented in virtual schools. Meanwhile, Black and Hispanic students are underrepresented. Asian and Native American students are enrolled in virtual schools at about the same rate as brick-and-mortar schools. English language learners are enrolled disproportionally less than in traditional in-person schools. Low-income students are also underrepresented in fully-virtual schools, but enrollment in online learning programs increased more rapidly for students in high- and medium-poverty schools during some years. Some research indicates the proportion of low-income students enrolled in blended schools is in line with the national average.

A large, nationwide study of fully-virtual and blended schools identified that virtual schools enrolled more special education students than the national average, and blended schools enrolled proportionally fewer (Molnar, et al., 2019). Other studies had mixed results. However, this may be the result of the lack of common terminology.

Currently, there is no clear connection between achievement and enrollment in virtual learning programs. While one large study in 2019 found that a smaller proportion of online schools had acceptable overall performance ratings than in-person schools, (Molnar, et al., 2019) other studies had more favorable results for virtual schools, but subgroups were not represented similarly to in-person schooling options, or the studies were small. Although two small studies found no significant difference between fully-virtual learning and in-person learning (Carnahan, 2012) and blended learning and in-person learning (Stratton, Chitiyo, Mathende & Davis, 2019), other studies found improved subgroup achievement in virtual schools. It is worth noting that two studies, one large and one small, both found students had better achievement in Science (Mislevy, et al., 2020) and STEM (Franklin, et al., 2015) when engaged in virtual learning options. More research is needed in that area.

Evidence suggests that class size can impact student outcomes in online learning, with ideal class sizes in most content areas between 35 and 42 -- the exception being foreign language classes, in which the optimal class size is 15, and English, in which class size did not impact outcomes (Lin, Kwon, & Zhang, 2019). However, on average, fully-virtual schools have class sizes of 44 (Molnar, et al., 2019).

Research on the impact of school size on achievement is less conclusive. One study of found that smaller schools outperformed their larger counterparts (Waddell, 2017). In a study of three virtual schools, there were subgroups in the smaller school with lower achievement than peers in their virtual schools and subgroups with lower achievement in virtual schools compared with than when they attended school in-person. The larger school did not have achievement gaps for those subgroups (Fernandez, et al., 2016).

Chapter 3

Methods

The focus of this study was to examine if participation in virtual leaning may have an effect on the reading and mathematics achievement of students in a high poverty urban middle school between the 2019-20 school year and 2020-21 school year. This chapter presents the research design, selection of participants, measurement, data collection procedures, data analysis, hypothesis testing, and limitations of study.

Research Design

A quantitative quasi-experimental design guided this study. A quasi-experimental design involves two test groups – an experimental group that receives a treatment, and a control group that does not (Lunenberg & Irby, 2008). A quasi-experimental design was most appropriate for this study because the study included administration of a posttest to two comparison groups: Sixth through eighth grade students who participated a traditional model of in-person learning, and sixth through eighth grade students who participated in virtual learning. In this study, the independent variable was learning format (i.e., in-person learning and virtual learning). The dependent variables were students' ELA score, mathematics score, reading growth, and mathematics growth.

Selection of Participants

The population of the study was sixth-, seventh-, and eighth-grade students at a public charter school in an urban setting. According to Lunenburg and Irby (2008), purposive sampling is sample selection based on the researcher's experience or knowledge of the group to be sampled and the objectives of the study. Purposive sampling was used to select participants. Two groups of students were selected. One group was the sixth-, seventh-, and eighth-grade

students who attended the Charter School H Middle School and participated in in-person learning during the 2019-2020 school year, and the other group was sixth-, seventh- and eighth-grade students from the same school who participated in virtual learning during the 2020-2021 year. The total sample size for this study was approximately 430 students in an urban Midwestern middle school. The participants were chosen because they attended Charter School H middle school and participated in either in-person learning during the 2019-20 school year or fully virtual learnings during the 2020-21 school year.

Measurement

English language arts (ELA) score. The ELA score was measured by the Catapult Evaluate ELA assessment. The score is a measure of the percent of questions a student answered correctly. The assessment consists of approximately 30 multiple choice and technology-enhanced questions aligned with Missouri Learning Standards. Technology-enhanced questions require students to interact with a question differently than a traditional multiple-choice question would. Students may select a sentence in the text, or select multiple check-boxes to answer a question. For example, a technology-enhanced question reads "imagine you are having a class discussion based on this passage. One of your classmates makes the claim that owls display such variety, there is sure to be one you can admire. Which sentence from the passage below BEST supports this claim?" Below it, a five-sentence paragraph is displayed. "*There are more than 100 different species of owls, ranging vastly in size and shape. Most owls are brown or gray and they often are streaked or spotted. This coloring, called camouflage, helps them to blend into their environment. One owl, the snowy owl, is almost pure white. Some of the largest owls may measure almost five feet from wingtip to wingtip, while the smallest owls have wingspans the size of a small robin*." To select the correct answer, a student will click on the sentence in the context

of the paragraph. Catapult Evaluate ELA is a predictive assessment that assesses all Missouri Learning Standards (MLS) over four assessment cycles. Catapult Evaluate ELA percent correct scores are calculated by the assessment software and longitudinal data is automatically stored for all students upon completion of the assessments. Scores can range from zero to 100. A range of scores corresponds to a performance level: Advanced, Proficient, Basic or Below Basic. The ranges for performance levels vary by grade level and month. One example of such a range is shown in Table 1. Catapult Evaluate ELA is an appropriate instrument for this population and setting because it was specifically designed to assess learning of Missouri Learning Standards at each specific grade level.

Table 1

Grade 6 Evaluate Performance Level Score Ranges

	Advanced	Proficient	Basic	Below Basic
ELA	110-80%	79-64%	63-34%	33-0%
Mathematics	100-67%	66-54%	53-28%	27-0%

The reliability and validity information of Catapult Evaluate ELA assessment was not available. However, Catapult Learning used student-level data from Missouri Assessment Program (MAP), to assess the validity of Evaluate scores. According to an update provided by Catapult Learning, the company reset the estimated achievement level thresholds based on the results of the validity assessment. Those thresholds are shown above in Table 1 (Catapult, 2019).

Mathematics score. The mathematics score was measured by the Catapult Evaluate Mathematics assessment. The score is a measure of the percent of questions a student answered

correctly. The assessment consists of approximately 30 multiple choice and short-answer questions aligned with Missouri Learning Standards. Catapult Evaluate Mathematics is a predictive assessment that assesses all Missouri Learning Standards (MLS) over four assessment cycles. Catapult Evaluate Mathematics percent correct scores are calculated by the assessment software and longitudinal data is automatically stored for all students upon completion of the assessments. Scores can range from zero to 100. A range of scores corresponds to a performance level: Advanced, Proficient, Basic or Below Basic. The ranges for performance levels vary by grade level and month. One example of such a range is shown in Table 1. Catapult Evaluate Mathematics is an appropriate instrument for this population and setting because it was specifically designed to assess learning of Missouri Learning Standards at each specific grade level.

The reliability and validity information of Catapult Evaluate Mathematics assessment was not available. However, Catapult Learning used student-level data from Missouri Assessment Program (MAP), to assess the validity of Evaluate scores. According to an update provided by Catapult Learning, the company reset the estimated achievement level thresholds based on the results of the validity assessment. Those thresholds are shown above in Table 1 (Catapult, 2019)

Reading growth. The reading growth was measured by STAR Reading by Renaissance Learning. STAR Reading assesses the Grade Equivalency (GE) reading level of students between Kindergarten and Grade 12 based on national reading standards for each of those grades. STAR Reading is an adaptive assessment. The difficulty level of the questions increases as a student answers questions correctly, and decreases as the student answers questions incorrectly. Students read passages and select a word from a multiple-choice list to fill in a blank

in the passage. Scores are reported as GE, which is two numbers separated by a decimal point. The first number represents the year of the student's grade level equivalence and the second number represents the month of that year. For example, a student who achieves a score of 7.3 on STAR Reading has a grade equivalence of seventh grade, third month. The reading growth indicates the difference between the Winter STAR Reading GE score and the Fall STAR Reading GE score. STAR Reading growth is calculated by the assessment software and longitudinal data is automatically stored for all students upon completion of the assessments. The overall reliability for the STAR Reading assessment is 0.97, and the average validity when correlated with state accountability tests is 0.73 (Renaissance, 2021).

Mathematics growth. The mathematics growth was measured by STAR Math by Renaissance Learning. STAR Math assesses the Grade Equivalency (GE) mathematics level of students between Kindergarten and Grade 12 based on national mathematics standards for each of those grades. STAR Math is an adaptive assessment. The difficulty level of the questions increases as a student answers questions correctly, and decreases as the student answers questions incorrectly. Students are presented with math problems and select an answer from a multiple-choice list. Scores are reported as GE, which is two numbers separated by a decimal point. The first number represents the year of the student's grade level equivalence and the second number represents the month of that year. For example, a student who achieves a score of 7.3 on STAR Math has a grade equivalence of seventh grade, third month. The mathematics growth indicates the difference between the Winter STAR Math GE score and the Fall STAR Math GE score. STAR mathematics growth is calculated by the assessment software and longitudinal data is automatically stored for all students upon completion of the assessments. The overall reliability for the STAR Math assessment is 0.97, and the average validity when

correlated other mathematics assessments is 0.75, and the average validity when correlated with Multi-State Consortium tests is 0.89 (Renaissance, 2021).

Data Collection Procedures

The researcher requested permission from the superintendent of Charter School H to conduct the research study. The researcher received written permission to conduct the study. Refer to Appendix A for the letter of approval to conduct the study. Permission to conduct the study was also granted from Baker University's Institutional Review Board (Appendix B).

All data were extracted by the researcher from the software programs. ELA and mathematics scores were extracted from Catapult Evaluate database, and STAR Reading and Math growth scores were extracted from the Renaissance Learning database. The data received were organized in Excel spread sheets by year, student grade level, and content area (reading or mathematics) which included student name and assessment scores. Enrollment data from the studied school years was extracted from enrollment reports from the PowerSchool student information system, and cross-referencing students' names with those on Catapult Evaluate and STAR reports. Students not in attendance for the entire research period of a school year was eliminated from the Excel worksheet before the data were analyzed. To maintain student anonymity, their names were removed before data were entered into the SPSS software for analysis.

Data Analysis and Hypothesis Testing

The data analysis and hypothesis testing consist of each research question, hypothesis and analysis.

RQ1. Is there a difference in ELA scores for low-income, urban students between in-person learning and virtual learning?

H1. There is a statistically significant difference in ELA scores for low-income, urban students between in-person learning and virtual learning.

An independent-samples *t* test was conducted to address RQ1. The two sample means were compared. An independent-samples *t* test was chosen for the hypothesis testing since it examines the mean difference of ELA scores between middle school students who participated in in-person learning and those who participated in virtual learning. The level of significance was set at .05. When appropriate, an effect size is reported.

RQ2. Is there a difference in mathematics scores for low-income, urban students between in-person learning and virtual learning?

H2. There is a statistically significant difference in mathematics scores for low-income, urban students between in-person learning and virtual learning.

An independent-samples *t* test was conducted to address RQ2. The two sample means were compared. An independent-samples *t* test was chosen for the hypothesis testing since it examines the mean difference of mathematics scores between middle school students who participated in in-person learning and those who participated in virtual learning. The level of significance was set at .05. When appropriate, an effect size is reported.

RQ3. Is there a difference in reading growth for low-income, urban students between in-person learning and virtual learning?

H3. There is a statistically significant difference in reading growth for low-income, urban students between in-person learning and virtual learning.

An independent-samples *t* test was conducted to address RQ3. The two sample means were compared. An independent-samples *t* test was chosen for the hypothesis testing since it examines the mean difference of reading growth between middle school students who

participated in in-person learning and those who participated in virtual learning. The level of significance was set at .05. When appropriate, an effect size is reported.

RQ4. Is there a difference in mathematics growth for low-income, urban students between in-person learning and virtual learning?

H4. There is a statistically significant difference in mathematics growth for low-income, urban students between in-person learning and virtual learning.

An independent-samples *t* test was conducted to address RQ4. The two sample means were compared. An independent-samples *t* test was chosen for the hypothesis testing since it examines the mean difference of mathematics growth between middle school students who participated in in-person learning and those who participated in virtual learning. The level of significance was set at .05. When appropriate, an effect size is reported.

Limitations

Lunenburg and Irby (2008) defined limitations as "factors that may have an effect on the interpretation of the findings or on the generalizability of the results" (p. 133). The researcher does not control the limitations. Limitations associated with the current research follow:

1. This study was conducted using data from one urban Missouri middle school, grades six through eight. This study's results cannot be generalized to elementary or high school settings or middle schools in other settings.
2. This study was conducted during building closure due to the Covid-19 pandemic. Results cannot be generalized to all virtual school experiences.
3. Laptop computers were provided for all students who did not have their own. Results cannot be generalized to virtual school experiences that do not provide devices.

Summary

This quantitative quasi-experimental study examined if a difference exists in student achievement scores between in-person learning and virtual learning for low-income, urban middle school students. Student achievement scores used for comparison included ELA scores, mathematics scores, reading growth, and mathematics growth. Chapter 4 contains the descriptive statistics, hypothesis testing, and related results.

Chapter 4

Results

The purpose of this study was to examine if participation in virtual leaning may have an effect on the reading and mathematics achievement of students in a high-poverty urban middle school between the 2019-20 school year and 2020-21 school year. Reading and mathematics scores from the 2020-21 school year were compared to baseline scores from the 2019-20 school year to establish whether student achievement in the areas of reading and mathematics differed from in-person learning to virtual learning. This chapter provides an analysis and discussion of the results of the study.

Descriptive Statistics

Descriptive analyses were conducted, and charts were constructed using data from participants from a middle school in an urban Midwestern city. Demographic data for the participants are shown in Figure 3 below.

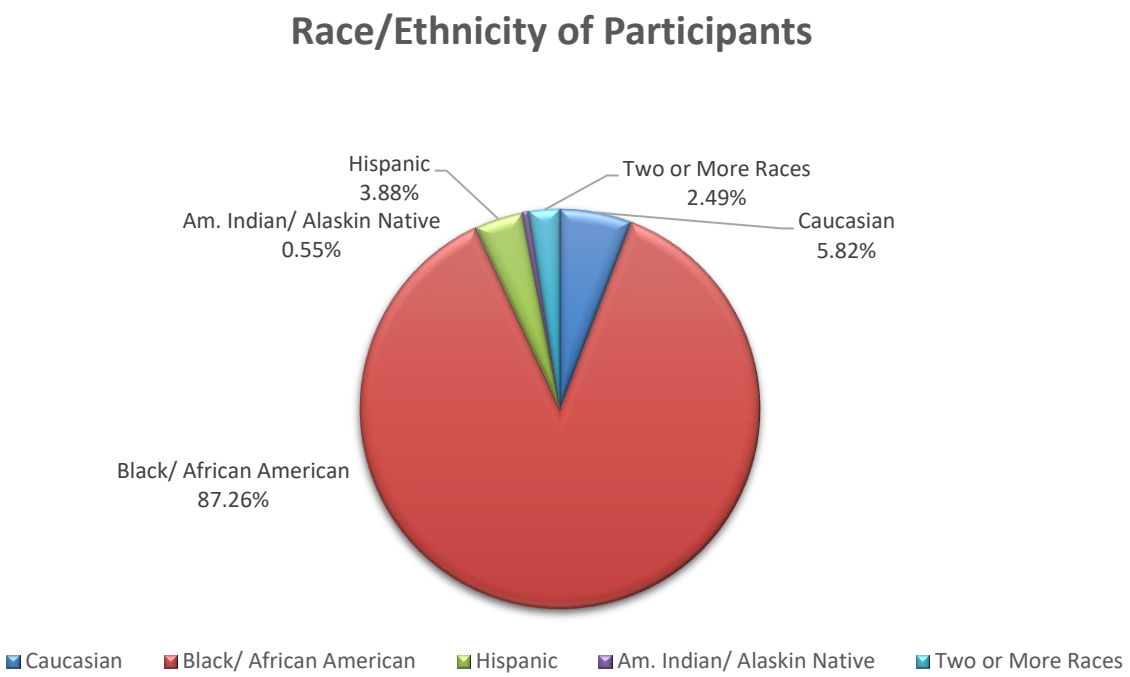

Figure 3: Race/Ethnicity of Participants

Four assessments were administered to participants. As seen in Table 2 below, student participation for each assessment is shown. Figure 4 and Figure 5 show the breakdown of grade levels for students who participated in the assessments.

Table 2

Number of Participants for Each Assessment Type

	In-person	Virtual
Evaluate ELA	292	146
Evaluate Mathematics	277	127
STAR Reading	274	130
STAR Math	251	121

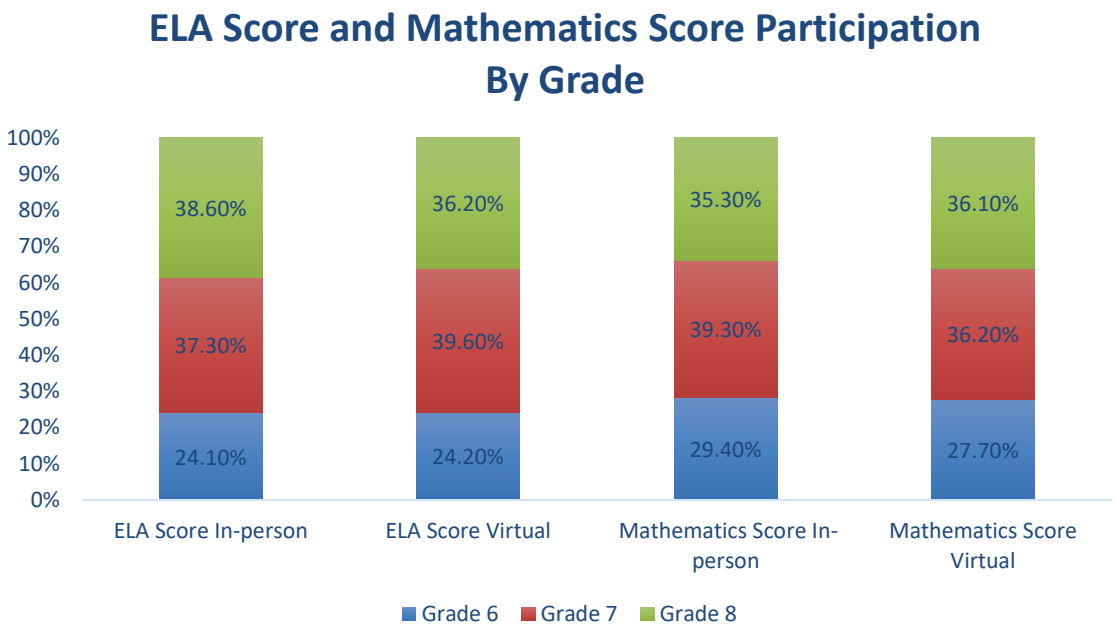

Figure 4: ELA Score and Mathematics Score Participation by Grade

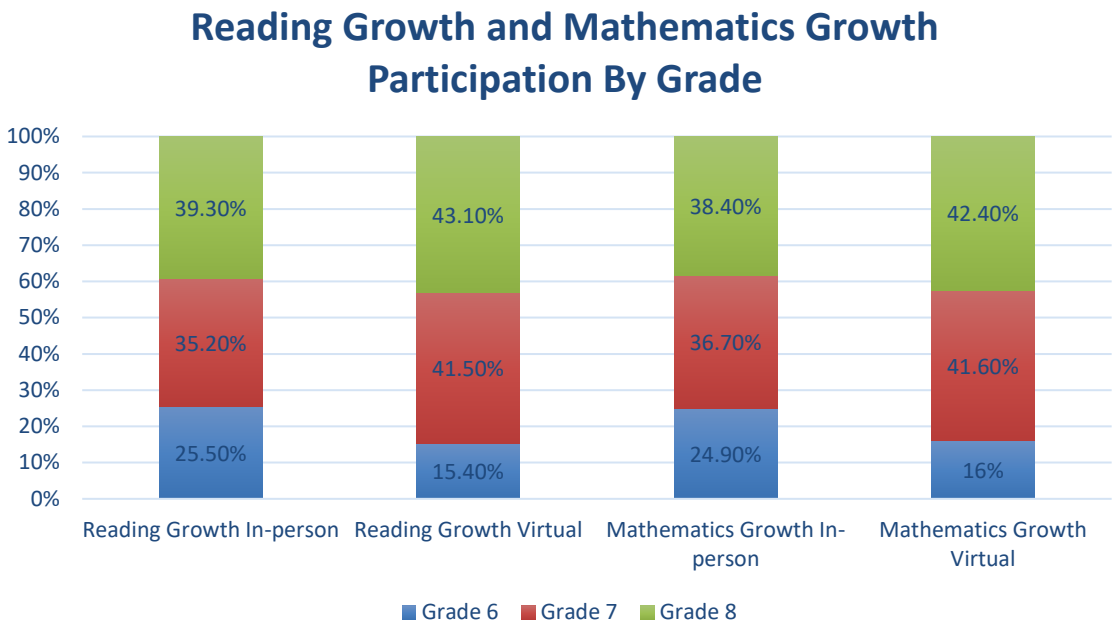

Figure 5: Reading Growth and Mathematics Growth Participation by Grade

Hypothesis Testing

Four research questions were addressed. The results of those analyses are presented below.

RQ1. Is there a difference in ELA scores for low-income, urban students between in-person learning and virtual learning?

H1. There is a statistically significant difference in ELA scores for low-income, urban students between in-person learning and virtual learning.

Outliers were detected and zero outliers were found. The results of the independent samples *t*-test indicated a statistically significant difference between the two means, $t(436) = 4.05$, $p < .001$, $d = 0.39$. The mean ELA score for in-person learning ($M = 46.64$, $SD = 20.07$, $n = 292$) was higher than the mean ELA score for virtual learning ($M = 38.39$, $SD = 20.23$, $n = 146$). The null hypothesis was rejected. The effect size indicated a small to medium effect.

RQ2. Is there a difference in mathematics scores for low-income, urban students between in-person learning and virtual learning?

H2. There is a statistically significant difference in mathematic scores for low-income, urban students between in-person learning and virtual learning.

Outliers were detected and ten outliers were found. The outliers were excluded from the following analysis. The results of the independent samples *t*-test indicated there was not a statistically significant difference between the two means, $t(392) = 1.86$, $p = .064$. The mean mathematics score for in-person learning ($M = 18.61$, $SD = 10.52$, $n = 272$) not significantly different than the mean mathematics score for virtual learning ($M = 16.51$, $SD = 10.07$, $n = 122$). I failed to reject the null hypothesis.

RQ3. Is there a difference in reading growth for low-income, urban students between in-person learning and virtual learning?

H3. There is a statistically significant difference in reading growth for low-income, urban students between in-person learning and virtual learning.

Outliers were detected and 31 outliers were found. The outliers were excluded from the following analysis. The results of the independent samples *t*-test indicated there was a statistically significant difference between the two means, $t(371) = 3.40$, $p = .001$, $d = 0.35$. The mean reading growth for in-person learning ($M = 0.28$, $SD = 0.95$, $n = 261$) was higher than the mean reading growth for virtual learning ($M = -0.10$, $SD = 1.07$, $n = 112$). The null hypothesis was rejected. The effect size indicated small to medium effect.

RQ4. Is there a difference in mathematics growth for low-income, urban students between in-person learning and virtual learning?

H4. There is a statistically significant difference in mathematics growth for low-income, urban students between in-person learning and virtual learning.

Outliers were detected and 35 outliers were found. The outliers were excluded from the following analysis. The results of the independent samples *t*-test indicated a statistically significant difference between the two means, $t(335) = 3.47$, $p = .001$, $d = 0.38$. The mean mathematics growth for in-person learning ($M = 0.38$, $SD = 1.06$, $n = 238$) was higher than the mean mathematics growth for virtual learning ($M = -0.07$, $SD = 1.13$, $n = 99$). The null hypothesis was rejected. The effect size indicated a small to medium effect.

Summary

This chapter presented the results of the hypothesis tests conducted to test the hypotheses specified for this study. The data compiled in this quantitative study support that there is a difference in student achievement in a low-income, urban middle school between in-person and virtual learning. ELA scores for the in-person learning group were generally higher than scores for the virtual learning group. Reading growth and mathematics growth were also higher for the in-person learning group than the virtual learning group. A small-to-medium effect was found on ELA scores, reading growth, and mathematics growth. However, there was not a significant difference in mathematics scores between the in-person learning group and the virtual learning group. Chapter five provides an overview of the problem, purpose statement, research questions, major findings, and findings related to the literature. Chapter 5 concludes with implications for action, recommendations for future research, and closing remarks.

Chapter 5

Interpretation and Recommendations

Study Summary

The quantitative study compared ELA and mathematics scores, and reading and mathematics growth for sixth-, seventh-, and eighth-grade students in a low-income, urban Midwestern middle school. This study explores whether there was a difference in student achievement between in-person and virtual learning. The findings seek to bring greater insight to the outcomes of both learning methods.

Overview of the problem. Due to the Coronavirus (COVID-19) pandemic, schools across the United States began closing their buildings in March of 2020. Schools continued to provide learning in various ways, meaning an abrupt change of setting and learning structure for students, families, and educators (Farlazzo, 2020). There is evidence indicating that students who experience poverty face more significant challenges than their suburban counterparts (Kincheloe & Hayes, 2007). This may make virtual learning a greater challenge, thus impacting student achievement. If students who experience poverty already face greater challenges impacting their learning (Jansen, 2009), the additional challenges of virtual learning (Fleming, Ford, & King, 2020) could further negatively impact their academic achievement. However, students who experience poverty are underrepresented in virtual schools (Molnar, et al., 2019), and little research exists that studied the experience of a single group of urban students who participated in both in-person and virtual learning.

Purpose statement and research questions. The purpose of this study was to examine the effect of virtual leaning on the reading and mathematics achievement of students in a high-poverty urban middle school between the 2019-20 school year and 2020-21 school year. ELA

and mathematics scores from January 2021 were compared to baseline scores from January 2020. Reading and mathematics growth from September 2019 to January 2020 were compared to baseline reading and mathematics growth from September 2020 to January 2021. These comparisons were made to examine whether or not student achievement in the areas of reading and mathematics changed from in-person learning to virtual learning.

RQ1. Is there a difference in ELA scores for low-income, urban students between in-person learning and virtual learning?

RQ2. Is there a difference in mathematics scores for low-income, urban students between in-person learning and virtual learning?

RQ3. Is there a difference in reading growth for low-income, urban students between in-person learning and virtual learning?

RQ4. Is there a difference in mathematics growth for low-income, urban students between in-person learning and virtual learning?

Review of the methodology. The quantitative study addressed the difference in student reading and mathematics achievement between in-person and virtual learning. A quasi-experimental quantitative design was used. ELA and mathematics scores using Catapult Evaluate and reading and mathematics growth scores using STAR were collected for the 2019-20 and 2020-21 school years. The means of ELA and mathematics scores and the means of reading and mathematics growth were compared using independent t-tests. The preliminary hypothesis was that there would be a statistically significant difference in scores between in-person and virtual learning.

Major findings. The data analysis found that a difference of means occurred when comparing the ELA scores, mathematics scores, reading growth, and mathematics growth

between in-person and virtual learning. Mean scores and growth during virtual learning were lower than mean scores and growth during in-person learning. For achievement scores as measured by Catapult Evaluate assessments, mean scores for virtual learning were lower than for in-person learning. There was a statistically significant difference in ELA scores and the effect size was small-to-medium. The difference in mean scores was not statistically significant for mathematics. As shown in Figure 6 and Table 3, average ELA scores for in-person and virtual learning fell into the Basic range and average math scores for in-person and virtual learning fell into the Below Basic range.

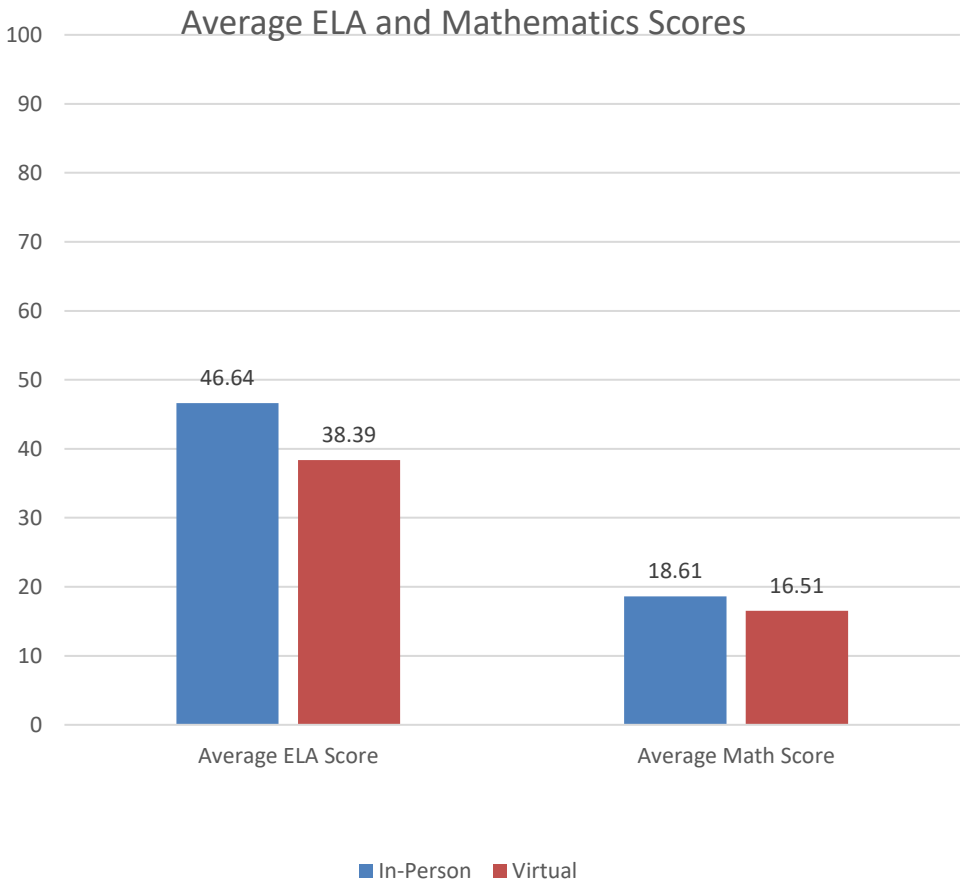

Figure 6: Average ELA and Mathematics Scores

Table 3

Grade 6-8 Evaluate Performance Level Score Ranges

	Advanced	Proficient	Basic	Below Basic
Grade 6 ELA	80-100%	64-79%	34-63%	0-33%
Grade 7 ELA	76-100%	70-75%	38-69%	0-37%
Grade 8 ELA	85-100%	73-84%	40-72%	0-39%
Grade 6 Mathematics	67-100%	54-66%	28-53%	0-27%
Grade 7 Mathematics	60-100%	41-59%	15-40%	0-14%
Grade 8 Mathematics	72-100%	46-71%	24-45%	0-23%

For student growth as measured by STAR Reading and STAR Math, there was a statistically significant difference in both reading and mathematics growth. A small-to-medium effect size was observed for reading and mathematics growth. STAR Reading and STAR Math were administered in September and January for both in-person and virtual learning. Because the assessments were administered four months apart, expected growth in both reading and mathematics is 0.4. As shown in Figure 7, reading growth and mathematics growth for in-person learning was less than the anticipated level. Reading growth and mathematics growth for virtual learning was not only lower than expected, but indicated a learning loss. For example, a growth score of -0.1 indicated the score on the assessment administered in January was lower than the score on the assessment administered in September.

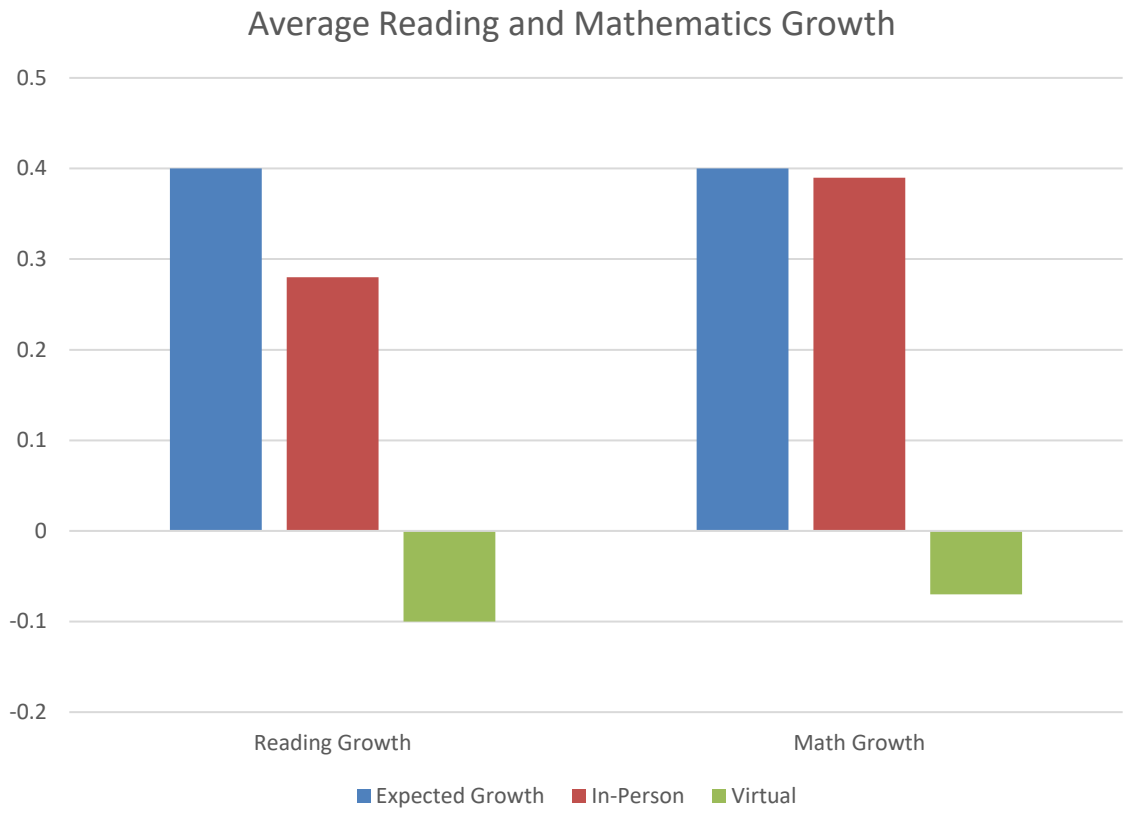

Figure 7: Average Reading and Mathematics Growth

Findings Related to the Literature

The 2019 research by Molnar, et al found that virtual schools enrolled substantially fewer low-income students when compared with national enrollment in public schools. This may be due to limited access to technology. However, many virtual schools often loan computers to students and pay for internet access. Mislevy, et al.'s 2020 study on virtual and in-person learning in Virginia found that students enrolled in fully online learning were less likely than their face-to-face course peers to be economically disadvantaged (p. 8). For this study, all participants qualified for free lunch, and were therefore designated low-income.

A 2014 study of virtual charter schools by Hasler-Waters, et al. identifies a concern that virtual schools are plagued by a variety of challenges including failing grades at higher rates than

their in-person counterparts. This research found that student achievement was lower for students who participated in virtual learning than in-person learning, and supports that claim.

The body of research on virtual learning revealed differing results for student achievement of virtual learners compared to their counterparts participating in traditional in-person methods of instruction. Carnahan's dissertation showed no significant difference in achievement between the two models (2012). However, Pace and Mellard's study found that completion/pass rates were lower for students enrolled in virtual learning when compared to their in-person counterparts (2016). Kwayke and Kibort-Croker's 2021 study of disruptions to learning during the COVID-19 pandemic found that low-income students were less likely to receive quality remote instruction and more likely to receive a failing grade than their peers. In fact, 23% of low-income students received a failing grade compared to 8% of non-low-income students (page 12). However, a smaller study that focused on blended learning (meaning students participated in both virtual and in-person instruction) had different achievement results than studies focused on fully virtual instruction. Seage and Turgeon's 2020 study of the effects of blended learning on Science, Technology, Engineering, and Mathematics (STEM) achievement of elementary school students found that students classified as low-income tend to achieve higher STEM scores when they participate in blended learning. Results of this study support findings that low-income students experienced lower achievement in reading and mathematics in virtual learning than in-person learning.

One study by Lueken, Ritter & Beck found that virtual schools may be improving over time, and the virtual school in that study showed improved achievement in its third year (2015). The urban middle school in this study was in its first year of implementation of virtual learning due to the onset of the COVID-19 pandemic. The school's lack of experience in providing

instruction virtually, and the lack of planning time prior to implementation may have contributed to the students' low achievement. There is not sufficient evidence from this study to support claims about virtual schools improving over time.

A concern about an overreliance on virtual learning in underserved schools arose in the body of research. Schools that face significant teacher shortages, like those in the Mississippi Delta region, have been forced to staff classrooms with non-certified monitors who supervise students receiving instruction from online programs (Davis & Wright, 2018). The research in this study contributes to the body of evidence suggesting that such an overreliance may not be a best practice.

Conclusions

Implications for action. A concern that arose from this research was that students had low engagement during virtual learning, meaning they were not regularly logging in for online lessons or not submitting a majority of assignments. Because this decreased engagement may have contributed to lower student achievement during virtual learning compared to in-person learning, districts serving low-income students should consider protocols and procedures to support motivation for students participating in distance learning.

Another possible contributing factor to the decrease in student achievement from in-person learning to virtual learning may have been family preparedness. When students participate in a traditional in-person model of instruction, they readily have access to certified teachers who have been trained to meet their academic needs. During virtual learning, the students in this study had limited access to their teachers. This meant that when they needed instructional support, they were relying on parents, guardians, siblings, or themselves. Because all participants in the study were classified as low-income, they may have had fewer resources at

home to support learning than their counterparts in other districts. District leaders should consider protocols for increasing instructional support for students participating in virtual learning.

Assessments were administered differently during virtual learning than in-person learning. During the in-person school year, assessments were administered to all students in a class at one time while a teacher maintained an ideal testing environment. For virtual learning, students logged into online assessment platforms from home at varying times. The difference in the testing environments may have contributed to the decrease in assessment outcomes. School leaders should consider procedures and protocols for creating stable assessment environments for virtual learners.

One rising concern about online learning is the overutilization of that tool in underserved schools in the United States instead of qualified teaching staff. According to an article in *The Hechinger Report* by Davis and Wright, some low-income districts are facing significant teacher shortages and must rely upon online learning to meet students' needs (2019). One data set from the National Center for Education Statistics supports this concern. According to that data, high- and medium-poverty school districts saw a greater increase in enrollment in technology-based distance education courses than low-poverty districts from the 2002-03 school year to the 2009-10 school year (NCES, 2018). Because this research found lower ELA and mathematics achievement, and not only lower growth, but a loss of learning, this research supports limiting utilization of this tool for low-income students.

Recommendations for future research. Additional information could be gained from replicating this research with other student populations. All participants in this study were categorized as low-income. Replicating this research in middle-class or affluent school districts

could provide further insight about socio-economic status and student achievement during virtual learning. A majority of participants in this study identified as Black/African American. Conducting this research in low-income schools with majority white, Latinx, Asian, or Native American students would contribute to the body of research around demographics and student achievement during virtual learning.

All students in this study had access to technology devices because they were provided by the school district. All students in this study were classified as low-income. Limited financial resources at home could mean access to the internet and other resources like electricity may not have been consistent. Replicating this study in low-income schools where students have consistent access to internet and utilities would contribute to the body of research about the impact of resources on virtual learning.

All participants in this study were in middle school. Additional insights could be gained by conducting this research with participants from other age groups. Research of this nature with elementary or high school students could provide information about the possible impact of a student's age in student achievement during virtual learning.

This study was limited to one school year. Replicating this study over a period of several years could provide information about how virtual schools perform over longer periods, and whether they improve over time.

For this study, student engagement during virtual learning was low. Further research on motivation strategies during virtual learning could provide information on how to improve student participation.

In this study, all students were classified as low-income, and may have lacked resources at home to be successful in virtual learning. Future research about protocols for resources and

support could provide information about how to improve outcomes for virtual students classified as low-income.

This was a quantitative study of student achievement during virtual and in-person learning. Interviews conducted with families and students in a qualitative study could provide more specific information about factors contributing to student outcomes. For example, "What challenges did you face during virtual learning?" and "What steps could the school have taken to better support your learning during virtual instruction?"

Future research that focuses on methods of virtual instruction could be used to provide professional development and instructional practices. Future research that focuses on teacher quality and virtual learning outcomes could help guide teacher recruitment and development practices in virtual schools. Research on academic, social emotional, or other supports for students participating in virtual learning could help determine whether low-income urban students might experience more success with additional resources.

Concluding remarks. The existing body of research shows varying results about the impact of virtual learning on student achievement, and the underrepresentation of low-income students in virtual learning creates challenges in drawing conclusions about the impact on achievement for the demographic. Educational leaders, teacher preparation programs, and educators should examine the effects of virtual learning on student achievement to ensure it meets the needs of students.

The data collected in this study provides educational leaders with evidence that student achievement in reading and mathematics decreased for low-income urban students during participation in virtual learning. Additional supports may be needed to help close the achievement gap for low-income urban students participating in virtual learning.

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Appendices

Appendix A. Superintendent Approval

July 26, 2021

To Whom It May Concern;

The purpose of this letter is to advise that I authorized and approved Annelise Thurber's use of [redacted] data to conduct a research project associated with her dissertation on student achievement in virtual and traditional models of instruction.

Sincerely,

[redacted]

Appendix B. IRB Approval

BAKER UNIVERSITY
Own Confidence

Baker University Institutional Review Board

September 9th, 2021

Dear Annelise Thurber and Jim Robins,

The Baker University IRB has reviewed your project application and approved this project under Exempt Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.
6. If this project is not completed within a year, you must renew IRB approval.

If you have any questions, please contact me at npoell@bakeru.edu or 785.594.4582.

Sincerely,

Nathan Poell, MLS
Chair, Baker University IRB

Baker University IRB Committee
Sara Crump, PhD
Nick Harris, MS
Christa Manton, PhD
Susan Rogers, PhD

Appendix C. Evaluate Assessments

MO-ELA/Lit-Grade 6 Assessment - FEB

Use the following information for answering question(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

A Class Election

Manny Soto could pinpoint the exact moment when nervousness turned his stomach upside down. The campaign for sixth-grade class president had just begun to heat up, spreading a contagious election fever through the middle school. This year the school principal had encouraged each student to get involved in some way -- from taking polls to designing posters for the candidates. Manny decided to go for the gold, becoming one of four students to run for class president.

His trouble began when the candidates presented their speeches at a school assembly. As a result of a random drawing, Darius Johnson spoke first. Darius was all about sports, so he proposed building new bleachers and cutting back on athletic fees with the help of the school administration. Next up was Antonio Rizzi, whose speech made the audience feel like they were at a comedy club. The comic relief was entertaining, but no one seemed to take Antonio very seriously. Then, Julia Thomas stepped up to the microphone and Manny listened to her proposals: Keep the library open longer after school…Work with the School Committee on reducing class size…Launch a homework center…. It was as if she'd read *his* speech, Manny thought as he walked to the podium. Delivering his speech as written, he emphasized the one idea that Julia hadn't already mentioned -- more healthy food choices on the school menu.

When the audience began to ask the candidates probing questions, the first went to Manny. "Can you explain the difference between your proposal and Julia's?" asked a student.

"Well...ah...that's a good question," Manny stalled. "Actually, Julia and I agree on many things, but the difference is I know how to get things done. I'm the one who can put those ideas into practice." Manny put such a good spin on it that he almost convinced himself his words were true.

During the next few days, Manny worried from noon to night. So did his campaign manager, Coral. "We need a strategy," she said one day, "or we're toast."

"Maybe not," said Manny, as an idea suddenly popped into his head. "Let's take a poll of all sixth-grade students to see who would win the election if it were held today. It'll help us figure out where we stand. Plus, we can use the data for our math project!"

As they worked on writing questions for the poll, Manny began to feel some of the old excitement flowing back. That excitement lasted until they tallied the poll results. Darius had earned 32% of the votes, Antonio 11%, Julia 25%, and Manny 28% with 4% of students undecided. Less than a week remained until Election Day.

"Second place so far," said Coral.

"Not too shabby. But we've got some work to do to earn those extra votes we need," said Manny, "so let's hear some ideas."

The clock ticked as Manny's campaign staffers threw balls of wadded-up paper into the trash. Coral was scrutinizing the poll results, scanning them over and over again.

"Wait a minute!" Coral exclaimed. "Do you realize what this poll tells us? Look! If you evaluate the numbers, you'll see that Antonio or Julia's percentage combined with ours equals victory! Maybe one of them would agree to run as your co-president!"

Everyone was dashing for the door when suddenly it opened, and in walked Julia Thomas.

"Hey, Manny," she said. "I think we need to talk."

Question #1

Which sentence from the passage should you cite to BEST support the claim that Manny is anxious about the election?

- Manny put such a good spin on it that he almost convinced himself his words were true.
- As they worked on writing questions for the poll, Manny began to feel some of the old excitement flowing back.
- Manny decided to go for the gold, becoming one of four students to run for class president.
- During the next few days, Manny worried from noon to night.

Question #2

How did Manny respond when Julia delivered a speech that was very similar to his just before it was his turn to speak?

- He became upset and threw balls of wadded-up paper into the trash can.
- He decided to change his speech at the last minute.
- He delivered his original speech, emphasizing one idea Julia didn't mention.
- He scrutinized the results of the poll to see if Julia might win the election.

Question #3

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

What is the main theme of the passage?

- Treat others how you want to be treated.
- Set goals and follow through with effort.
- It's normal to feel nervous before a big win.
- Good students are involved in their schools.

Part B

Select TWO sentences from the passage that help develop the theme identified in Part A.

- This year the school principal had encouraged each student to get involved in some way -- from taking polls to designing posters for the candidates.
- Manny Soto could pinpoint the exact moment when nervousness turned his stomach upside down.
- During the next few days, Manny worried from noon to night.
- Manny decided to go for the gold, becoming one of four students to run for class president.
- "But we've got some work to do to earn those extra votes we need," said Manny, "so let's hear some ideas."

Question #4

Read the following sentence from the passage.

Coral was scrutinizing the poll results, scanning them over and over again.

What is the meaning of the word "scrutinizing" as it is used in this sentence?

- examining
- ignoring
- counting
- charting

Question #5

Read the following paragraph from the passage.

"Well...ah...that's a good question," Manny stalled. "Actually, Julia and I agree on many things, but the difference is I know how to get things done. I'm the one who can put those ideas into practice." Manny put such a good spin on it that he almost convinced himself his words were true.

How does this paragraph contribute to the meaning of the passage?

- It helps the reader understand that Manny and Julia agree on everything.
- It helps the reader know how hard Manny has worked to win the election.
- It helps the reader understand that Manny is trying to appear confident, but in reality, he is nervous.
- It helps the reader know that the election has put Manny and Julia's friendship in danger.

Question #6

Imagine you are having a group discussion about this passage. One of the group members makes the claim that Manny is the best choice for class president. Which sentence from the passage BEST supports this claim?

- Manny decided to go for the gold, becoming one of four students to run for class president.
- "I'm the one who can put those ideas into practice."
- "If you evaluate the numbers, you'll see that Antonio or Julia's percentage combined with ours equals victory!"
- As they worked on writing questions for the poll, Manny began to feel some of the old excitement flowing back.

Question #7

Imagine your teacher has asked you to give a formal oral presentation about this passage. Read the following excerpt from your presentation. Then click on the sentence that shows the LEAST formal use of language and will need to be revised.

Manny and Julia would be wise to combine efforts and run for office together. After all, they'd practically given the exact same speech. Since their goals are similar, a partnership between the two would be a natural combination. The only issue they might have is deciding who will be president and who will be co-president.

Question #8

Imagine you are the author of the following narrative. You would like to add transition words to help your audience understand the order of events. Select the transition words or phrases from the drop-down boxes that BEST complete each sentence.

Manny and Julia will need to come up with a plan if they want to win the election. select , they will need to have a long discussion about their views and goals to be sure they agree on all issues. select , they will need to think of a campaign slogan they both

Question #9

Imagine you are conducting research on what a class president is required to do. Which would be the BEST source of reliable information?

- a pamphlet from your state's student government association titled "Roles and Responsibilities of Student Government Officers"
- a social media post written by a previous class president discussing her accomplishments
- a novel about a shy student who makes many new friends after winning the election for class president
- an online encyclopedia article titled "The History of Student Government in American Schools"

Question #10

Read the following concluding sentence from the passage.

"Hey, Manny," she said. "I think we need to talk."

Imagine you are the author of this passage and you want to add more details to the conclusion. Which TWO choices below would make the most sense to add to the conclusion?

- Manny was worried Julia was there to tell him that Antonio won the election.
- "Hi Julia," said Manny. "I'm hoping you're here because you have the same idea as me."
- Manny was glad to see Julia standing in the doorway. He knew they would make a great team.
- "Do you have any poster board I could borrow?" asked Julia.
- Next, Manny and Julia decided to work on their math project together.

Question #11

Imagine you have written the following paragraph about attending a conference. Click on the ONE sentence that is incorrect and needs to be revised.

Marley and I will be traveling to our nation's capital next summer. We were chosen to represent our school at a conference. Marley, her teacher was glad that she was chosen. When we go, we will be taking pictures of important landmarks to share with our classmates.

Question #12

Imagine you are conducting research in order to write an informational essay. You found several sources during your research and made the following observations regarding these sources. Drag each observation to the appropriate column to tell if it indicates the source is either credible or not credible.

	IS an indication of a credible source	Is NOT an indication of a credible source
links to unrelated products		
dates of research are listed		
some spelling errors		
author is listed		
a list of cited sources		

Use the following information for answering question(s): 13, 14, 15, 16, 17, 18, 19, 20, 21

Eleanor Roosevelt: Breaking Barriers

Who was Eleanor Roosevelt? She was a feisty woman who was determined to break down barriers. She was a bold woman who was unafraid to stand up for those who lacked power and money. Eleanor Roosevelt was also the woman who changed the role of the first lady. She paved the way for future first ladies to play an active role in the White House.

If you're wondering how Eleanor Roosevelt grew to play a unique role in American history, you need to understand how she came to possess a strong sense of fairness. Her journey reveals a woman with great determination, passion, and understanding.

Eleanor Roosevelt was born in New York City in 1884. When she was eight years old, her mother died. After her mother's death, Eleanor went to live with her grandmother. Two years later, her father died. When Eleanor was fifteen, she was sent to a boarding school in England. At eighteen, she returned home to New York and lived with cousins. It is likely that the personal losses that Eleanor suffered during her early years contributed to her compassion for people who faced obstacles in their lives.

In 1905 Eleanor married Franklin Delano Roosevelt, who later became the 32nd president of the United States. In the early years of their marriage, Eleanor and Franklin led busy lives. While he was launching his political career, she took care of their five children. In addition to her role as mother, Eleanor became involved in volunteer work. When the United States entered World War I in 1917, Eleanor worked for the American Red Cross and volunteered in Navy hospitals.

In 1921 Franklin was stricken with polio. The disease left him unable to walk, and from that point on, Eleanor devoted herself to helping her husband. She became more involved in politics. She wanted not only to help Franklin reach his goals but also to pursue the issues that she cared about. She worked hard to end discrimination against women, poor people, and African Americans.

When Franklin became president in 1933, Eleanor played a key role in shaping American policies. During the 1930s, the years of the Great Depression, many people were out of work and had very little money. Eleanor traveled around the country and visited with ordinary citizens. When she returned to Washington, Eleanor would share her observations with her husband. What she witnessed had an effect on the decisions made by her husband -- the president of the United States.

Beginning in 1935, Eleanor wrote a daily newspaper column called "My Day." She expressed her views on issues that she felt strongly about. She wrote the column for more than twenty years. Many of her ideas for it grew out of her travels. During World War II, Eleanor journeyed overseas. She went to England and the South Pacific in an effort to keep up the spirits of American soldiers fighting in the war.

Eleanor urged women to have a stronger voice in politics. In 1940 she became the first woman to speak at a national convention when she addressed the Democratic National Convention. After Franklin died in 1945, Eleanor continued to play an important role in American politics. In

1948 she was appointed chairwoman of the Human Rights Commission at the United Nations. In 1961 President John F. Kennedy appointed her to head the President's Commission on the Status of Women.

When she died in 1962, many important people attended her funeral, including President Kennedy, Vice President Lyndon Johnson, and former presidents Truman and Eisenhower. Like so many others, they realized how much Americans would miss this brave woman who had dedicated herself to helping so many others.

Photo courtesy of Library of Congress

Question #13

Read the following sentence from the passage.

She paved the way for future first ladies to play an active role in the White House.

How does the author's use of the phrase "paved the way" add to the meaning of the passage?

- It helps the reader understand the valuable work Eleanor Roosevelt did in road construction while serving as first lady in the White House.
- It helps the reader understand that Eleanor Roosevelt played an active role in the White House.
- It emphasizes the fact that Eleanor Roosevelt was the president's wife and lived in the White House.
- It emphasizes the fact that by being the first to take on an active role, Eleanor Roosevelt made it easier for other first ladies to do the same.

Question #14

Read the following sentences from the passage.

In 1921 Franklin was stricken with polio. The disease left him unable to walk, and from that point on, Eleanor devoted herself to helping her husband.

What is the meaning of the phrase "stricken with" as it is used above?

- seriously affected by
- not involved with
- hit by
- interested in

Question #15

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

- Eleanor suffered through many struggles during her childhood.
- Eleanor Roosevelt dedicated her life to being a mother, volunteer worker, and supportive wife.
- Eleanor Roosevelt became first lady of the United States in 1933.
- Eleanor Roosevelt changed the role of the first lady.

Part B

Which TWO sentences from the passage below best support the development of the main idea selected in part A?

- She paved the way for future first ladies to play an active role in the White House.
- When she died in 1962, many important people attended her funeral, including President Kennedy, Vice President Lyndon Johnson, and former presidents Truman and Eisenhower.
- When Franklin became president in 1933, Eleanor played a key role in shaping American policies.
- She worked hard to end discrimination against women, poor people, and African Americans.
- It is likely that the personal losses that Eleanor suffered during her early years contributed to her compassion for people who faced obstacles in their lives.

Question #16

Read the following paragraph from the passage.

When she died in 1962, many important people attended her funeral, including President Kennedy, Vice President Lyndon Johnson, and former presidents Truman and Eisenhower. Like so many others, they realized how much Americans would miss this brave woman who had dedicated herself to helping so many others.

Why did the author include this paragraph in the passage? Choose the TWO best answers.

- The author wanted to convince the reader that the important people who attended the funeral were compassionate people.
- The author wanted to provide evidence to support the claim that Eleanor Roosevelt had been a very influential person.
- The author wanted to provide evidence to support the claim that President Kennedy and former President Roosevelt had been friends.
- The author wanted the reader to understand that people respected Eleanor Roosevelt.
- The author wanted readers to know the names of some of the most important people of the 1960s.

Question #17

Imagine your teacher has asked to give a presentation on the topic of this passage. Which TWO visual aids would be best to use for your presentation? Drag a checkmark into the box next to each correct choice.

Choose two	Visual Aids
	a timeline showing important events occurring during President Roosevelt's presidency
	a chart listing all of the former presidents of the United States
	a timeline depicting the important events of Eleanor Roosevelt's life
	a caption explaining the effects of Polio
	an excerpt from one of Eleanor Roosevelt's "My Day" columns

Question #18

Read the following excerpt from the passage.

Eleanor Roosevelt was born in New York City in 1884. When she was eight years old, her mother died. After her mother's death, Eleanor went to live with her grandmother. Two years later, her father died. When Eleanor was fifteen, she was sent to a boarding school in England. At eighteen, she returned home to New York and lived with cousins. It is likely that the personal losses that Eleanor suffered during her early years contributed to her compassion for people who faced obstacles in their lives.

Imagine you are writing a research report and want to include information from this excerpt in your report. Which answer choice below is the BEST way to paraphrase this excerpt while avoiding plagiarism?

- When she was eight years old, her mother died. Two years later, her father died.
- Eleanor Roosevelt endured many hardships as a child, but they helped her feel compassion for others who were having hardships.
- Eleanor went to boarding school in England. Afterward, she returned home to New York and lived with cousins.
- It is likely that the personal losses that Eleanor suffered during her early years contributed to her compassion for people who faced obstacles in their lives.

Question #19

Imagine you are leading a group discussion about this passage. Which question would be BEST to ask your classmates in order to get them to elaborate on details from the passage?

- How many children did Eleanor Roosevelt have?
- What would you do if you got to live in the White House?
- What are some ways Eleanor Roosevelt showed her determination?
- What was the name of Eleanor Roosevelt's daily newspaper column?

Question #20

Read the following excerpt from the passage. Then click on the piece of evidence that BEST supports the inference that Eleanor Roosevelt did not let the tragic events from her childhood ruin her life.

Eleanor Roosevelt was born in New York City in 1884. When she was eight years old, her mother died. After her mother's death, Eleanor went to live with her grandmother. Two years later, her father died. When Eleanor was fifteen, she was sent to a boarding school in England. At eighteen, she returned home to New York and lived with cousins. It is likely that the personal losses that Eleanor suffered during her early years contributed to her compassion for people who faced obstacles

Question #21

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

What is the author's perspective in this passage?

- The author thinks that Eleanor Roosevelt helped influence politics in America.
- The author believes that Franklin Roosevelt would not have succeeded without the help of his wife, Eleanor.
- The author thinks that although Eleanor Roosevelt worked hard to end discrimination, she wasn't able to make much progress.
- The author believes that Eleanor Roosevelt would have been a better first lady if she hadn't suffered losses in her early life.

Part B

Which TWO sentences from the passage best support the author's perspective selected in Part A?

When Franklin became president in 1933, Eleanor played a key role in shaping American policies. During the 1930s, the years of the Great Depression, many people were out of work and had very little money. Eleanor traveled around the country and visited with ordinary citizens. When she returned to Washington, Eleanor would share her observations with her husband. What she witnessed had an effect on the decisions made by her husband -- the president of the United

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Question #22

Study the dictionary entry below.

beacon (**bee**-kuh n) *n.* 1. a source of inspiration 2. a light that acts as a signal or warning 3. a person that offers encouragement or guidance *v.* 4. to light up

Now read the following sentence.

The island's old beacon has saved many ships from running ashore over the years.

Which definition of the word "beacon" is used in this sentence?

- definition 1
- definition 2
- definition 3
- definition 4

Question #23

Imagine you are conducting research to answer the question "What is the best way to keep insects away?" Which TWO sources below would be best to include in your research?

- an article in a science journal titled "A Guide to the Most Effective Insect Repellents"
- an advertisement for a handheld insect catcher
- a social media post about using vinegar to keep insects away
- an interview with an expert about the most dangerous insects in your area
- a pamphlet from the health department titled "How to Avoid Insect Bites"

Question #24

Read the following sentences.

As Regan listened to the little girl talk about how much she loved her first trip to the dentist, she thought of her own parents, who were both dentists. Suddenly, she knew she wanted to follow in her parents' footsteps someday.

What is the meaning of the phrase "follow in her parents' footsteps" as it is used above?

- act more like an adult
- walk behind her parents
- pay close attention to directions
- do the same thing as her parents

Question #25

Read the following sentence.

Since our players were able to foil the other team's attempts to score, we ended up winning the game with a score of 14-0.

What is the meaning of the word "foil" as it is used in this sentence?

- gain
- assist
- prevent
- improve

MO-ELA/Lit-Grade 7 Assessment - FEB

Use the following information for answering question(s): 1, 2, 3, 4, 5, 6, 7, 8, 9

The Rainy Day

Henry Wadsworth Longfellow

The day is cold, and dark, and dreary;
It rains, and the wind is never weary;
The vine still clings to the moldering wall,
But at every gust the dead leaves fall,
And the day is dark and dreary.

My life is cold, and dark, and dreary;
It rains, and the wind is never weary;
My thoughts still cling to the moldering past,
But the hopes of youth fall thick in the blast,
And the day is dark and dreary.

Be still, sad heart! and cease repining;
Behind the clouds is the sun still shining;
Thy fate is the common fate of all,
Into each life some rain must fall,
Some days must be dark and dreary.

The above material is in the public domain.

Question #1

Based on the details provided in the poem, the reader can infer that the poet is yearning for his younger days. Choose the TWO pieces of evidence from the poem that best support this inference.

- My thoughts still cling to the moldering past,
- But the hopes of youth fall thick in the blast,
- Into each life some rain must fall,
- It rains, and the wind is never weary;
- My life is cold, and dark, and dreary;

Question #2

Use the poem to answer the following questions. Be sure to answer both parts.

Part A

Read the following line from the poem. Then click on the word that brings to mind the most negative emotion about the setting.

The day is cold, and dark, and dreary;

Part B

How does the setting influence the problem written about in the poem?

- The setting allows the author to express his joy more freely.
- The setting provides a place for the author to build a wall between himself and the storm.
- The setting provides a way for the author to enjoy the rain.
- The setting allows the author to compare gloomy seasons of weather to hard times in life.

Question #3
How does the structure of the poem contribute to its overall meaning?

- The poet's use of parallels helps the reader understand the similarities between a depressing day and a negative attitude.
- The poet's use of rhyme helps the reader understand that the sun rises every day.
- The poet's use of imagery helps the reader understand that the seasons are always changing.
- The poet's use of stanzas helps the reader understand when the weather changes.

Question #4
Imagine your teacher has asked you to write an essay in which you are to analyze the work of Longfellow and decide upon a common theme he uses. Which of the following choices is the most credible and relevant source you could reference in your essay?

- a journal article detailing multiple themes associated with "The Rainy Day"
- a blog post from a college student who is studying Longfellow
- a collection of Longfellow's poetry
- a biography detailing the early life of Longfellow

Question #5
Read the following lines from the poem.

My thoughts still cling to the moldering past,
But the hopes of youth fall thick in the blast,

What is the correct meaning of these lines as they are used in this poem?

- A blast of wind is irritating the author so he is thinking about his past to distract himself from it.
- The author can't stop thinking about his younger days, but he has lost the hope he once had.
- It is important to not only have high hopes when you are young, but also to never lose sight of those hopes.
- The past is more important than the future, so it is essential to not forget it.

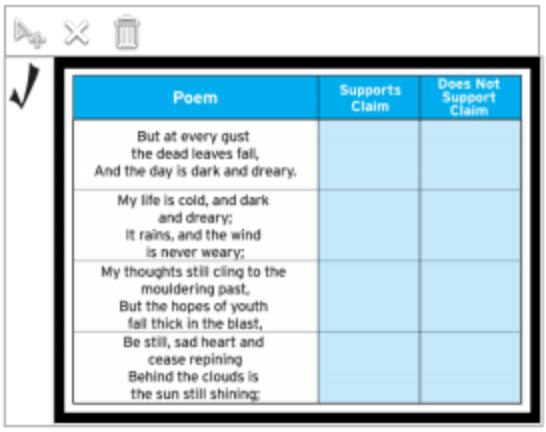
Question #6

Imagine you are leading a group discussion about this poem. Which would be the TWO best questions to ask other members of the group to encourage extended discussion focused on the poem?

- What is the meaning of the word "dreary" as it is used in the poem?
- How does a vine grow on a wall?
- Why does the poet make comparisons between the weather and his feelings?
- How old was the poet when he wrote "The Rainy Day"?
- How does the poet use figurative language to express the theme of hope?

Question #7

Imagine you are participating in a group discussion about this poem and someone in your group makes the claim that the poet is still hopeful for the future. Read the lines from the poem in the chart below. Then drag a checkmark to the appropriate column to tell if the lines support or do not support this claim. You should have ONE checkmark in each row.



Poem	Supports Claim	Does Not Support Claim
But at every gust the dead leaves fall, And the day is dark and dreary.		
My life is cold, and dark and dreary; It rains, and the wind is never weary;		
My thoughts still cling to the mouldering past, But the hopes of youth fall thick in the blast,		
Be still, sad heart and cease repining Behind the clouds is the sun still shining;		

Question #8

Use the poem to answer the following questions. Be sure to answer both parts.

Part A

What is the main theme of this poem?

- Rain is necessary for all living beings.
- Youth have the most fun.
- Grief is usually unbearable.
- Everyone must experience some sadness in their life.

Part B

Read the following lines from the poem. Then select the TWO lines that best support the theme selected in Part A.

- But the hopes of youth fall thick in the blast,
- Into each life some rain must fall,
- Some days must be dark and dreary.
- The vine still clings to the moldering wall,
- It rains, and the wind is never weary;

Question #9

Imagine you have been asked to write an informational essay on the theme of this poem. Which TWO choices below would make the best concluding sentences for your essay?

- After all, suffering and bad weather both cycle through everyone's life.
- Finally, Longfellow finished a series of poems describing the weather.
- On the other hand, rain makes some people happy.
- Moreover, suffering and bad weather only happen to people who aren't prepared.
- Ultimately, the poet made an interesting connection between the weather and human emotions.

Question #10
Imagine you are editing a report you wrote about healthy eating. Read the following sentences from your rough draft.

Nutrition studies reveal that a diet rich in fruits and vegetables promotes good health. Likewise, many teenagers do not eat a healthy diet.

The word "likewise" does not correctly link the ideas. Which word or phrase from the options below should be used instead?

- As a result
- For example
- Furthermore
- However

Question #11
Imagine you have written the following sentence.

After speaking with the veterinarian, my dog will need medication.

As you are editing you notice that the sentence above contains a dangling modifier. Which choice below shows the correct way to write the sentence?

- After speaking with the veterinarian, medication will be needed by my dog.
- After speaking with the veterinarian, I will need to give medication to my dog.
- After speaking with the veterinarian, my dog will need medication given by me.
- After speaking with the veterinarian, medication will need to be given to my dog by me.

Question #12
Read the following excerpt from an article about influenza.

No one wants to get sick, especially with a severe illness such as influenza. Influenza, more commonly called the flu, sickens many people every year. It is a serious illness that can lead to hospitalization. Everyone should know the signs and symptoms of the flu. One sign that sets the flu apart from other illnesses is the sudden onset. Flu sufferers go from feeling fine to feeling like they have been "hit by a truck" within a matter of hours. The symptoms come on quickly and in full force, not gradually as with some other illnesses. The main symptoms of the flu are fever, body aches, headache, and a cough. Sometimes the cough is accompanied by congestion, but it is usually not severe. If your main symptoms are vomiting or diarrhea, then you probably do not have the flu. If you recognize the symptoms of the flu, you should contact your doctor immediately and stay home so you don't infect others.

Which choice below shows the BEST way to paraphrase this excerpt while avoiding plagiarism?

- One sign that sets the flu apart from other illnesses is the sudden onset. Flu sufferers go from feeling fine to feeling like they have been "hit by a truck" within a matter of hours. The symptoms include fever, body aches, headaches, and a cough.
- If you have stomach symptoms such as vomiting or diarrhea, then you probably don't have the flu. This means that you are free to go to school and socialize as normal.
- Symptoms of influenza, or the flu, are fever and a cough accompanied by both a headache and body aches. The symptoms will come on quickly and severely.
- It is important to recognize the symptoms of influenza. The main symptoms of the flu are fever, body aches, headache, and a cough. Sometimes the cough is accompanied by congestion, but it is usually not severe.

Use the following information for answering question(s): 13, 14, 15, 16, 17, 18, 19, 20, 21

Owls: Fact and Fiction

Throughout history and across many cultures, people have had different and contradictory beliefs about owls. In the myths and folktales of the ancient Greeks, owls were considered wise and helpful. Later they came to be considered scary, mysterious creatures. They live in abandoned trees, barns, or houses, and appear to prefer the dark to daylight. Their large eyes, which seem to glow ominously, and their eerie call frighten many people.

Even though owls are in many ways extraordinary, there is really nothing unnatural about them. On the contrary, they are essential to our environment. Owls have extremely sensitive hearing, vision that is 50 to 100 times better than humans' vision in poor light conditions, and "stealth feathers" for silent flight. These characteristics make owls exceptional hunters. They help maintain a natural balance between plant and animal life by hunting rats and mice, reptiles, and insects. Without them, farmers' fields would be overrun with these pests.

There are more than 100 different species of owls, ranging vastly in size and shape. Most owls are brown or gray and they often are streaked or spotted. This coloring, called camouflage, helps them to blend into their environment. One owl, the snowy owl, is almost pure white. Some of the largest owls may measure almost five feet from wingtip to wingtip, while the smallest owls have wingspans the size of a small robin.

Baby owls, often called "chicks," stay with their fathers and mothers until they are almost three months old. After that time, they each find their own hunting territory and may stay there for the rest of their lives. Owls may live to be almost 20 years old!

Today, at least in Europe and the United States, superstitions about owls are dying out. Once thought of as the worst bird in the world, the owl has become one of the most popular.

Question #13

Imagine you are having a class discussion based on this passage. One of your classmates makes the claim that owls display such variety, there is sure to be one you can admire. Which sentence from the passage below BEST supports this claim?

There are more than 100 different species of owls, ranging vastly in size and shape. Most owls are brown or gray and they often are streaked or spotted. This coloring, called camouflage, helps them to blend into their environment. One owl, the snowy owl, is almost pure white. Some of the largest owls may measure almost five feet from wingtip to wingtip, while the smallest owls have wingspans the size of a small robin.

Question #14

Select the statement that provides the BEST summary of the passage.

- While owls vary in size and color, their social patterns tend to remain consistent. Parents raise their chicks until the age of three months; at that time, the chicks find their own hunting territory and may remain there for a lifetime.
- Owls, at times considered both wise and scary, are essential to our environment. The many species of owls help maintain balance in nature, and are now considered one of the most popular types of birds.
- The various species of owls range in size from a wingspan of five feet to a wingspan of just a few inches. They also range in color from brown and gray to pure white.
- Throughout history, owls have been considered wise and helpful. They have also been considered mysterious and frightening.

Question #15

Which set of words or phrases below did the author use to reinforce the fact that some people and cultures viewed owls as scary creatures?

- "eerie call", "ominously"
- "extraordinary", "essential"
- "stealth feathers", "hunters"
- "superstitions", "popular"

Question #16

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

Which statement below BEST summarizes the author's perspective regarding the topic of this passage?

- The author believes that while owls are important creatures in both mythology and superstition, they don't serve any other purpose.
- The author feels that while there are differing beliefs about owls, they are essential to maintaining a healthy environment.
- The author believes that owls are often used in folktales and myths to represent wisdom.
- The author feels that owls are mysterious and eerie creatures.

Part B

Select TWO of the sentences from the passage that best support your answer to Part A.

- Even though owls are in many ways extraordinary, there is really nothing unnatural about them.
- There are more than 100 different species of owls, ranging vastly in size and shape.
- Owls may live to be almost 20 years old!
- Without them, farmers' fields would be overrun with these pests.
- They live in abandoned trees, barns, or houses, and appear to prefer the dark to daylight.

Question #17

Imagine your teacher has asked you to create a multimedia presentation on the topic of this passage. Select the TWO components that would be best to include in your presentation in order to emphasize important points.

- a Venn diagram comparing and contrasting baby owls and baby eagles
- a video clip of a farmer explaining how owls benefit his farm
- a diagram showing the specific purposes of an owl's eyes, ears, and feathers
- a map of ancient Greece
- a photograph of an abandoned tree

Question #18

Read the following excerpt from the passage.

Later they came to be considered scary, mysterious creatures. They live in abandoned trees, barns, or houses, and appear to prefer the dark to daylight. Their large eyes, which seem to glow ominously, and their eerie call frighten many people.

What does the word "ominously" mean as it is used in this excerpt?

- in a threatening way
- in an inviting way
- in a depressed way
- in a hopeful way

Question #19

Based on the information in the passage, you can conclude that owls play an important role in their ecosystems. Read the following paragraph from the passage. Then click on the TWO pieces of evidence that best support this conclusion.

Even though owls are in many ways extraordinary, there is really nothing unnatural about them. On the contrary, they are essential to our environment. Owls have extremely sensitive hearing, vision that is 50 to 100 times better than humans' vision in poor light conditions, and "stealth feathers" for silent flight. These characteristics make owls exceptional hunters. They help maintain a natural balance between plant and animal life by hunting rats and mice, reptiles, and insects. Without

Question #20

Read this excerpt from an article about owls written by a different author.

Not only are owls beautiful birds, but they are also beneficial to human populations. Owls help scare away nuisance birds. Since some birds fear owls, people may place a fake owl around buildings where they do not want other birds nesting. Furthermore, farmers often encourage owls to nest around their farms in order to help control the number of rats and mice that might destroy the crops. Despite the benefits that owls bring, their habitat is shrinking due to people developing the land for other uses. It is essential to protect the habitat of these important birds.

Which statement correctly identifies similarities or differences between the excerpt and the passage *Owls: Fact and Fiction*?

- Both the passage and the excerpt are written using a compare and contrast organizational structure.
- The excerpt contains a firsthand account of an experience with an owl, but the passage does not.
- Both the passage and the excerpt are written in an informative tone.
- The passage uses a persuasive tone while the excerpt does not.

Question #21

Imagine you are doing research to learn more about how owls capture their prey. Which of the following choices would be the BEST phrase to type into a search engine in order to get the most focused results?

- typical owl diet
- hunting skills of owls
- common prey animals
- owls daily food intake

Question #22

Imagine you are writing a report about long-term weather predictions. Choose the MOST reliable source for finding that information.

- a daily newspaper
- a science textbook
- an atlas
- an almanac

Question #23

Study the dictionary entry below.

institution (in(t)-stə-'tü-shən) *n.* **1.** a large organization, such as a college or hospital **2.** an organization that has been part of a community for a long time **3.** an established law or custom (the *institution* of marriage) **4.** a society founded for a social or religious purpose

Now read the following sentence.

After a few days at your first job, you will learn that the coffee break is an American institution.

Which definition of "institution" is used in this sentence?

- definition 1
- definition 2
- definition 3
- definition 4

Question #24

Read the following sentence.

- ignored
- befriended
- celebrated
- encircled
- surrounded

Question #25
Read the following sentence.

The sullen teenager was being very childish when she refused to eat dinner with her family.

Choose the word that has the same connotation as the underlined word.

- immature
- energetic
- lively
- forgetful

MO-ELA/Lit-Grade 8 Assessment - FEB

Use the following information for answering question(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

Benjamin Banneker: Scientist, Inventor, Author

Benjamin Banneker, America's first African American scientist, was hardly typical of his time. Benjamin was born in 1731 to parents descended from slaves. However, his parents were among the five percent of free black people living in Baltimore County, Maryland. And unlike most other free African Americans, they owned a small tobacco farm.

Benjamin's grandmother taught him to read, and he occasionally attended classes in a one-room country schoolhouse. But Benjamin was mostly self-educated, devouring books about literature, mathematics, and science. At age 15, Benjamin took over running the family farm. To increase its productivity, he invented an irrigation system consisting of canals and dams that brought water to the fields, even in times of drought. The farm flourished, and in his spare time Benjamin continued reading and tinkering with mechanical objects.

This woodcut portrait of Benjamin Banneker is from the title page of an almanac that he wrote in 1795.

At age 22, Banneker was intrigued by a friend's pocket watch, the first he'd seen. Banneker's friend gave him the watch to take apart and examine. Delighted, Banneker disassembled the watch and studied its workings. Banneker returned the watch and then -- *never having seen a clock* -- he created a working clock by carving wood pieces to create its components. The clock was accurate to the minute, and it had the distinction of being the first clock totally made in America. Banneker's clock greatly impressed community members and established Banneker's reputation as a clock expert. Banneker then started his own watch and clock repair business.

Banneker's lively intelligence and natural charm overcame many whites' prejudice against African Americans. As a result, he developed friendships with white people who shared his interest in science and mathematics. One white friend loaned Banneker a telescope and several books about astronomy. Working alone, Banneker mapped the position of the moon, planets, individual stars, and constellations. People reported that on many nights, Banneker could be found in his yard, observing the constellations as they moved across the heavens. Using his advanced mathematical abilities, he predicted a solar eclipse on April 14, 1789, more accurately than other scientists of his day.

Banneker's accomplishments were many. He tended beehives and wrote a scientific study about bees. He calculated the 17-year cycles of locusts, an insect that could destroy farmers' crops. He taught himself how to play the flute and violin.

In early 1791, Banneker agreed to help a white friend, Andrew Ellicott, survey a ten-square-mile section of land on which our nation's capital would be built. The project's architect, Pierre L'Enfant, had drawn up elaborate plans for avenues, open spaces, monuments, statues, and buildings. When politicians requested some changes to L'Enfant's design, he erupted in a fit of temper, and President George Washington fired him. L'Enfant took his plans with him, much to everyone's dismay. However, Banneker was able to recreate the plans from memory, and the capital's construction continued.

A few months later, Banneker returned to his farm and love of astronomy. He prepared tables showing the locations of planets, stars, and constellations throughout the seasons. Banneker published his findings in his own almanac, which also included essays and information about medicines, tides, and eclipses. He sent a copy of his almanac to Thomas Jefferson, who was then secretary of state. Thomas Jefferson was on record as having claimed that slavery was an evil, yet he owned 200 slaves. And in Jefferson's *Notes on the State of Virginia*, which had been published in 1785, Jefferson stated that blacks were less intelligent than whites. Banneker pointed out that the almanac was researched and written by a black man. Banneker suggested that Jefferson reconsider his racist notions about the inferiority of blacks.

Jefferson was impressed with Banneker's almanac and wrote to Banneker, "Nobody wishes more than I do to see such proofs as you exhibit, that nature has given to our black brethren, talents equal to those of the other colors of men, and that the appearance of a want of them is owing merely to the degraded condition of their existence." Jefferson went on to become the third president of the United States and signed a bill outlawing slave trade in an attempt to stop its spread.

Banneker continued to produce almanacs and to speak out against slavery, his accomplishments proof of what people of color could accomplish. Banneker's final years were spent on his farm, studying and entertaining friends and visitors. He never married and died peacefully in his sleep at age 74. The day after his burial, his home caught fire and burned to the ground. The clock he had invented perished in the blaze, never having lost a single minute of time in more than 50 years.

Question #1

Based on the passage you can infer that Benjamin Banneker's success was a direct result of his intense desire to know and understand things. Which TWO sentences from the passage best support this inference?

- The farm flourished, and in his spare time Benjamin continued reading and tinkering with mechanical objects.
- And unlike most other free African Americans, they owned a small tobacco farm.
- Working alone, Banneker mapped the position of the moon, planets, individual stars, and constellations.
- The clock he had invented perished in the blaze, never having lost a single minute of time in more than 50 years.
- At age 15, Benjamin took over running the family farm.

Question #2

How does the information in the passage about Banneker's interaction with Thomas Jefferson help the reader understand Banneker's life?

- It provides evidence of Banneker and Jefferson's shared interest in science and mathematics.
- It shows that Banneker's influence reached all the way to top political individuals.
- It emphasizes Banneker's writing skills.
- It explains how slavery was legally abolished.

Question #3

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

What is the organizational structure of this passage?

- compare and contrast
- descriptive
- problem and solution
- chronological sequence

Part B

Select TWO of the following choices that best describe how the organizational structure of the text contributes to meaning.

- The structure helps the reader understand why Banneker was discriminated against.
- The structure provides the reader with an overview of Banneker's life.
- The structure helps the reader visualize how the intricate wooden clock worked.
- The structure allows the reader to compare Banneker with other important men of his time.
- The structure helps the reader understand the events that led to Banneker's success in life.

Question #4

Read the following sentence from the passage.

Banneker returned the watch and then -- *never having seen a clock* -- he created a working clock by carving wood pieces to create its components.

What is the meaning of the word "components" as it is used in the sentence?

- parts of a larger whole
- a sturdy base on which to set a clock
- musical chimes
- minutes and seconds

Question #5

Imagine you are listening to a speaker giving a presentation on the topic of this passage. The speaker claims that Banneker was highly creative. Read the following excerpt from the passage, then click on the ONE piece of evidence from the excerpt that best supports this claim.

At age 22, Banneker was intrigued by a friend's pocket watch, the first he'd seen. Banneker's friend gave him the watch to take apart and examine. Delighted, Banneker disassembled the watch and studied its workings. Banneker returned the watch and then -- never having seen a clock -- he created a working clock by carving wood pieces to create its components. The clock was accurate to the minute, and it had the distinction of being the first clock totally made in

Question #6

Imagine you are giving a presentation on the topic of this passage and would like to add multimedia components to clarify information from the passage and add interest to your presentation. Which TWO components listed below would make the most sense to add to your presentation?

- a Venn diagram comparing and contrasting Banneker and Thomas Jefferson
- a map showing the many places Banneker traveled
- a timeline showing important events in Banneker's life
- a photograph of a one-room schoolhouse similar to the one Banneker attended
- a poster with drawings of Banneker's creations

Question #7

Imagine you are researching whether the irrigation system designed by Banneker was widely used. Which of the following choices would be the BEST phrase to type into a search engine to get the most focused results?

- reasons farmers irrigate their land
- irrigating the home garden using canals
- farm irrigation methods used in the 1700s
- tools needed to irrigate dry land

Question #8

Read the following sentences from the passage.

(1) He calculated the 17-year cycles of locusts, an insect that could destroy farmers' crops. (2) He taught himself how to play the flute and violin.

Imagine you are the author of this passage. You decide to add a word to the beginning of sentence 2 to connect the thoughts expressed in each sentence. Choose the word that BEST connects the sentences.

- Consequently,
- Additionally,
- Usually,
- Occasionally,

Question #9

Imagine you are writing an argumentative essay in which you claim that Benjamin Banneker was more intelligent and skilled than other men of his time even though he was mostly self-educated. Read the following excerpt from the passage. Then click on the phrase that you should quote in your essay to BEST support your claim.

Banneker's lively intelligence and natural charm overcame many whites' prejudice against African Americans. As a result, he developed friendships with white people who shared his interest in science and mathematics. One white friend loaned Banneker a telescope and several books about astronomy. Working alone, Banneker mapped the position of the moon, planets, individual stars, and constellations. People reported that on many nights, Banneker could be found in his yard, observing the constellations as they moved across the heavens. Using his advanced mathematical abilities, he predicted a

Question #10

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

Which of the following choices BEST states the main idea of the passage?

- Benjamin Banneker was an intelligent and creative African American man who made many important contributions to society, such as developing innovative inventions and influencing others to recognize the problems of discrimination and slavery.
- Benjamin Banneker studied a friend's pocket watch and was then able to construct a working clock that was so accurate it hadn't lost a single minute's time even at Banneker's death.
- Benjamin Banneker was one of the few free black men of his day and he learned to read without having a formal education, only occasionally attending a one-room schoolhouse.
- Benjamin Banneker was the most influential man in America during the 1700s, and without him, discrimination and slavery might not have been addressed.

Part B

Read the following sentences from the passage. Then select the TWO that together best support the development of the main idea selected in Part A.

- Benjamin's grandmother taught him to read, and he occasionally attended classes in a one-room country schoolhouse.
- To increase its productivity, he invented an irrigation system consisting of canals and dams that brought water to the fields, even in times of drought.
- One white friend loaned Banneker a telescope and several books about astronomy.
- Banneker suggested that Jefferson reconsider his racist notions about the inferiority of blacks.
- However, his parents were among the five percent of free black people living in Baltimore County, Maryland.

Question #11

Imagine you are writing an essay and you want to use information from the following excerpt from the passage.

At age 22, Banneker was intrigued by a friend's pocket watch, the first he'd seen. Banneker's friend gave him the watch to take apart and examine. Delighted, Banneker disassembled the watch and studied its workings. Banneker returned the watch and then -- never having seen a clock -- he created a working clock by carving wood pieces to create its components. The clock was accurate to the minute, and it had the distinction of being the first clock totally made in America. Banneker's clock greatly impressed community members and established Banneker's reputation as a clock expert. Banneker then started his own watch and clock repair business.

Which choice below shows the BEST way to paraphrase this information for your essay while avoiding plagiarism?

- Benjamin Banneker once constructed a clock made of hand-cut wooden pieces. The clock was accurate to the minute, and it had the distinction of being the first clock totally made in America. Banneker's clock greatly impressed community members and established Banneker's reputation as a clock expert.
- Banneker once studied a watch that belonged to a friend. Banneker returned the watch and then -- never having seen a clock -- he created a working clock by carving wood pieces to create its components. The clock was accurate to the minute, and it had the distinction of being the first clock totally made in America.
- Benjamin Banneker took apart a watch belonging to a friend, studied it and then reassembled it. From this experience alone he was able to build a clock that worked precisely. The clock was very accurate and helped Banneker start his own watch and clock repair business.
- Banneker was much smarter and more creative than other inventors. He was able to build an accurate clock after studying one pocket watch. Because of this, he deserves more attention than he has gotten in the past.

Question #12

Imagine you have written a paragraph about a time you went shopping with a friend. Read the rough draft of your paragraph below.

My friend, Mirette, had been saving for months to buy her own prom dress. We were both excited when we heard that a local dress shop was having a huge sale. On Saturday, Mirette and I went to the store and found a long line of waiting customers frantic to get a good deal on the dress of their dreams. Mirette waited patiently for her turn, but patience was not shown by some of the other customers.

One of the sentences in your rough draft contains an error. Select the answer choice below that shows the proper way to revise the incorrect sentence.

- My friend, Mirette, she had been saving for months to buy her own prom dress.
- We were both excited when we both heard that a local dress shop was having a huge sale.
- On Saturday, Mirette and I, we went to the store and found a long line of waiting customers frantic to get a good deal on the dress of their dreams.
- Mirette waited patiently for her turn, but some of the other customers did not show patience.

Question #13

Imagine you have written a narrative about your pet. As you are editing you notice an error in punctuation. Which choice below shows the correct way to write the sentence?

- Many families choose to have a cat or dog in their home, however, we have a pot-bellied pig.
- Many families choose to have a cat or dog in their home; however, we have a pot-bellied pig.
- Many families choose to have a cat or dog in their home—however, we have a pot-bellied pig.
- Many families choose to have a cat or dog in their home: however, we have a pot-bellied pig.

Question #14

Imagine you are writing a narrative essay about a frightening experience. Read the following excerpt from your rough draft.

As my friends and I left the school building, we had no clue that we were about to be part of a frightening event. As we were about to step off the curb into the usually quiet street in front of the building, we heard a loud noise coming from far away. Before we knew it, a car drove right past us. We all jumped back and gasped at the close call we had just encountered.

Which choice below shows the BEST way to revise the underlined sentence to include precise language, without changing the meaning of the sentence?

- A car drove right past us before we even knew what happened.
- We saw the bright red car with gleaming metallic wheels and a thick black racing stripe on our street.
- Before we knew what happened, a black car sped past us so close it almost hit us.
- Before we knew it, a red car drove quickly past us.

Use the following information for answering question(s): 15, 16, 17, 18, 19, 20

On the Orphan Train

From 1854 to 1929, thousands of orphaned and homeless children roamed East Coast cities. Charitable institutions, desperate to find adoptive families for the children, put about 200,000 children on "orphan trains" bound for distant rural areas. At each train stop, children got off the train so people could adopt them. Those not chosen got back on the train and rode to the next stop.

I stared out the train window at vast green hills and a cloudless blue sky. Four days previously, I had never been outside of New York City or seen open land. My five-year-old sister, Maddie, and I had been orphans living on the street until police relocated us to an orphanage. There we received actual baths, hot food, and clean clothing. Then the orphanage lady put us on the "orphan train," promising that it was our destiny to have better lives somewhere else.

On the seat next to me, Maddie squirmed and anxiously asked, "Charlie, will the next town be different?" Her frightened, whispery voice barely rose above the train's clacking wheels.

I looked down at Maddie's pale, thin face and confidently replied, "We'll just look and act like normal kids, and eventually someone will choose us."

Actually, I doubted that anyone would fancy us. Thus far, people adopted orphans who were either robust boys, big and strong enough to work long hours doing farm labor, or charming tots. At 14, I was thin and gangly. Maddie was sickly and so timid that she was speechless around strangers. Only one person had taken an interest in either of us, and that was two stops back: An unwashed man who smelled like garbage and wanted to examine Maddie's teeth, so he tried to pry open her mouth with his filthy hands. In an uncommon act of defiance, the usually obedient Maddie bit down on his finger.

The train wheels clacked on, the calm shattered by Roscoe's rough voice bellowing "Hey, Charlie!" from the other end of the train car. I pretended not to hear him. Roscoe was a big, muscular kid, about sixteen years old, and the orphanage bully. He'd paw through orphans' meager possessions and steal whatever he wanted, and anyone protesting his actions would get punched in the stomach. Roscoe was getting off at the next stop because a farmer there had prearranged to adopt him.

The train whistle blew, and the wheels screeched to a stop. I hustled Maddie outside so we could be at the front of the train platform. I pasted a smile on my face and protectively hugged trembling Maddie close to me. Adults assembled around us and pointed at us as if we were jungle animals in the Bronx Zoo. A woman nudged her husband and pointed to a red-faced man at the rear of the crowd. "There's Gus, here to adopt another boy. He worked that last boy like a mule until he finally ran off."

Gus shoved his way toward the platform and shouted, "Anyone named 'Roscoe' here?" Roscoe muscled me aside, giving me a self-satisfied smirk as he passed to join the man who would adopt him.

In the half hour that followed, many orphans found homes, but no one took much interest in Maddie and me. We were about to get back on the train when an older couple approached us. The slender man wore a clean white shirt and dark trousers. The pretty, rosy-cheeked woman with him sported a ruffled pink dress, ironed to crisp perfection.

In a gentle voice, the man politely enquired, "What's your name, young man?"

I found out that the couple's names were Daniel and Mary Thomson, and they owned the largest store in town. Mary claimed they had always wanted children but were never blessed with any. Maddie gave them a rare dimpled smile and proposed, "You could adopt us!"

Mary crouched down to Maddie's eye level and noted, "Now that you mention it, I've always wanted a sweet little girl just like you, and a handsome boy like your brother." And with that, Maddie and I descended from the platform and strolled home, arm in arm, with our new parents.

Question #15

Read the following excerpt from the passage.

"There's Gus, here to adopt another boy. He worked that last boy like a mule until he finally ran off."

What does the author mean when he says, "worked that last boy like a mule"? Select the TWO best answers.

- Gus made the boy work very hard.
- Gus made the boy work while riding a mule.
- Gus was not happy that the boy avoided work.
- Gus made the boy work for a long time.
- Gus made the boy feed the mules.

Question #16

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

Why do authors use imagery in their writing?

- to add rhythm and meter so the text sounds better when read aloud
- to make reference to a figure, place, or event outside of the text
- to create visual representations that appeal to our physical senses
- to give human qualities to a thing, an idea, or an animal

Part B

Read the following excerpt from the passage. Then click on TWO sentences or phrases that best demonstrate the author's use of imagery.

In the half hour that followed, many orphans found homes, but no one took much interest in Maddie and me. We were about to get back on the train when an older couple approached us. The slender man wore a clean white shirt and dark trousers. The pretty, rosy-cheeked woman with him sported a ruffled pink dress, ironed to crisp perfection.

In a gentle voice, the man politely enquired, "What's your name, young man?"

Question #17

How does the author's use of sequential text structure add to the meaning of the passage?

- The structure helps the author provide vivid details of the setting.
- The structure helps the author keep important details hidden until the end of the story.
- The structure helps the reader compare and contrast orphan life with family life.
- The structure helps the reader understand that finding a new family can be a long process.

Question #18

Based on the passage, the reader can infer that some people viewed the orphans they adopted only as servants. Read the excerpt from the passage below and click on ONE piece of evidence that most clearly supports this inference.

The train whistle blew, and the wheels screeched to a stop. I hustled Maddie outside so we could be at the front of the train platform. I pasted a smile on my face and protectively hugged trembling Maddie close to me. Adults assembled around us and pointed at us as if we were jungle animals in the Bronx Zoo. A woman nudged her husband and pointed to a red-faced man at the rear of the crowd. "There's Gus, here to adopt another boy. He worked that last boy like a mule

Question #19

Imagine you and your classmates are analyzing this passage during a discussion. Read the following ideas that were brought up during the discussion and select the one that is BEST supported by the passage.

- Charlie and Maddie must have been relieved to be adopted by a nice family.
- Orphans should have been able to stay in the city in which they were born.
- Orphanage bullies should be punished so they stop hurting the younger children.
- Train rides seem like a relaxing and scenic way to get to a destination.

Question #20

Imagine you are conducting research about the orphan train. Which choice below would be the most reliable source for finding relevant information?

a collection of poems about life as an orphan in the late 1800s

- an online encyclopedia entry about the history of trains
- a current map of orphanages located in the United States
- a research article documenting the challenges faced by orphans in the late 1800s

Question #21

Imagine you are writing an informative essay about feeding wild birds in the winter. You want to present the idea that you should put out birdseed for multiple species of birds. Which TWO pieces of evidence below should you include in your essay to best support your idea?

- The bright red cardinals have been known to consume a large amount of birdseed, so it is crucial to put out enough.
- By attracting many different types of birds, you will enjoy a colorful show around your bird feeder every day.
- Since feeding wild birds increases their population, it is important to supply different types of birdseed to support all the wild birds in your area.
- It is necessary to maintain a clean supply of birdseed that is dry and free from mold, along with a fresh clean water source.
- When purchasing bird feeders and a birdbath, make sure to buy quality products that will last through all types of weather.

Question #22

Read the following sentences.

I was leaving my room late one night for a quick snack when I heard an unusual noise in the hallway. My feet were frozen in place as I listened carefully to figure out what it was.

How does the use of the phrase "frozen in place" add meaning to the sentences?

- It tells the reader that the temperature in the hallway is much colder than in the bedroom.
- It tells the reader that the author is trying to find a snack quickly.
- It tells the reader that the noises are coming from the freezer.
- It tells the reader that the author doesn't want to move because he is afraid.

Question #23

Imagine you are conducting research to determine how to write your first resume. Select the TWO sources below that would be the most credible.

- a social media post written by your friend about how his great resume helped him get hired immediately
- an advertisement for a company that creates professional-looking resumes

- a chapter from a life skills book titled "The Three Most Important Elements of a Resume"
- a pamphlet from the local employment office titled "Creating an Effective Resume"

Question #24

Study the dictionary entry below.

bore (bôr) *v.* 1. to make a hole 2. to make tired and restless by being uninteresting *n.* 3. the hollow part inside a tube, especially a gun barrel 4. a person whose talk or behavior is dull

Now read the following sentence.

The fruit fly uses sharp mouthparts to bore into the skin of the fruit so it can consume the juices inside.

Which definition of the word "bore" is used above?

- definition 1
- definition 2
- definition 3
- definition 4

Question #25

Use the passage to answer the following questions. Be sure to answer both parts.

Part A

Read the following paragraph. Then click on the sentence that contains personification.

The crisp air smelled of fresh evergreen mixed with hints of toasted marshmallows. The sky was so clear we could see the stars winking down at us as we devoured toasted marshmallows and greedily licked our fingers. I felt cozy wrapped in a flannel blanket sitting beside the warm fire. I was thoroughly enjoying the first night of my first camping trip and hoped it was only the beginning of many more camping adventures to come.

Part B

Which sentence below BEST explains the personification in Part A?

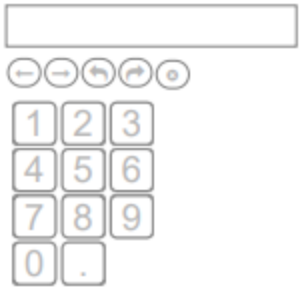
- The author is enjoying the fragrant smells in the air.
- The twinkling light of the stars makes them appear to be winking.
- The author wanted to express how warm and cozy it was at the campsite.
- The marshmallows not only taste good, but they also smell delicious.

MO-Mathematics-Grade 6 Assessment - FEB

Question #1

Find the quotient.

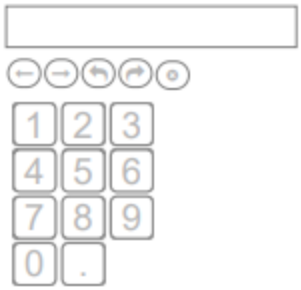
$18\overline{)396}$



Question #2

Multiply.

$3.79 \times 8.4 = \square$



Question #3

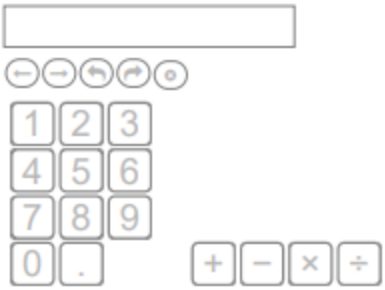
Complete the expression below to create an expression equal to 72 + 45.

(8 + 5)

Question #4

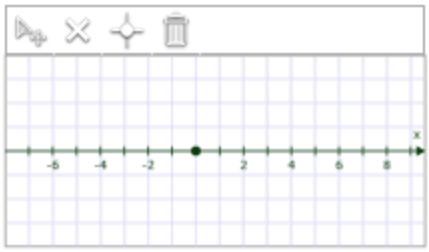
The support for a bridge has its base 83 feet below the surface of a river and its highest point 214 feet above the river's surface.

If an engineer uses the numeral 214 to represent the elevation of the bridge support's highest point with respect to the river's surface, what numeral should the engineer use to represent the elevation of the bridge support's base with respect to the river's surface?



Question #5

Plot the points for the values -6, 4, and -3 on the number line below.



Question #6

Poppy would like to buy a new keyboard that costs $157. She has saved $93 from her part-time job, and $21 from babysitting her cousin last week.

Write an inequality which shows how much Poppy still needs to save in order to buy the keyboard.

$x \geq \$$ ____

Question #7

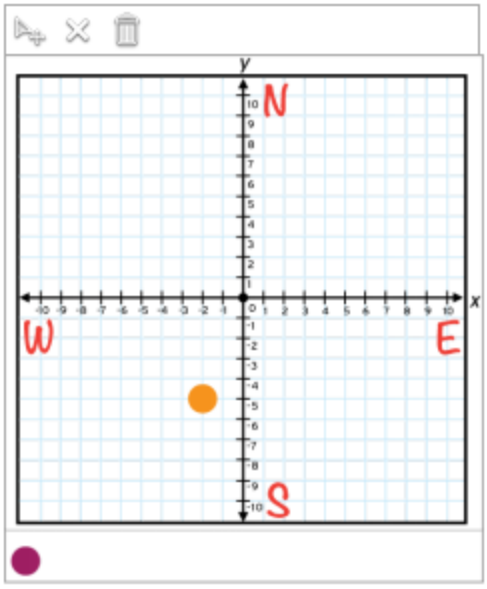
Select the value(s) below with an absolute value of 2.

- -4
- -2
- 4
- 2
- 6

Question #8

James is the fire chief. He is planning the emergency route to the hospital from the local middle school on the coordinate plane. He uses the axes to represent north (*N*), south (*S*), east (*E*), and west (*W*). Each unit on the graph represents one block.

James places an orange dot to represent the middle school at (-2, -5). The hospital is 8 blocks north and 7 blocks east of the school. Drag and drop the purple dot to the location that James should place the hospital.



Question #9

Complete the sentence by dragging the words below.

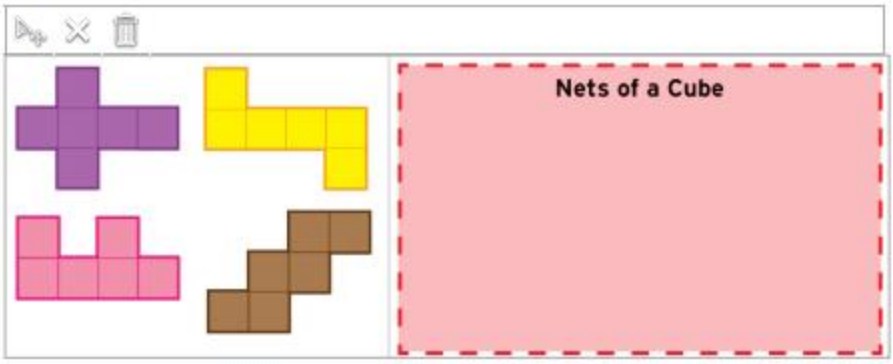
$$\frac{8x}{2}=12$$

In the given equation 8 is a _____ and 12 is a _____.

product	variable	sum
base	coefficient	difference
quotient		

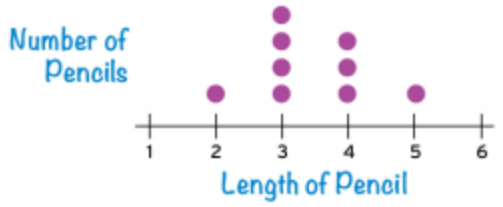
Question #10

Drag the net(s) of a cube into the box labeled "Nets of a Cube."



Question #11

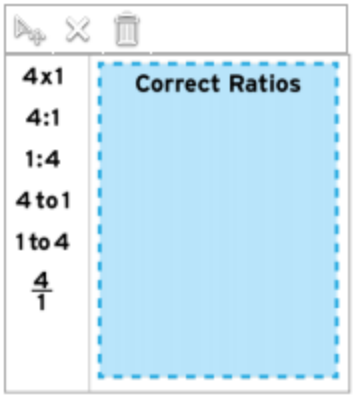
Jack measured the length of each pencil in his desk. He created a dot plot to show his data, but unfortunately, he forgot to label the units. Which units would best describe the data in Jack's dot plot?



- yards
- feet
- inches
- meters

Question #12

When Carly makes chili she uses 8 cans of beans for every 2 batches of chili. Drag the ratios that correctly represent this relationship into the box on the right.

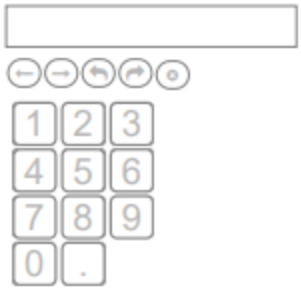


Question #13

Mikayla is reading her science textbook for school. She reads 16 pages every 12 minutes. At this rate, how many minutes will it take Mikayla to read 128 pages?

It will take Mikayla _____ minutes to read 128 pages at this rate.

Ryan's window is 3 meters wide. How many inches wide is Ryan's window? Use a ratio to find the solution. (Use 39.37 inches = 1 meter)



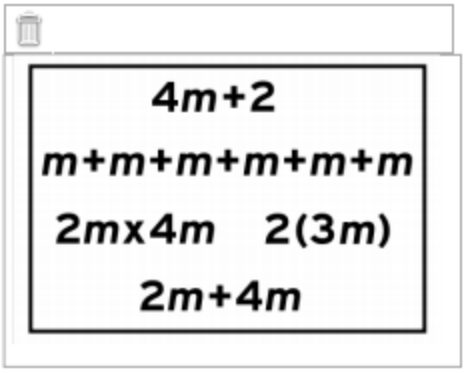
Question #15

Simplify the expression.

$30 - 4^2 \div 2$

Question #16

Click on the expressions below that are equivalent to 6*m*.



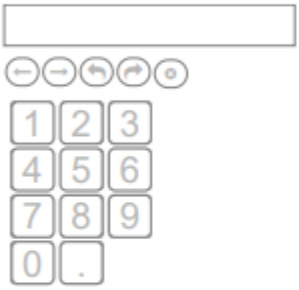
Question #17

Select the numbers below that make the inequality $5 > 3x$ true.

- $x = 0$
- $x = 1$
- $x = 2$
- $x = 3$
- $x = 4$

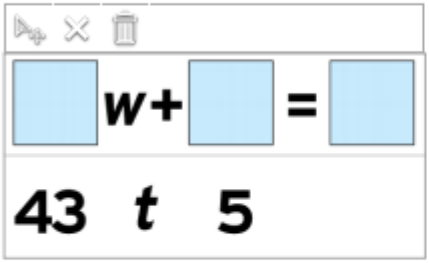
Question #18

Seth enjoys hiking to the observation point at the top of Mt. Blue. The hike is 19 miles long. To calculate the number of times he hiked to the observation point, Seth used the equation $19h = 627$, where h represents the number of hikes he completed to the observation point. If Seth hiked a total of 627 miles to the observation point last year, how many times did Seth hike to the observation point?



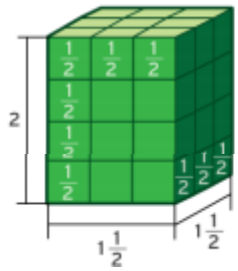
Question #19

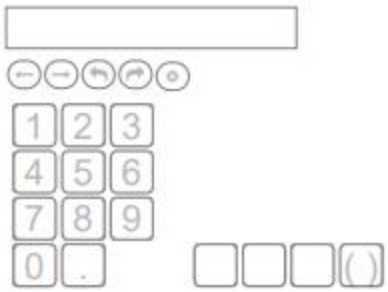
George is saving money to buy a new video game. He has $43 and earns an additional $5 every week for completing his chores. Drag and drop the values to create an equation to represent the total amount of money, t, he has after w weeks.



Question #20

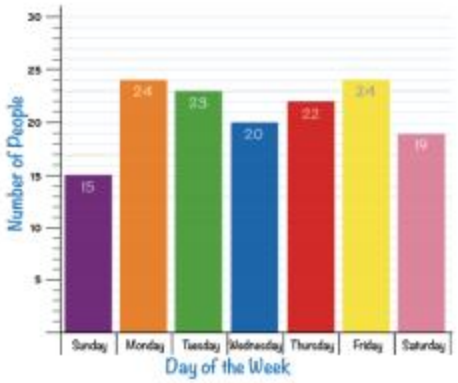
What is the volume, in cubic units, of the rectangular prism below? Express the answer as a mixed number in lowest terms.





Question #21

The graph below shows the number of people who attended yoga classes at the local gym each day over the course of a week.



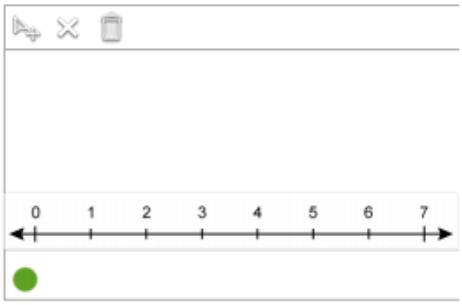
What is the mean number of people who went to yoga each day?

What is the mean number of people who went to yoga each day?

Question #22

Joe is a dentist. He recorded the number of cavities that his patients had before the age of 10 in the tally chart below. Create a dot plot to represent the data by dragging the dots to the chart.

Number of Cavities	Tally
Zero	///
One	///
Two	//
Three	
Four	/
Five	/

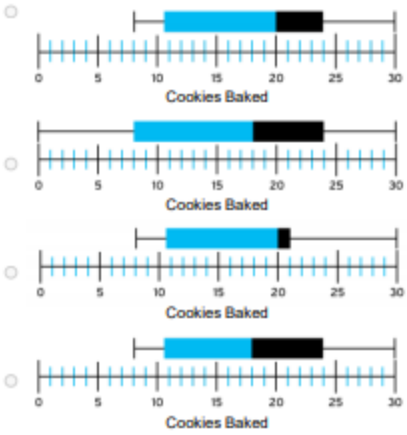


Question #23

Ed baked cookies for his school's bake sale. The list shows the number of cookies that were in each batch that Ed baked.

11, 10, 24, 8, 20, 24, 30, 12, 23

Which box-and-whisker plot correctly displays the information?



Question #24

Julie read 70 pages. This was 40% of the pages in a book. How many pages are in the book?

1 2 3
4 5 6
7 8 9
0 .

Question #25

Becca mixes her own perfume. In a typical batch, she uses 0.3 ounces more lavender oil than rose oil and 0.2 ounces more rose oil than sandalwood oil.

Part A

Veronica knows Becca used 1.1 ounces of rose oil when making a batch of perfume.

To find how much lavender oil she used, Veronica wrote the following equation, with x representing the ounces of lavender oil Becca used, and solved it as shown.

$$x + 0.3 = 1.1$$

$-0.3 \quad -0.3$

$x = 0.8$

Which evaluation of Veronica's work is true?

- Veronica set up her equation correctly and solved it correctly. Becca used 0.8 ounces of lavender oil.
- Veronica set up her equation correctly but made an error when solving. Becca used 1.4 ounces of lavender oil.
- Veronica should have solved $x - 0.3 = 1.1$. Becca used 0.8 ounces of lavender oil.
- Veronica should have solved $x - 0.3 = 1.1$. Becca used 1.4 ounces of lavender oil.

Part B

Enter the numerals needed to rewrite 0.3 and 0.2 as fractions in lowest terms.

0.3 is ____/____, and 0.2 is ____/____.

Part C

Becca also likes to add vanilla and lemon oil to her perfume. She adds 3 drops of vanilla for each drop of lemon oil, and 2 drops of lemon oil for each cup of perfume she makes.

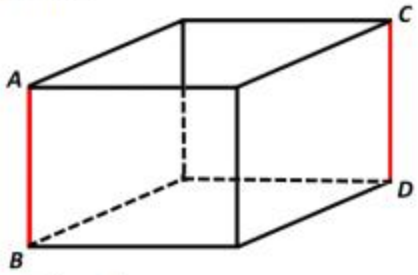
Complete the statements to make them true.

An equation for the number of drops of vanilla, *v*, that Becca adds to her perfume, in terms of the number of cups, *c*, she makes is *v* = ____ *c*. The independent variable in this situation is ____ and the dependent variable is ____.

MO-Mathematics-Grade 7 Assessment - FEB

Question #1

What is the shape of the cross-section formed when the rectangular prism pictured below is cut by a plane passing through the two red edges, *AB* and *CD*?



- a trapezoid
- a rectangle
- a triangle
- a hexagon

Question #2

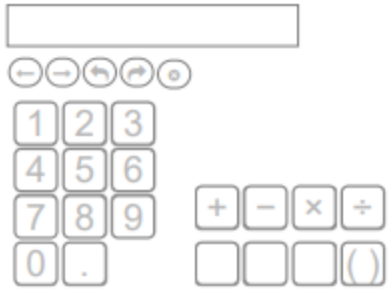
What is the value of the expression below? If entering the value as a fraction or mixed number, give the answer in lowest terms.

$$-0.1+\left(-\frac{3}{5}\right)+1.95-\left(-\frac{1}{2}\right)$$

Question #3

What is the value of the expression?

$\left(-\frac{3}{10}\right) \div (-0.5)$



Question #4

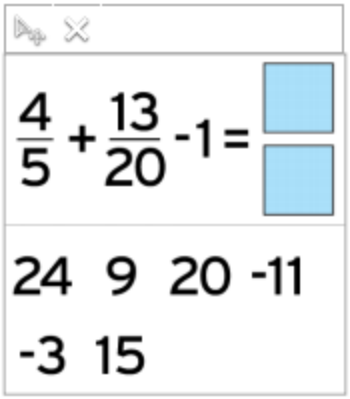
What is the quotient?

$732.7 \div 3.4 = \square$

- 2,155
- 215.5
- 21.55
- 2.155

Question #5

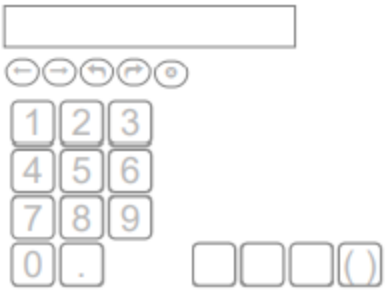
Drag the correct values to complete the equation.



Question #6

Simplify.

$\frac{3}{4} + \frac{5}{8} - (-7)$



Question #7

Jared believes $\frac{\pi}{4}$ is a rational number. Bethany says it is not rational.

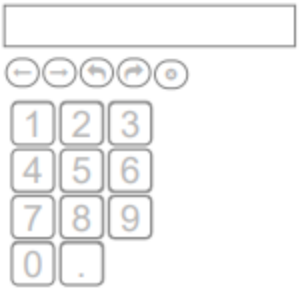
Who is correct and why?

- Jared is correct because $\frac{\pi}{4}$ is a fraction.
- Jared is correct because $\frac{\pi}{4}$ is not an integer.
- Bethany is correct because $\frac{\pi}{4}$ cannot be rewritten as the quotient of two integers.
- Bethany is correct because $\frac{\pi}{4}$ cannot be rewritten as a single integer.

Question #8

Simplify the expression.

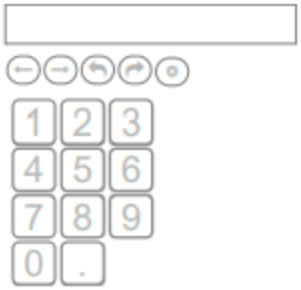
$2 + 0.75(16 + 20) - 0.9 \times 3$



Question #9

Hector paid $12 for 6 pastries. He wants to create an equation in the form $c = \square p$, to represent the total cost, c, to buy p pastries.

What number should Hector put in the square to complete his equation?

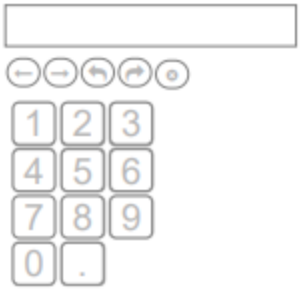


Question #10

The table below shows the costs of different quantities of hot dogs at a stadium.

Number of Hot Dogs	Total Cost (Dollars)
2	6.30
4	12.60
6	18.90

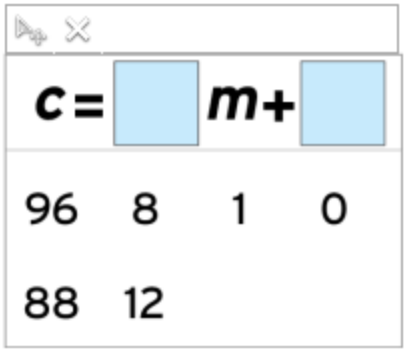
The total cost is directly proportional to the number of hot dogs bought. What is the constant of proportionality?



Question #11

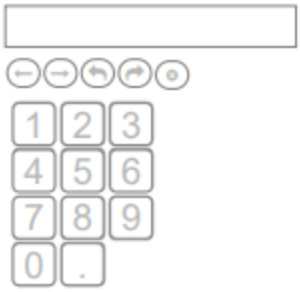
Jordan burned 96 calories walking on a treadmill for 8 minutes. He knows the total number of calories burned jogging on a treadmill is proportional to the number of minutes spent walking and wants to create an equation that can be used to predict the number of calories he will burn for any amount of time spent walking on the treadmill.

Drag the correct values to create an equation which will accurately represent the total number of calories, *c*, Jordan should expect to burn if he walks on the treadmill for *m* minutes.



Question #12

A plane flew 732 miles in $1\frac{1}{2}$ hours. If the plane continued to fly at the same rate, how many miles did it fly in 4 hours?

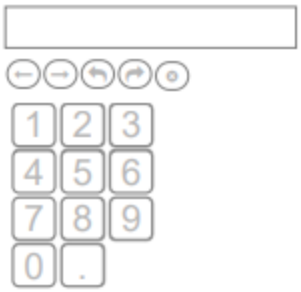


Question #13

Mrs. Kimpton had the students in her crafts class sew pillows. She inspected each pillow to make sure it was satisfactory before accepting it as complete.

After the first inspection, she accepted 25% of the pillows as complete, and asked the rest of the students to make corrections. On her next inspection, she accepted 75% of those that remained.

If there are 32 students in the class, how many pillows has Mrs. Kimpton accepted after two inspections?



Question #14

At a roller rink, customers can rent a set of traditional roller skates for $5.85 or a set of inline skates for $7.35. The rink adds a cleaning fee equal to 12% of the total cost of a rental. Which expressions represent the total amount a family will have to pay to rent t sets of traditional skates and r sets of inline skates? Select all that apply.

- $1.12\,(5.85t + 7.35r)$
- $5.85t + 7.35r + 0.12(t + r)$
- $t + r + 0.12(5.85t + 7.35r)$
- $5.85t + 7.35r + 0.12(5.85t + 7.35r)$
- $(5.85 + 7.35 + 0.12)(t + r)$
- $5.85(1.12t) + 7.35(1.12r)$

Question #15

Heather is playing a video game, and she needs to earn at least 1,200 points to advance to the next level.

She has already earned 720 points, and she will earn 16 points for each key she finds in the game.

Set up and solve the inequality that represents this situation.

Let k represent the number of keys Heather finds in the video game.

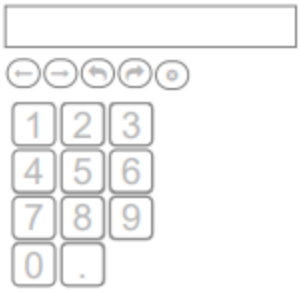
The inequality that represents this situation is select ≥ select .

The solution is $k \geq$ [ ], which means that Heather must find at least [ ] keys to advance to the next level in the video game.

Question #16

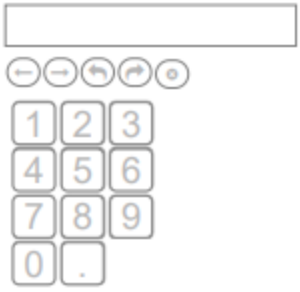
Wadia played a game with a six-sided cube numbered 1 through 6 as shown below.

If Wadia rolled the number cube 450 times, approximately how many times can she expect to roll a 5 or a 6?



Question #17

Gwen works at a pizzeria. She can make $\frac{1}{2}$ of a pizza in $\frac{1}{24}$ of an hour. If she continues to work at the same rate, how many pizzas can Gwen make in an hour?



Question #18

Barry wants to rent furniture for his new apartment. The cost of the furniture rental is $120 each month. There is also a one-time delivery fee of $250. Which equation can be used to model the total cost, *c*, of furniture rental for *m* months?

- $c = 250 - 120m$
- $c = 120 + 250m$
- $c = 120m + 250$
- $m = 250 - c$

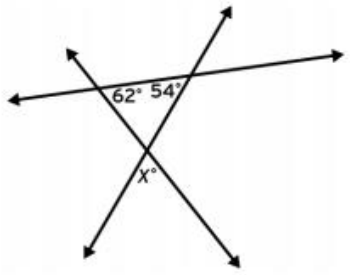
Question #19

Alessandra is having a dinner party. She calculates that each meal will cost $13.00 a person. She has an $85 budget for her party. Which inequality represents the number of people, *p*, Alessandra can invite to her dinner party without going over her $85.00 budget?

- $13p > 85$
- $13p < 85$
- $13p \leq 85$
- $13p \geq 85$

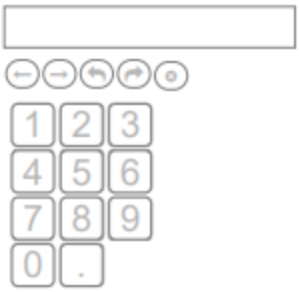
Question #20

What is the value of *x* in this figure?



Question #21

The value of Matt's comic book collection has increased in value by 5% since last year. If the value of his collection was *c* dollars last year, what number should Matt multiply by *c* to find the value of his collection now?



Question #22

On Saturday 840 people attended an Outdoor Sports Expo. Frank surveyed 40 of the attendees to learn their favorite sport. The results of his survey are shown in the table below.

Sport	Number of Responses
Cycling	7
Swimming	11
Running	13
Skiing	9

Based on his data, which conclusion(s) below can Frank make about all of the attendees at the Outdoor Sports Expo?

- about 231 people like swimming the best
- about 70 people like cycling the best
- about 9 people like skiing the best
- twice as many people like running the best compared to skiing
- more than half of the attendees like either swimming or running the best

Question #23

When Mason goes to the gym, he spends $\frac{1}{2}$ of an hour lifting weights and $\frac{1}{3}$ of an hour on the treadmill.

Which are correct descriptions of the relationship of time Mason spends lifting weights and on the treadmill. Select all that apply.

- Mason spends $\frac{2}{3}$ of an hour on the treadmill per hour spent lifting weights.
- Mason spends $\frac{2}{3}$ of an hour lifting weights per hour spent on the treadmill.
- Mason spends $\frac{3}{2}$ hours on the treadmill per hour spent lifting weights.
- Mason spends $\frac{3}{2}$ hours lifting weights per hour spent on the treadmill.
- Mason spends $\frac{1}{6}$ of an hour on the treadmill per hour spent lifting weights.
- Mason spends $\frac{1}{6}$ of an hour lifting weights per hour spent on the treadmill.

Question #24

Peter wants to buy a flower arrangement from the florist where he works. He has a coupon for 5% off the regular price of the arrangement. Because he works in the store, Peter will get an employee discount of 15% off the price after the coupon is applied.

To figure out how much he will pay for a flower arrangment that normally costs $40, Peter finds 20% of 40 and subtracts that from $40.

Complete the sentences to make them true.

The amount Peter's calculations say he will pay for the flower arrangement is select . He will

Question #25
Use the number cube and the bag of marbles below to answer all three parts of the question.

The number cube is labeled 1-6, and the bag contains 4 blue marbles, 4 green marbles, and 2 orange marbles.

Part A

If the cube is rolled and a marble is drawn from the bag at random, what is the probability the cube will land on an even number and a green marble will be drawn? Express the answer as a decimal.

The probability of the cube landing on an even number and a green marble being drawn is .

Part B

A student wants to identify all of the different combinations that they can get when rolling the number cube and drawing a marble at random. Which method(s) can they use?

- There is no way to determine all of the possible combinations.
- Create a table of all of the possible outcomes.
- Roll the number cube and draw a marble ten times and list the outcomes.
- Construct a tree diagram to find all of the possible outcomes.
- Create an organized list of all of the possible outcomes.

Part C

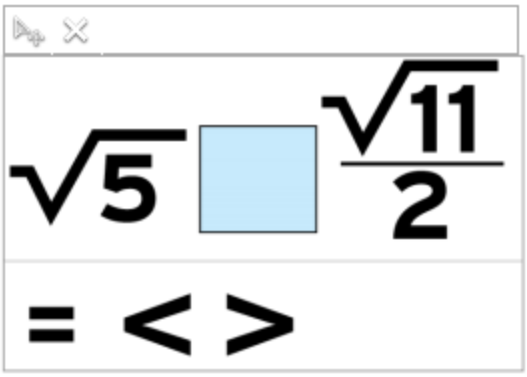
Elijah has 6 different pairs of pants, 4 blue shirts, 4 green shirts, and 2 orange shirts in his closet. He assigned each number on the number cube to a pair of pants and each marble in the bag to a shirt of the corresponding color. If Elijah is wearing an orange shirt, what is the probability of Elijah rolling the cube and drawing a marble from the bag, resulting in the pant and shirt combination he is wearing at that moment? Express the answer as a decimal rounded to the nearest thousandth.

The probability of Elijah getting the same results as the pants and orange shirt he is wearing is

MO-Mathematics-Grade 8 Assessment - FEB

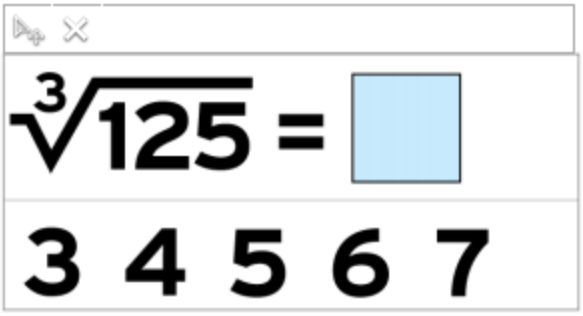
Question #1

Compare the irrational numbers below by dragging the correct symbol in the box.



Question #2

Evaluate the cube root below and drag the correct answer in the box.



Question #3

Jeremy is comparing the distances traveled by two satellites since their launch. He estimates the Orion satellite has traveled 6×10^9 kilometers. Jeremy estimates the Zeus satellite has traveled 3×10^{10} kilometers.

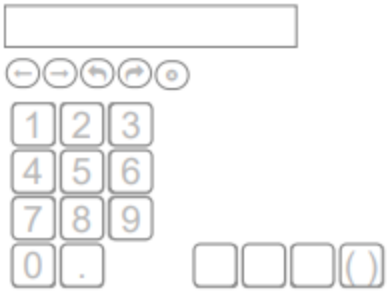
Complete the sentence to make it true.

According to Jeremy's estimates, the select satellite has traveled select times as far as the select satellite.

Question #4

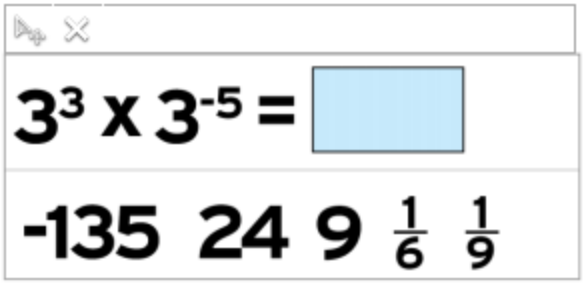
Vince evaluated $\sqrt[3]{27}$. Marta evaluated $\sqrt{64}$. Amber took Vince's and Marta's answers and added them together.

What was Amber's sum?



Question #5

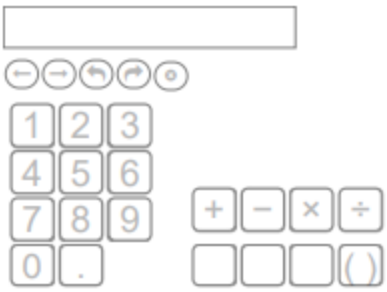
Simplify the expression below and drag the correct answer into the box.



Question #6

Simplify. Express the answer in scientific notation.

$(1.104 \times 10^{-4}) \div (4.6 \times 10^{-2})$



Question #7

Simplify.

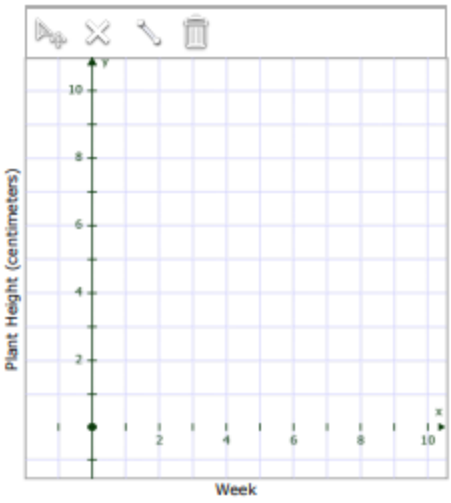
$5^{-2} \times \left(5^{-2}\right)^2 = ?$

- $\frac{1}{25}$
- 25
- $\frac{1}{15,625}$
- 390,625

Question #8

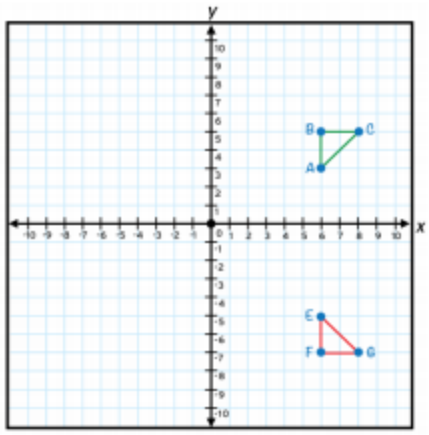
Amy planted a plant seed for her science project, and then measured the growth of her plant over a three week period. By the end of the first week her plant was 5 centimeters tall. At the end of the second week her plant had grown an additional two centimeters. Finally, by the end of the third week her plant had grown an additional 3 centimeters.

Draw a graph to model the situation, provided Amy's plant grew at the same rate throughout each week. Note: The graph should be drawn in 3 sections, one for each week that Amy measured her plant.



Question #9

In the diagram below, $\triangle CBA$ was reflected across the x-axis and translated 2 units down. The resulting image is $\triangle GFE$.

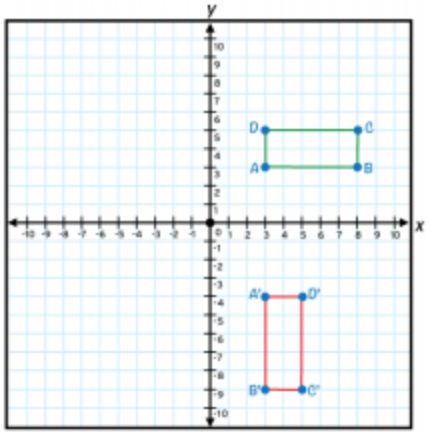


How does $\angle CBA$ compare to $\angle GFE$?

- $\angle CBA$ is larger than $\angle GFE$.
- $\angle CBA$ is congruent to $\angle GFE$.
- $\angle CBA$ is smaller than $\angle GFE$.
- There is not enough information to determine a relationship between $\angle CBA$ and $\angle GFE$.

Question #10

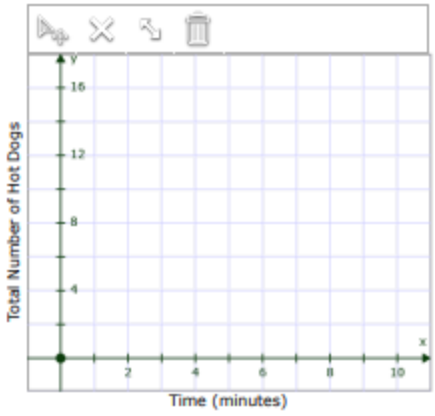
Which two transformations of rectangle *ABCD* result in the image *A'B'C'D'*?



- a reflection over the *x*-axis and a rotation of 90° about the origin clockwise
- a rotation of 90° about the origin clockwise and a translation 1 unit down
- a rotation of 90° clockwise about the origin and a translation 1 unit up
- a translation 1 unit right and a 180° counterclockwise rotation about the origin

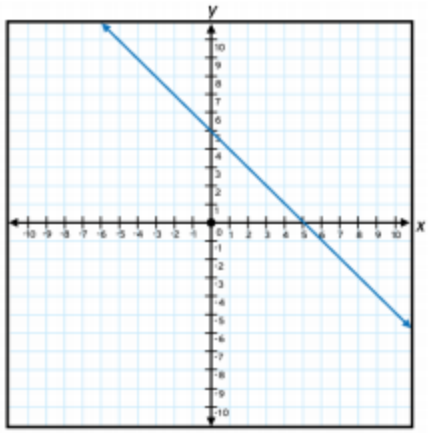
Question #11

The winner of the hot dog eating contest ate 4 hotdogs every minute. Create a graph that shows the relationship between time and the number of hot dogs the winner ate if she continued to eat the hot dogs at the same rate.



Question #12

Complete the equation for the graph below.



The equation is $y =$ select $x +$ select .

Question #13

Solve the equation below for x.

$$\frac{1}{3}(3x + 9) = 60$$

Question #14

Solve the following system of equations algebraically.

$3x + 2y = 25$
$y = 15 - 2x$

$x =$ ☐ and $y =$ ☐

Question #15

The local internet company charges $28 per hour during the day and $9.50 per hour at night. Esther paid $552 for 25 hours of use. The system of equations that represents this scenario is shown below, where d is the number of daytime hours and n is the number of nighttime hours. How many daytime hours and nighttime hours was Esther charged for?

$28d + 9.50n = 552$

$d + n = 25$

- ○ 21 daytime hours and 4 nighttime hours
- ○ 8 daytime hours and 17 nighttime hours
- ○ 17 daytime hours and 8 nighttime hours
- ○ 12 daytime hours and 13 nighttime hours

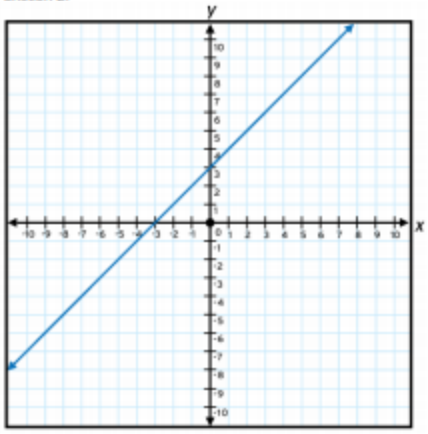
Question #16

What can be said about the following functions?

Function 1:

$$y = \frac{1}{2}x + 3$$

Function 2:



- Function 1 has a positive slope and Function 2 has a negative slope.
- Function 1 has a slope of 1.
- Function 1 has a slope of $\frac{1}{2}$.
- Function 2 has a slope of 1.
- Function 2 has a slope of -1.

Question #17

Select all of the functions that are not linear.

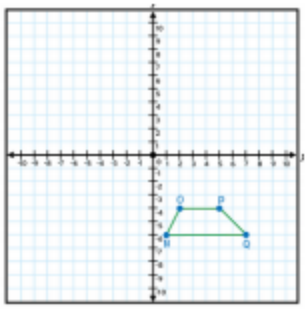
- $y = \frac{4}{x}$
- $y = 3x + 8$
- $y = -5x + 2$
- $y = x^3 - 2$
- $y = 6x$
- $y = 3x^2$

Question #18

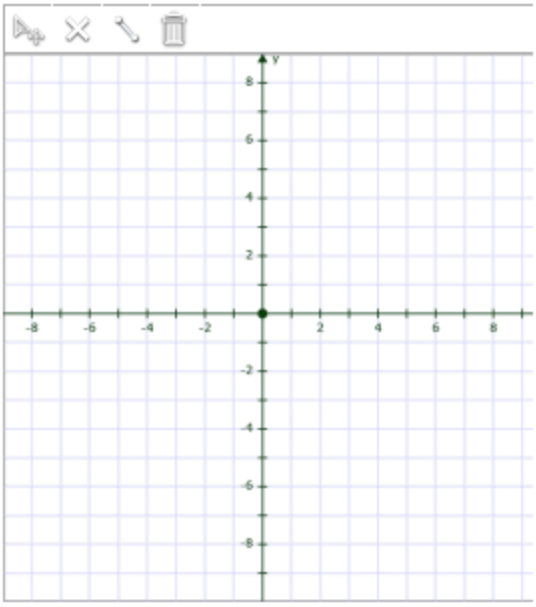
The graph shows the money earned by Alice for each hour that she works. According to the graph, what is the rate of change in dollars per hour?

Question #19

A trapezoid *NOPQ* is defined in the coordinate plane by the points (1, -6), (2, -4), (5,-4), and (7, -6).

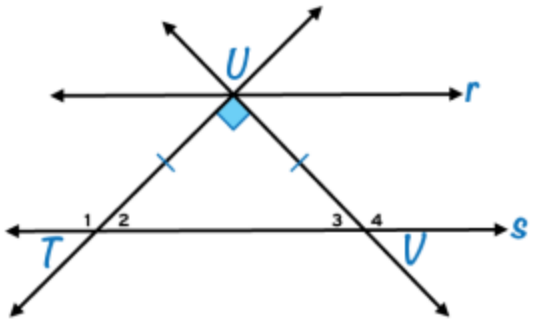


Draw the trapezoid reflected across the *x*-axis.



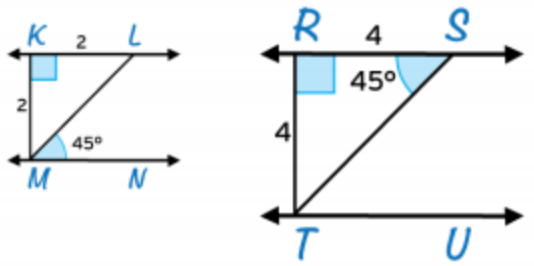
Question #20

If lines *r* and *s* are parallel, and triangle *TUV* is a right isosceles triangle, what is the measure of ∠1?



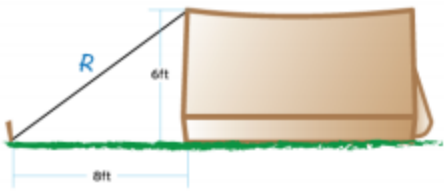
Question #21

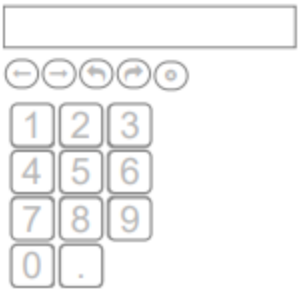
In the diagram below, $\overline{KL}$ is parallel to $\overline{MN}$ and $\overline{RS}$ is parallel to $\overline{TU}$. Select the true fact(s) about $\triangle KML$ and $\triangle RTS$.



- ∠*LMK* = 90°
- ∠*KLM* = 45°
- ∠*STR* = 45°
- ∠*RTU* = 45°
- △*KML* is similar to △*RTS*
- △*KML* is congruent to △*RTS*

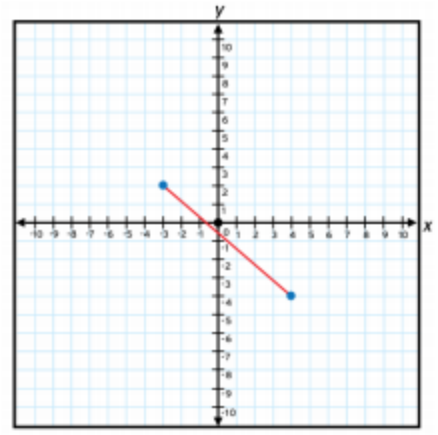
Simon set up his tent in his backyard last night. His tent is 6 feet tall. To secure it to the ground, he attached a rope from the top of the tent to the ground 8 feet away from the bottom of the tent as shown below. How many feet long, *R*, is the rope?





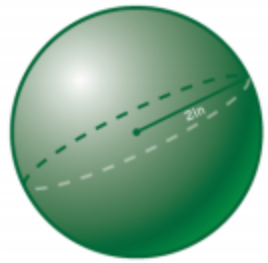
Question #23

Use the Pythagorean Theorem to find the approximate distance between the points (-3, 2) and (4, -4) as shown below. Round the answer to the nearest hundredth.



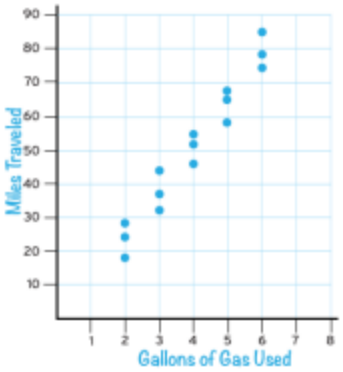
Question #24

Find the volume of the sphere in cubic inches. Use $\pi = 3.14$. Round the answer to the nearest hundredth.



Question #25

The scatter plot below shows the relationship between the number of gallons of gas used and the number of miles traveled on a road trip.



Answer the following questions based on the scatter plot. Be sure to answer all three parts.

Part A

Which statement below best describes the correlation between gallons of gas used and miles traveled on the road trip?

- There is a negative correlation between gallons of gas used and miles traveled.
- There is a positive correlation between gallons of gas used and miles traveled.
- There is no correlation between gallons of gas used and miles traveled.

- There is not enough information to determine a correlation between gallons of gas used and miles traveled.

Part B

Which equation below accurately represents the line of best fit for the data in the scatter plot?

- $y = 12x + 3$
- $y = -12x + 3$
- $y = 6x + 3$
- $y = -6x + 3$

Part C

Renee collected data from her brother Sean, who drives a motorcycle. She found that the relationship between the gas used and distance traveled can be modeled by the equation below, where *g* represents gallons of gas used, and *m* represents miles traveled.

$m = 8g + 1$

If Sean used 9 gallons of gas, what is his expected number of miles traveled?

If Sean used 9 gallons of gas, the expected number of miles traveled is ____.

MO-Algebra I-Grade 9 Assessment - FEB

Question #1

Select the situation(s) not representative of a constant rate of change.

- Loretta invested money in a savings account. The account has a compound interest rate of 12% a year.
- Joey recruits people to join the police department. He recruits 25 people per month.
- Hannah is a race car driver. She drives at a speed of 180 miles per hour.
- Ivan is growing bacteria in a petri dish for science class. Every hour, the number of bacteria triples.
- Li likes to build sand castles. She can build one sand castle for every two hours she spends at the beach.

Question #2

Divide: $\frac{10x^{14} + 30x^{10} + 25x^{8}}{5x^{2}}$

- $5x^7 + 25x^5 + 20x^4$
- $5x^{12} + 25x^8 + 20x^6$
- $2x^7 + 6x^5 + 5x^4$
- $2x^{12} + 6x^8 + 5x^6$

Question #3

When deriving the quadratic formula given the function $ax^2 + bx + c = 0$, the first step is to divide each term in the equation by *a*. What is the second step?

- Take the square root of both sides of the equation.
- Add the squared value to both sides of the equation.
- Take half of the *x* coefficient and square it.
- Divide each term in the equation by *x*.

Question #4

The domain of the function $d(t) = \frac{1}{3}t - 12$ is {9, 12, 15, 18, 21}. What is the range of the function?

- {9, 12, 15, 18, 21}
- {-9, -8, -7, -6, -5}
- {9, 8, 7, 6, 5}
- {15, 16, 17, 18, 19}

Question #5

Solve $4m - 13 < 11$ and complete the inequality below to show all solutions of m.

[ ] select m

Question #6

When planning soccer practices, Coach Koger incorporates the following constraints.

The team will spend more than twice as much time on drills as they spend scrimmaging.

The team will spend at least 40 minutes total on drills and scrimmaging.

When x is the number of minutes the team spends on drills and y is the number of minutes the team spends scrimmaging, the situation is modeled by this system of inequalities.

select

select

$x \geq 0$

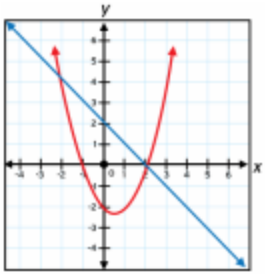
$y \geq 0$

Since the point (35,10) select a solution of the system, the team select spend 35 minutes on drills and 10 minutes scrimmaging at a practice.

Question #7

What are the solutions to the following system of equations graphed below?

$$\begin{matrix} y = x^2 - x - 2 \\ y = -x + 2 \end{matrix}$$



- (-2, 4) and (2, 0)
- (-2, 4) and (0, 2)
- (-1, 0) and (2, 0)
- (4, -2) and (0, 2)

Question #8

Nathan gathered data from 30 restaurants about whether they accept reservations and whether they have a frequent diner club. He organized the data into a frequency table, representing percentages as decimals between 0 and 1, rounded to the nearest hundredth.

	Frequent Diner Club	No Diner Club	Total
Reservations	0.64	0.36	1.00
No Reservations	0.57	0.43	1.00
Total	0.60	0.40	1.00

Which statements are supported by the table?

Select all the correct answers.

- 57% of the restaurants with a frequent diner club do not accept reservations.
- 36% of the restaurants that accept reservations do not have a frequent diner club.
- There are more restaurants that both accept reservations and have a frequent diner club than restaurants that do neither.
- There are more restaurants with a frequent diner club than restaurants without a club.
- There are an equal number of restaurants that do and do not accept reservations.
- 64% of the restaurants accept reservations and have a frequent diner club.

Question #9

Jonah's homework says to solve the system of equations below using the substitution method.

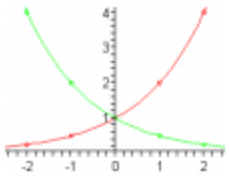
$$3x - 2y = 11$$
$$y = -2x + 9$$

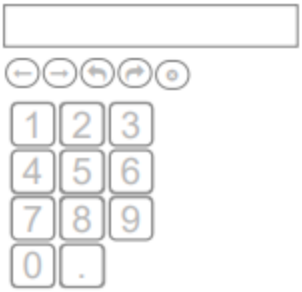
Which equation shows the first step in solving the system of equations using the substitution method?

- $5x + 0y = 20$
- $x + 0y = 21$
- $3x - 2(-2x + 9) = 11$
- $3(-2x + 9) - 2y = 11$

Question #10

The graph below shows the functions $y = \left(\frac{1}{2}\right)^x$ and $y = 2^x$. What is the *y*-value of the solution to the system of equations?





Question #11

Chris is studying for his scuba diving license test and needs to memorize the pressure in pounds per square inch at different depths of water. The table below shows the pressure in pounds per square inch at different depths of water.

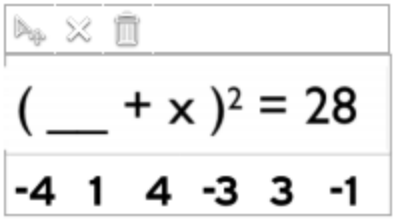
Depth (feet)	Pressure (pounds per square inch)
0	14
1	19
2	24
3	29

Which function can be used to find the water pressure $p(f)$, at f feet?

- $p(f) = f + 14$
- $p(f) = 14f + 5$
- $p(f) = 5f + 14$
- $p(f) = 10f + 14$

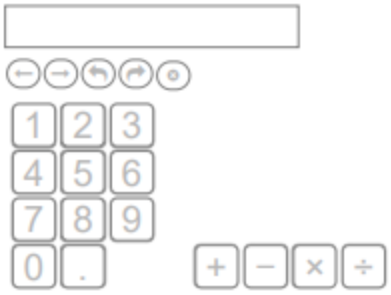
Question #12

Nina's teacher asked her to complete the square of the equation $x^2 - 8x = 12$. Drag and drop the missing number below to help Nina finish completing the square.



Question #13

Sarah likes to ride her bike around her neighborhood. The chart below shows her distance, in yards, from her home on her bike ride. What is the rate of change, in yards per minute, for the first five minutes of Sarah's bike ride?



Question #14

What can be said about the following functions?

Function 1:

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

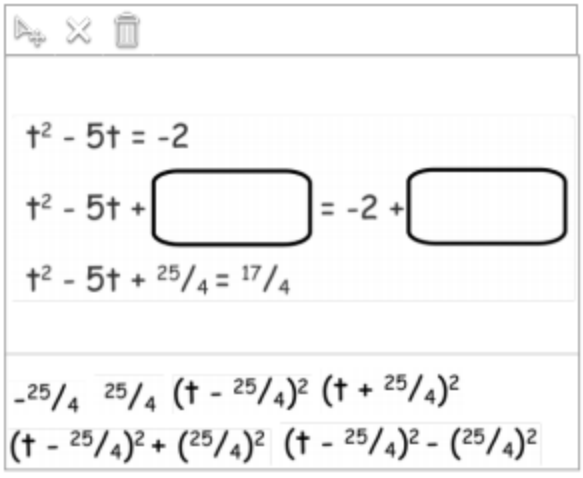
Function 2:

$f(x) = x^2 - 6$

- Function 1 has a larger minimum than Function 2.
- Function 2 has a larger minimum than Function 1.
- Both functions have the same minimum.
- Neither function has a maximum. They both have a minimum.
- Neither function has a minimum. They both have a maximum.
- Function 1 has a minimum and Function 2 has a maximum.

Question #15

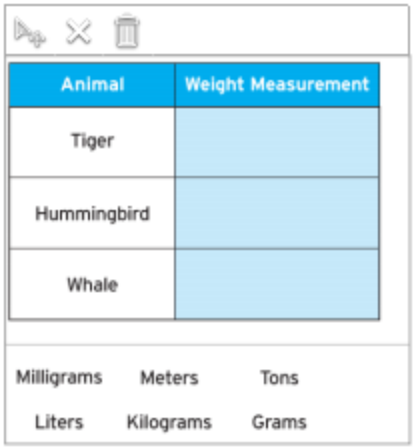
Winston's teacher asked him to complete the square in math class. Drag the term(s) and expression(s) below into the boxes to complete the first step of the problem for Winston.



Samantha is a zoo keeper. She needs to determine the weight of the following animals:

- **Tiger**
- **Hummingbird**
- **Whale**

Drag and drop the unit that best measures the weight of each animal into the chart to the right.



Question #17

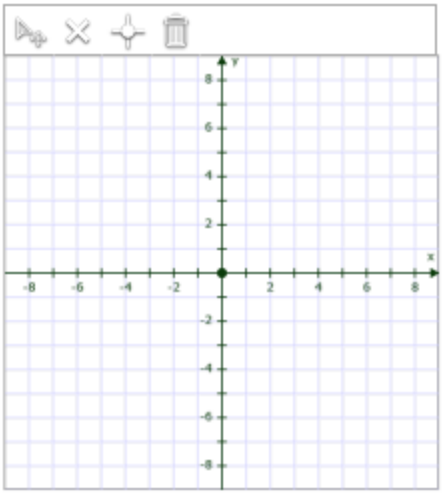
Consider the expression: $x^{\frac{1}{3}} \cdot x^{\frac{1}{3}}$.

Because the two exponents being multiplied have the same base, the product will have a base equal to the select of the two factors and a power equal to the select of the powers of the two factors.

Question #18

Solve the system of linear equations below and graph the solution on the coordinate plane.

$3y = 9x - 6$
$y = 6x - 2$



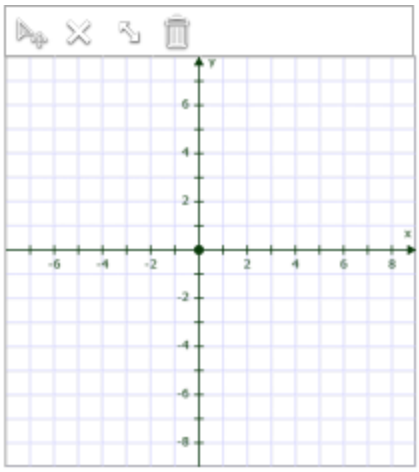
Question #19

Pablo bought a sunflower plant for his garden. The plant is currently 4 inches tall. He knows that sunflowers grow at an average rate of 1.5 inches per day. Complete the function below to show the total height, *h*, of Pablo's sunflower plants in inches, after *d* days.

$h =$ [ ] $d +$ [ ]

Question #20

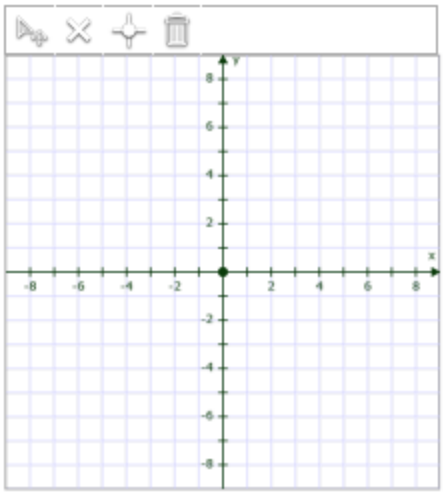
Draw the graph of a function with a *y*-intercept of 3 and a rate of change of -6.

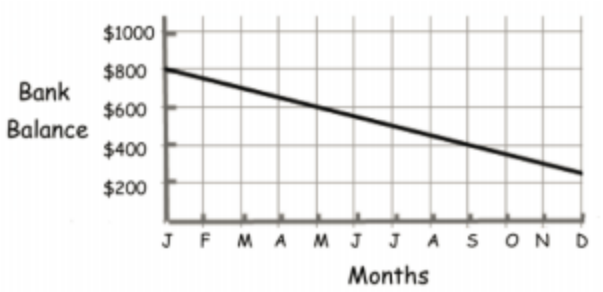


Question #21

Plot a point on the coordinate plane to represent the *y*-intercept of the linear equation below.

$y = -2x - 3$





- the number of months Andrea saved
- the number of dollars left in the account after Andrea withdrew $800
- the number of dollars in the account at the start of the year
- the change in the number of dollars in the account each month over the course of a year

Question #23

Consider the sequence.

10, 50, 250, 1,250, ...

Since every pair of consecutive terms in the sequence has a common select, the sequence can be represented by select function.

The nth term of the sequence is defined by the function $f(n)$ = select.

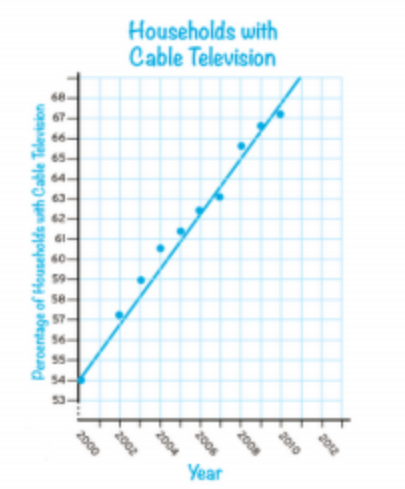
Question #24

Select all the factors of $2x^3 + 11x^2 - 6x$.

- x
- $2x$
- $x - 1$
- $2x - 1$
- $2x - 3$
- $x + 1$
- $x + 3$
- $x + 6$

Question #25

Osman is researching the percentage of homes that have had cable television since 2000. He recorded the mean number of households with cable over a period of 10 years, and created a graph to represent the data.



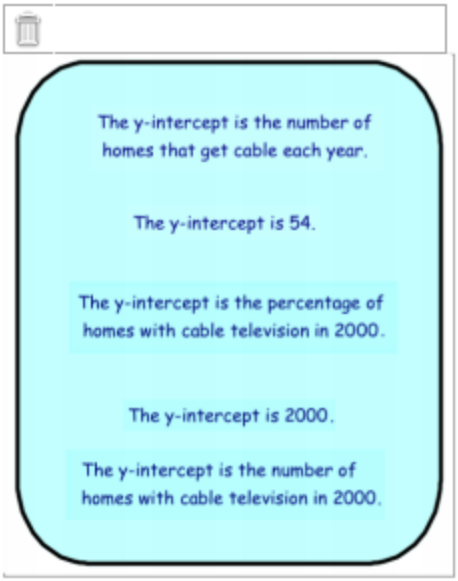
Part A

Osman found that in the year 2011, sixty eight percent of homes had cable television. He represented this with the point (2011, 68). What is the residual value of this point from the line of best fit?

The residual value is ____.

Part B

What does the *y*-intercept of the line of best fit of Osman's graph represent? Click on the items that accurately describe the *y*-intercept.



Part C

What does the slope of the line of best fit of Osman's graph represent?

- The percentage of homes with cable television.
- The time homes spend watching cable television.
- The number of homes that subscribe to cable television over a 10-year period.
- The rate at which the percentage of homes with cable television increases each year.