Blending Assessment with Instruction: Improving the Mathematics Performance of Fifth-Grade Students Through Implementation of Research-Based Lessons and Tutorials

By

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Ed.S., Emporia State University, 2001

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ABSTRACT

This study was designed as part of a formative pilot study to enhance the Blending Assessment with Instruction Program (BAIP) prior to implementation statewide. Specifically, the main objectives were to obtain teacher perceptions on the usability of BAIP, identify the program's instructional value and the appropriateness of its infrastructure for improvement purposes, and begin determining the impact BAIP has on student outcomes in mathematics. BAIP is designed to improve student mathematics achievement through aligning mathematics instruction with curriculum standards. BAIP incorporates both mathematics lessons and tutorials designed for teachers and students. BAIP lessons were developed using Rosenshine and Stevens' (1986) six instructional procedures of effective instruction. BAIP tutorials were designed utilizing Gagne's (1985) nine stages of instruction.

A comparison quasi-experimental design was used. The experimental group consisted of fifth-grade students in four school districts and two private schools, a total of 198 students (including 20 students with disabilities and 49 students who qualified for free and reduced-cost lunch). The comparison group consisted of four school districts, a total of 202 students (including 12 students with disabilities and 58 students who qualified for free and reduced-cost lunch). Surveys were used to determine teacher perceptions of the usability of BAIP and data were collected to evaluate the effectiveness of BAIP relative to improving the mathematics performance of fifth-grade students on a statewide mathematics assessment and a posttest measure.

Results from the correlational analyses, differences between pretest and posttest mean scores, and formative data gathered through teacher surveys, emails, and phone calls provided valuable information regarding the instructional value, usability, and the appropriateness of the infrastructure of BAIP. These data, in turn, will be used to enhance the BAIP program.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE

Introduction

Many have equated financial success with mathematics literacy (Moses, 2001; Schoenfeld, 2002). According to Schoenfeld (2002), “to fail children in mathematics, or to let mathematics fail them, is to close off an important means of access to society’s resources” (p. 1). This is supported by Moses (2001), who estimated that by 2010 all jobs will require significant technical skills, causing a demand for professionals with strong mathematics abilities (Moses, 2001). Moreover, Murnane, Willet, and Levy (1995) found that mathematics skills taught up to the eighth grade correlate significantly with later earning potential. Thus, early success in mathematics opens the door to educational opportunities and better employment possibilities (Maccini & Gagnon, 2005).

These findings have negative implications for students with disabilities and students who are considered to be academically at risk due to economic factors as these students often fail to make the same academic gains as their general education peers (Deshler et al., 2001; Taylor, 2005). This is supported by the National Assessment of Educational Progress, which found that the mathematics performance of students who were eligible for federal free and reduced-cost lunch programs, based on family income levels, was consistently lower than that of students who were not eligible for the lunch programs (National Center for Education Statistics, 2004). The negative correlation found by National Assessment of Educational Progress between a student’s socio-economic status and academic performance is not an isolated finding; other research studies have replicated the same negative correlation (Krashen, 2005; Taylor, 2005). Such replications have led to the conclusion that a negative correlation between a student's socio-economic status and academic performance is reliable. Thus, researchers have used the negative correlation to predict academic achievement and test score performance for students who are academically at risk.

In addition to the mathematics achievement gaps between students deemed at risk and their general education peers, achievement gaps in mathematics have been found between students with disabilities and their nondisabled peers. Thus, research has shown that the mathematics competencies of students with disabilities are consistently lower than those of their general education peers (Cawley & Miller, 1989). What is more, this gap begins during the first year of school and progressively increases with each academic year (Cawley, Parmer, Yan, & Miller, 1998; Deshler et al., 2001). For example, students with learning disabilities progress academically approximately one year for every two years they are in school. Research has also indicated that the academic achievement of students with learning disabilities eventually reaches a plateau at which time they stop making noticeable academic gains (Deshler et al.).

Beyond the achievement gaps in mathematics between subgroups within the United States, there is concern regarding the mathematics achievement gap between students in the United States and students in other countries. According to the results of the 2003 Trends in International Mathematics & Science Study conducted by the

National Center for Educational Testing, 11 out of 25 countries outperformed fourth-grade students in the United States in mathematics (Institute of Education Sciences, 2006).

These ongoing mathematics achievement gaps are disheartening, as professionals and advocacy groups in the United States have been working toward improving student achievement, stimulated, in part, by the publication of A Nation at Risk in 1983 and the National Council on Education Standards and Testing report in 1992 (National Commission on Excellence in Education, 1983; Ravitch, 1995).

The U.S. Department of Education, state governors, and national organizations such as the National Council of Teachers of Mathematics (NCTM) have worked diligently to improve academic achievement in all areas, including mathematics, through developing academic standards (Berger, 2000; Sandholtz, Ogawa, & Scribner, 2004). These efforts have led to national goals and federal laws such as Goals 2000 in 1994, Title I of the Improving America's Schools Act in 1994, the Individuals with Disabilities Education Act in 1997 and in 2004 [IDEA 2004], and No Child Left Behind Act of 2001 [NCLB] designed to advance the development and implementation of a standards-based reform model to reduce achievement gaps and educational inequalities by improving teaching and learning for all students (Thurlow, 2000).

The standards-based reform model is based on the belief that to achieve equity and reduce achievement gaps, provisions must be in place to ensure that all students, regardless of circumstances or characteristics, are instructed in the same challenging content and held to the same performance expectations. Specifically, the standards-based reform model consists of three key components: (a) universal content and achievement standards, (b) assessments, and (c) high-stakes accountability (Embler, Hernandez, & McLaughlin, 2005). Thus, provisions of NCLB (2002) and IDEA (1997, 2004), designed to hold all students to the same performance expectations, focus on universal content and achievement standards, assessments, and high-stakes accountability. As a result of NCLB and IDEA regulations, school districts are required to annually assess all students on the same content and achievement standards in grades 3 through 8, and once during grades 10 through 12. Scores from the assessments are analyzed annually to determine if schools are making adequate yearly progress toward having all students academically proficient by the year 2014. To ensure that all students, including students with disabilities, are being included in the assessment process, schools and districts are required to report assessment results for every student. As a result, school districts are under immense pressure to raise state assessment scores for all students (Thurlow, 2000). If adequate academic progress is not made, under the provisions of NCLB (2002) a school can lose federal funding or be forced to divert Title I funds to cover the cost of transferring students to higher performing schools.

Statement of the Problem

Despite the increasing pressure resulting on educators from legislative provisions pushing for standards-based reform, Trends in International Mathematics & Science Study and National Assessment of Educational Progress results and research findings indicate that achievement gaps in mathematics continue to exist (Institute of Education Sciences, 2006; National Center for Education Statistics, 2004).

Researchers have identified three major reasons why the standards-based reform model is failing to reduce current achievement gaps in mathematics. First, most schools and teachers are not able to produce the kind of learning that is needed to meet the demands of standards-based reform (National Commission on Teaching and America's Future, 1997). Many elementary school teachers lack the mathematics knowledge necessary to effectively introduce and teach math concepts (Ma, 1999). Second, insufficient effort has been made toward aligning classroom instruction with what students are expected to learn and be tested over (Elliott & Thurlow, 2000; English 2000). Third, teachers do not have the resources and materials necessary to help them meet the mandates of standards-based reform (Guskey, 2003; Oakes & Saunders, 2004).

Lack of Teacher Knowledge

As a result of the standards-based reform movement, much of the content in mathematics that teachers present in their instruction is derived from state standards; however, teachers are still often left to decide how content in mathematics will be presented (Malloy, 2004). Their decisions, in turn, are often based on their own fundamental understanding of mathematics (Ball, 2003). This can be problematic in that research has shown that many teachers have a procedural understanding of math content rather than a conceptual understanding (Ma, 1999; Mistretta, 2005). A procedural understanding of mathematics is shallow and is usually acquired through memorization of basic facts and step-by-step approaches to solving mathematics problems (Miller & Hudson, 2006). Teachers with a procedural understanding of mathematics concepts often focus their instructional time on memorization and practice of basic computation facts and provide students with worksheets that aid in drill and practice (Jitendra, DiPipi, & Perron-Jones, 2002). Conceptual understanding, on the other hand, refers to a thorough understanding of mathematical concepts, operations, and the relationships between them, resulting in a comprehensive breadth of mathematics knowledge (Moyer-Packenham, 2004). A procedural level of mathematics understanding or limited mathematics knowledge leads to poor mathematics instruction (Ma, 1999). Specifically, a lack of conceptual understanding and subsequent lack of mathematics knowledge has resulted in fragmented mathematics instruction, which has led to unsatisfactory mathematics learning in United States schools (Ball, 2003, Ma, 1999).

Difficulties in Aligning Curriculum

Several researchers have claimed that the only way school districts will meet accountability mandates is through curriculum alignment; that is, alignment between classroom instruction and what students are expected to know and be tested over (Elliott & Thurlow, 2000; English 2000). According to English (2000), without alignment, there can be no fair judgment of how well students are learning or how well schools and teachers are teaching. Moreover, Elliott and Thurlow (2000) noted that, without meaningful alignment, the standards-based reform movement “can be dissolved into nothing more than another education bandwagon that has tried to function without all of the cogs in the wheel" (pp. 3637). Thus, for standards-based reform to be effective in improving learning, instruction, and, ultimately, close the gap in mathematics achievement, focus must be placed on the original intent of standards-based reform: to help educators learn how to link classroom instruction with expected achievement outcomes (Guskey, 2003; National Research Council, 1999). For alignment to be effective, classroom instruction should include instructional procedures that have been associated with effective instruction (Rosenshine & Stevens, 1986). For learning to occur, a mathematics curriculum cannot be left to chance; it must be well planned out (Ediger, 2005).

Lack of Materials and Resources

Finally, the standards-based reform movement is largely based on the assumption that once educators receive the results of state assessment, they will make the instructional changes necessary to improve student performance (National Research Council, 1999).

This assumption embodies several problems with regard to mathematics instruction. First, state mathematics assessments are administered toward the end of the school year when instruction is concluding (Guskey, 2003), leaving little time for educators to evaluate and improve their mathematics instruction based on state assessment results. Several argue that for assessments to be effective, they must be formative and provide immediate, ongoing feedback rather than summative, end-of-the-year or one-time feedback (Bangert-Browns, Kulik, Kulik. & Morgan, 1991;

Black & Wiliam, 1998; Yeh, 2006). If assessments are conducted regularly and immediate feedback is provided, teachers are better able to gauge levels of student success and adjust their instructional efforts accordingly (Schmoker, 2005). Some schools have found that formative data collection can help ensure that instruction is on target and is effectively moving students toward meeting standards (Shellard, 2005). When evaluating the effectiveness of Rapid Assessment Programs—a formative test system designed to align district and state curriculum standards—Yeh (2006) found that the assessment system improved teaching by providing immediate feedback that could be used to adjust instruction, collaborate to solve instructional issues, and increase accountability. In addition, end-of-the-year state assessment results often lack the detail necessary to help target specific academic weaknesses. Finally, many educators find it difficult to translate state standards into clear instructional goals (McColskey & McMunn, 2000). And even if teachers are able to identify clear instructional goals from annual assessment results, they often lack the curriculum materials and technology resources necessary to meet the mandates of standards-based reform (Oakes & Saunders, 2004).

Recent studies have found that some schools do not have the instructional materials that are necessary to meet state concept standards. Without the proper educational resources and materials, teachers are faced with the daunting challenge of translating summative, year-end assessment results into instructional goals that can meet their students' educational needs — instructional goals that can identify and address a student's remediation needs, analyze a student's readiness to learn, and outline how new concepts and skills should be introduced and taught.

Current Research

Educators, especially those with limited mathematics knowledge, limited knowledge regarding content standards, or those who have limited materials or resources, need access to instructional tools and materials that are aligned with what their students are expected to learn (Schmoker, 2005).

Several researchers have recommended procedures that be followed when developing aligned resources or tools (Elliott & Thurlow, 2000; English, 2000). For example, Elliott and Thurlow (2000) recommended an instructional planning process that begins by identifying state standards that students are expected to meet and then examining those standards to identify all the components, concepts, and skills within each standard, a process referred to as backmapping. Once the components, concepts, and skills within each standard have been identified, they should be incorporated into classroom materials or resources.

However, alignment does not stop with backmapping. Once the standards are broken down into their components, concepts, and skills, resources or tools must be designed that incorporate instructional procedures that have been shown to improve instruction and learning. According to studies conducted by Rosenshine and Stevens (1986), six instructional procedures correlate with effective instruction: (a) prior skill or knowledge review, (b) content presentation, (c) guided practice, (d) correction and feedback, (e) independent practice, and (f) review.

In addition to educational tools and resources that are aligned with state standards and are designed using components of effective instruction, teachers need access to tools or resources that can aid them in determining their students' educational and remediation needs on a daily basis rather than summative test results provided at the end of the year (Guskey, 2003). Thus, it has been shown that teachers in high-performing schools regularly use student data to help modify teaching instruction. Regularly gathering data on student skills and progress helps educators to gauge their students' success and adjust their instructional efforts accordingly (Schmoker, 2005). Some schools have found that formative data collection can help ensure that instruction is on target and is effectively moving students toward meeting standards (Shellard, 2005). One way to provide teachers with educational tools, resources, and guidance that can aid them in curriculum alignment and gauge their students' academic needs is through the use of technology.

Role of Technology

Modern technology, especially the Internet, makes it possible to easily distribute educational materials that are designed to identify standards and provide instructional tools and materials that can be used to help align classroom instruction with standards, gauge student performance and progress, provide mathematical support and practice for students, and improve learning. According to Martindale, Cates, and Qian (2005), when technologies, such as Web-based resources, are used appropriately, they contribute to effective learning. Moreover, the *Principles and Standards for School Mathematics* developed by the National Council of Teachers of

Mathematics (2000) state that “technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students’ learning” (p. 3). Irish (2002) found that when general classroom instruction was supplemented with computer-assisted instruction, the accuracy on basic multiplication facts of students with learning and cognitive disabilities increased. According to Gullatt and Lofton (1998), “learning activities delivered with a variety of technologies are especially useful and appropriate for at-risk students … technology affirms students’ strengths, offers student learning resources that complement and enhance their ability to learn” (p.12).

Several Web sites allegedly provide teachers with tools and resources that are aligned with content standards. However, many of the instructional resources that are currently available online fail to provide teachers with sound, research-based resources or tools that have been shown to improve classroom mathematics instruction, align classroom instruction with state mathematics standards, and provide a means for student practice; rather, current Internet resources often link teachers to mathematics games, other Web sites, and lessons that have not been evaluated and deemed educationally effective.

Purpose of the Study

The primary purpose of this study was to pilot test the Blending Assessment with Instruction Program (BAIP), a standards-based mathematics intervention designed to improve mathematics instruction. BAIP provides teachers with educational tools and resources aligned with curriculum standards in the form of research-based lessons in mathematics for teachers and tutorials for students via Internet delivery. Specifically, the primary objectives were to obtain teacher perceptions on the usability of BAIP, identify the program's instructional value and the appropriateness of its infrastructure for improvement purposes, and begin determining the impact BAIP has on student outcomes in mathematics at the fifth-grade level.

The BAIP Web-based lessons align classroom instruction with state standards and provide teachers with mathematics lessons developed using Rosenshine and Stevens' (1986) six instructional procedures that have been shown to correlate with effective instruction: prior skill or knowledge review, content presentation, guided practice, feedback, independent practice, and review.

BAIP tutorials provide students with individualized mathematics instruction and practice through a Web-based instructional format that aligns state assessment indicators with mathematics instruction and practice problems. The BAIP tutorials help students understand key concepts within state indicators by defining the indicators in student terms, providing direct instruction through a problem-based approach, and offering opportunities for students to practice completing math problems based on content standards. In addition, the tutorials were designed to be used by educators to gauge and identify mathematical concepts students are struggling to learn or have mastered so that they can align classroom instruction with concepts covered on the statewide assessment. The BAIP program consists of a total of 276 teacher lessons and 410 student tutorials spanning grades 3 through 12.

Questions

Research Questions

The study investigated the following research questions:

1. Do significant differences exist between 2006-2007 state assessment scores for the six selected indicators for fifth-grade students who received the BAIP interventions and those who received traditional math instruction?
2. Do significant differences exist between the scores on the 2006-2007 state mathematics assessments for fifth-grade students who received the BAIP intervention and those who received traditional math instruction?
3. Do significant differences exist between the posttest scores of fifth-grade students who qualified for free and reduced-cost lunch, students with disabilities, and general education students who received the BAIP intervention?
4. Is there a significant correlation between the total number of tutorials completed by fifth-grade students and the students' 2006-2007 state assessment scores?
5. Is there a significant correlation between selected indicator tutorial scores (number correct out of 8) and the 2006-2007 selected indicator scores on the state assessment?

Null Hypotheses

Therefore, the following null hypotheses were tested:

1. No significant differences exist between 2006-2007 state assessment scores for the six selected indicators for fifth-grade students who received the BAIP interventions and those who received traditional math instruction.

2. There are no significant between the scores on the 2006-2007 state mathematics assessments for fifth-grade students who received the BAIP intervention and those who received traditional math instruction.
3. There are no significant differences between the posttest scores of fifth-grade students who qualified for free and reduced-cost lunch, students with disabilities, and general education students who received the BAIP intervention.
4. There is not a significant correlation between the total number of tutorials completed by fifth-grade students and the students' 2006-2007 state assessment scores.
5. There is not a significant correlation between selected indicator tutorial scores (number correct out of 8) and the 2006-2007 selected indicator scores on the state assessment.

Summary

To meet the increasing instructional demands resulting from NCLB (2002) and IDEA (2004), additional efforts must be made to improve the mathematics knowledge of teachers; increase alignment between classroom instruction, content standards, and assessments; and develop and distribute educational tools or resources that can aid teachers in classroom instruction. Web-based instructional material or resources, when developed and used appropriately, can help teachers gather data and align classroom instruction with state content standards throughout the academic year (Gandel & McGiffert, 2005; Martindale et al., 2005). Such tools or resources can help teachers discern which students need remediation with which learning targets or standards (Gandel & McGiffert, 2005). Thus, Web-based instructional tools or resources can aid teachers who have limited understanding and skills in mathematics, have limited means of curriculum alignment, or those who have limited resources with which to gauge student performance, ensure that instructional alignment occurs. This study examined the effectiveness of BAIP in improving the mathematic performance of fifth-grade students and the educational perceptions of fifth-grade teachers regarding BAIP's effectiveness toward improving curriculum alignment.

Definitions

Adequate Yearly Progress (AYP)

The term refers to the growth rate in the percentage of students who achieve the state's definition of academic proficiency. Thus, it is the "process for making judgment as to whether or not all public elementary and secondary schools, districts, and states are reaching the annual targets to ensure that all students achieve the state's definition of proficiency by 2013-2014" (Kansas Department of Education, 2006).

At-Risk Students

Kansas statue defines at-risk students as "pupils who are eligible for free meals under the National School Lunch Act and who are enrolled in a district which maintains an approved at-risk pupil assistance plan" (Kansas Senate Bill No. 82§ 72-6407, 2003).

Curriculum Alignment

Refers to "A process to improve the match between the formal instruction that occurs in the school and the classroom and that which any test will measure" (English, 2000, p. 63)

Selected Indicators

Selected indicators refer to the indicators that were chosen to evaluate the effectiveness of BAIP. For the purpose of this study, two subject-matter experts at the University of Kansas used a qualitative approach to identify selected indicators at the fifth-grade level. *Subject-matter experts* in this study refer to individuals who have extensive mathematics knowledge, teach mathematics at the university level, have a thorough understanding of state mathematics standards, and have experience writing mathematics content for textbooks or mathematics assessments.

During the qualitative process, mathematics standards were reviewed to identify content that would most likely to be taught during the spring semester, prior to the administration of the state assessments. Next, recommendations from mathematics educators at the University of Kansas and public school K-8 mathematics teachers regarding which indicators might be the most challenging, most critical, or most common for student were reviewed. Based on this review, six indicators were selected by the subject matter experts.

State Standards

Refers to the academic standards that the state of Kansas implemented as a result of the NCLB legislation, which defines academic standards as the adoption of "challenging academic content standards and challenging student academic achievement standards that will be used by the State, its local educational agencies, and its schools" (NCLB, 20 U.S.C. 6311, 2002).

Student with a Disability

Refers to the IDEA 2004 definition of a "child with a disability." "The term refers to a child with mental retardation, hearing impairments (including deafness), speech or language impairments, visual impairments (including blindness), serious emotional disturbance, orthopedic impairments, autism, traumatic brain injury, other health impairments, or specific learning disabilities; and who, by reason thereof, needs special education and related services" (IDEA, 20 U.S.C. 1401, 2004).

CHAPTER TWO

Literature Review

Introduction

The purpose of the study was to pilot test the Blending Assessment with Instruction Program (BAIP) a standards based mathematics intervention, at the fifth grade level. While no studies have evaluated the impact of an intervention as comprehensive as BAIP at improving mathematics achievement, there has been research and legislative mandates calling for standards-based instruction. Therefore, the literature base for this study examines; (1) the need for the development of a comprehensive intervention designed to improve student achievement and meet current standards-based reform mandates and (2) examine theories that can be utilized when creating a research-based comprehensive intervention, such as BAIP

To determine the need for an intervention (such as BAIP) designed to improve math achievement through curriculum alignment, a historical perspective of the accountability mandates that have led to the standards based reform movement is provided. This is conveyed by describing critical legislation that has fostered the current standards-based accountability system as legislated in the Individuals with Disabilities Education Act (IDEA, 2004) and the No Child Left Behind Act (NCLB, 2002). A description of NCLB is provided, describing how schools and districts meet accountability goals set forth by NCLB and the impact on schools who fail to meet these goals.

The failure of the accountability movement to close achievement gaps in mathematics is examined. While students with disabilities are now included in today's accountability system, there continues to be a gap between the performances of students with disabilities and their non-disabled peers in mathematics (National Assessment of Education Progress, 2005). As a result, the current achievement gap and the impact of the gap for students with disabilities are examined.

The significance of the movement to a high stacks accountability environment on the teaching practices is reviewed. Critical to these practices is the lack of mathematics knowledge and preparation of elementary teachers in mathematics methodology (Parmar & Cawley, 1997; Lovelles & Coughlan, 2004); Maccini & Gagnon, 2002). In addition, research regarding the lack of materials aligned with math standards will be discussed (Cavanagh, 2006; Guskey, 2003, National Research Council, 1999).

Critical to the design of the BAIP intervention are several research-based instructional components. Emphasis in this section will be given to a) analyzing the pattern of teaching math skills, which provides a framework for the lesson and tutorial intervention design, b) describing current web-based solutions, which provide curriculum-aligned resources to teachers and students, c) reviewing studies in web-based tutorial instruction, including studies describing the impact of tutorials on low achievers and students with special learning needs (Kulik & Kulik, 1991; Niemiec & Walberg, 1985), and d) research which identifies key components of effective tutorial instruction will be examined (Wager & Mory, 1993). In particular, Gagnes (1985) nine stages of information processing are described, which are used as the framework for the BAIP tutorial design.

Accountability

Instructional Accountability

Instructional accountability is not a new phenomenon. In fact, assessment and accountability has been a staple of educational reform since the late 1950s, when policymakers began to focus their attention on improving the educational achievement for students by allocating additional funding in the areas of science and mathematics (Linn, 2001). By 1965, the Elementary and Secondary Education Act, designed to provide aid to elementary and secondary schools, was passed. The Act included provisions for the evaluation of programs designed to improve student achievement (Marion & Sheinker, 1999; National Research Council, 1999). These evaluations included standardized tests designed to measure student achievement. Soon the use of standardized test to measure student achievement, moved beyond the national accountability mandates to the state level. By the late 1960s and early 70s, many states had enacted legislation that required schools to administer minimum competency achievement tests (MCAT). These tests were designed to help states identify basic skills acquired at different grade levels, identify students in need of remediation, and provide a means for local accountability. By the early 1980s, 34 states had created and were using MCATs to ensure that students had the minimum level of knowledge and skills needed to progress to the next grade or to graduate from high school (Linn, 2001). Pipho, believes that the MCATs started “an accountability notion by establishing an achievement floor or the minimum level of achievement needed to" determine if students were ready to move onto the next grade or ready for graduation (p. 1, 1997). Despite the newly established accountability notion, set in place by standardized testing, problems soon began to surface as states differed on their definitions of minimum competency. Although the problem was not resolved, the minimum competency movement continued. In 1983 the accountability movement was fueled by the publication of A Nation at Risk report (Marion & Sheinker, 1999). The report raised concerns regarding students' academic preparation to compete in a global society, which gave rise to the question of whether or not the nation needed to develop national education goals or standards. In 1989, governors from across the nation met at the National Education Summit to discuss the need for national goals. The summit resulted in the creation of the first national educational goals (Thurlow, 2000). By 1992, the National Council on Education Standards and Testing issued a report supporting national standards and testing (Sandholtz et al., 2004). By 1994, a revised version of the goals was written into law in the Goals 2000: Educational Act (Porter, 2005). The reauthorization of Title I of the Elementary and Secondary Education Act, referred to by the Improving America's Schools Act, in 1994 required states to develop challenging standards and assessments that measure student performance (National Research Council, 1999). As a result, many states and school districts began to move towards standards-based reform (Goertz, 2005). However, just like the problems with the lack of consistency in the definition of minimum competency, states and districts defined success towards standards differently and posed different consequences for schools that did not meet standards. The differences between states' definitions and consequences regarding standards was addressed in the reauthorizations of the Elementary and Secondary Education Act in 2001 referred to as NCLB passed in 2002 (Goertz, 2005).

Accountability for Students with Disabilities

Although standards based reform was meant for all students, historically students with disabilities had been excluded from the reform efforts (Thurlow, 2000). As legislative mandates began to call for the development of standards, many states failed to consider students with disabilities when developing state assessments. According to Thurlow, Ysseldyke, Gutman and Geenen (1998), only 17% of states (47 at the time) considered students with disabilities when developing standards. Thus, students with disabilities were not only excluded from standards based reform assessments but were excluded when items for the assessments were being developed (Thurlow, 2000). However, after the passage of the Elementary and Secondary Education Act in 1965, advocates for educating students with disabilities lobbied for federal grants to improve the educational services for students with disabilities (Huefner, 1997). As a result, the Education for All Handicapped Children Act was passed in 1975, which was to be later renamed the Individuals with Disabilities Education Act (IDEA) in 1990 (Raymond, 2004). The act placed educational accountability for students with disabilities onto schools, districts, and states by ensuring that all children were provided with a free and appropriate pubic education. Since 1975, Congress has attempted to improve the quality of programming for students with disabilities by amending the act. In fact, the reauthorization of the act in 1997, focused on improving the educational outcomes of students with disabilities by requiring states and districts to improve performance outcomes by requiring all children, including students with disabilities, to participate in all mandated state and district assessments. As a result, state and district accountability levels were increased, as states and districts were and are required to report data on the performance of students with disabilities.

Accountability under No Child Left Behind

Standards based reform also known as accountability under NCLB (2002) is based on the assumption that school systems will align their curriculum to external academic standards and assessments by requiring states to annually evaluate students' performance towards meeting state standards (Elliott & Thurlow, 2000). As a result, NCLB legislation requires states to set achievement goals to ensure that all students, including students with disabilities, are proficient in reading and mathematics by 2014. Under the accountability mandates of NCLB, schools that do not reach their achievement goals for two consecutive years in the same subject area are labeled as schools "in need for improvement" and are forced to implement mandatory mandates. These mandates are the same for each state. The first year that a school does not meet their goals, the school is required to offer families the option to transfer their children to higher performing schools within the district. If the school fails to meet its goals the following year, the school must offer access to supplemental academic services.

Eventually after six years, the school must undergo restructuring which can lead to job loss and eventually school closure.

Effects of Accountability

Curriculum Alignment

The increased pressure resulting from standards-based reform and thus NCLB (2002) mandates has caused many school districts to focus their attention on aligning large-scale standards-based assessments with classroom instruction. This is based on the belief that blending large-scale assessments with classroom instruction and curriculum are the backbone of standards-based reform. As a result, schools and classroom teachers are no longer controlling their own curriculum in the manner they have been accustomed to, as NCLB mandates have brought additional rigor to accountability in standards-based reform. In fact, NCLB mandates have resulted in a call for substantial curriculum alignment (Goertz, 2005) as it sets forth conditions for measuring progress on the part of schools in meeting the standards-based assessments. Furthermore, assumptions driving standards based reform have resulted in a belief that testing provides a "clearer focus" to curriculum for teachers and learning for students, therefore large-scale assessments aim to streamline curriculum into specific standards and outcomes students are expected to meet (Elford, 2002). Research has identified that the availability of curriculum aligned with the tested curriculum positively influences classroom practices and learning (McGehee & Griffith, 2001). This has become apparent in the area of mathematics. In fact, Long & Benson (1998) believe that the alignment of mathematics curriculum "directly affects the degree to which valid and meaningful inferences about student learning can be made" (p. 504). The Curriculum and Evaluation Standards for School Mathematics states that curriculum alignment "occurs when the curriculum, instruction, and assessment communicate the same expectations to students" (Long & Benson, 1998, p. 504). Without this alignment "students – especially those with learning disabilities – would face an unfair and almost impossible challenge to prove what they have learned" (Wiley, Thurlow, & Klein, 2005, p. 3). Thus, adequately aligned math curriculum is an essential component of any successful standards-based reform.

Current Academic Achievement Gaps

Despite a history and impacts of standards based reform, there continues to be achievement gaps in mathematics within subgroups in the United States. In fact, there continues to be achievement gaps between students with disabilities and their non disabled peers. Many would argue that because students with disabilities have not consistently had the benefit of a standards-based curriculum, they historically have not performed as well as their non-disabled peers on large-scale assessments in math (Maccini & Gagnon, 2002). This lack of access to the general education math curriculum is due, in large part, to the practice of providing students with disabilities less rigorous curriculum that is primarily focused on individual goals rather than "long-term general education outcomes" (p. 325), as these students were not included in standards based assessments. As a result, the achievement gap between students with disabilities and their non-disabled peers is significant. According to the National Assessment in Mathematics' results, overall academic gains have not resulted in closing the achievement gap nor has it resulted in students with learning disabilities being better prepared for advanced instruction in math. The National Assessment of Education Progress (2005) reported "in 2003 the average scale score difference for students with disabilities and students without disabilities was 23. This gap decreased only by 2 points in 2005 when average scale score differences for student with disabilities and students without disabilities was 21" (National Center for Educational Statistics, 2005). Additionally, the National Center for Educational Outcomes reported in 2004 that not only were students with disabilities performing below all students across the country, but the achievement gap actually grew significantly larger as students got older (Thurlow & Wiley, 2004). Furthermore, research now suggests that students with learning disabilities perform poorly on standards-based assessments (Thurlow, Albus, Spicuzza, & Thompson, 1998). More specifically, 83% of non-disabled students passed a state assessment on basic math skills, while only 34% of students with disabilities passed the test. Research has found that students with learning disabilities typically function two to four grades below expectancy across the mathematics curriculum (Parmar & Cawley, 1997). Additionally, these students only attain fifth to sixth grade performance levels by the time they graduate from high school. A study of 1,200 students with learning disabilities found that these students experienced an age-in-grade discrepancy over a 6-year period demonstrating that the discrepancy progressively increases as students become older and move to higher grades.

This increasing gap significantly impacts students' academic abilities through their school age years as well as future employment options (Marchand-Martella, Slocum, & Martella, 2004; Stein, Silbert, & Carnine, 1997). Clearly, the current mathematics performance of students with learning disabilities does not prepare them to pursue programs in math related careers at the post secondary level. Unfortunately, research has shown that students with learning disabilities have weaknesses in essential math skills including: (1) basic skills (Algozzine, O'Shea, Crews, & Stoddard, 1987), (2) algebraic reasoning (Maccini, McNaughton, & Ruhl, 1999), and (3) problem-solving (Hutchinson, 1993; Montague, Bos, & Doucette, 1991). The building blocks of elementary mathematics are critical for students long-term success considering that by the 8th grade students must have mastery of basic arithmetic if they are to successfully learn algebra and geometry in high school (Loveless & Coughlan, 2004). Loveless and Coughlan state that, "without some proficiency in algebra, students will have little grasp of calculus, physics, or chemistry and little chance of succeeding in college mathematics and science courses" (p. 56). Furthermore, Murnane et al. (1995) have found that skills taught up to the 8th grade correlate significantly with later earning potential.

In addition to the achievement gaps between non-disabled and disabled students, achievement gaps are present in students deemed at risk due to economic factors and their peers. In fact, several researchers have found that socioeconomic status is significantly related to a student's mathematics achievement (Lauzon, 2001; Ma, 2005; Okpala, 2002). Lauzon (2001) found that a student's socioeconomic status

(SES) lead to lower than average test scores. This is supported by Ma (2005) who found that white and Asian students who have a low family socioeconomic status had a lower rate of mathematical growth than students from a higher status. Moreover, when examining the mathematics achievement of 4th grade students during 1994, 1995, and 1996, Okapala (2002) found that a student's economic status negatively impacted the student's achievement on the North Carolina state mandated end of year tests. When analyzing the Third International Mathematics and Science Study, Ercikam, McCreith, and Lapointe (2005) found that one of the strongest predictors of mathematics achievement and participation in advanced mathematics courses was a student's socioeconomic status.

The achievement gap is not only seen within subgroups in the United States; rather the achievement gap in mathematics extends beyond the United States. According to the results of the 2003 Trends in International Mathematics & Science Study conducted by the National Center for Educational Testing, 11 out of 25 countries out preformed the United States in mathematics achievement at the fourth grade level and 14 out of 45 countries out preformed the United States at the eighth grade level (Institute of Education Sciences, 2006). Moreover, comparisons between the United States Trends in International Mathematics & Science Study test results in 1995 and 2003 indicate that the average math performance for students at the fourth grade level did not improve during the 15-year span between the two assessments.

Impact on Teaching Practices

Despite standards based reform efforts that are based on the belief that testing gives a "clearer focus" to curriculum for teachers and student learning, the National Commission on Teaching and America's Future (1997), has found that many teachers cannot produce the kind of learning demanded by the educational reforms – "not because they do not want to, but because they do not know how…" (p. 14). According to Graham and Fennell (2001), Pagliaro (1998), and Shulman (1987), successful mathematics instruction requires teachers to have a thorough understanding of content, students as learners, and pedagogical strategies. Furthermore, teachers report that the greatest barrier they face in a standards-based environment is a lack of suitable materials for instruction. In fact, research has shown that general and special educators do not have materials needed to align math curriculum for students with disabilities (Maccini & Gagnon, 2002). This lack of materials is especially disconcerting for students with disabilities who "require manipulative, multiple representations, and varied examples and non-examples as teachers progress through the concrete-semi-concrete-abstract phases of instruction" (Maccini & Gagnon, 2002, p. 339).

In addition to materials, educators must have extensive knowledge and understanding of mathematics if they hope to "…transform the content knowledge they possesses into forms that are pedagogically powerful and yet adaptive to the variation in ability and background presented by the students" (Shulman,1987, p. 15).

Despite the research indicating the need for strong background knowledge, many researchers in the mathematics field argue that pre-service teachers as well as current teachers-especially those at the elementary and middle school levels- are not graduating with the depth or breath of knowledge necessary to effectively teach mathematics (Ball, Goffney, & Bass, 2005; Graham & Fennell, 2001; Ma, 1999). This is due, in part, to the limited amount of mathematics requirements needed for certification. Currently, elementary education certification programs typically require only between 6 to 12 credits of mathematics; whereas mathematics certification at the middle school level and special education certification programs vary in content or subject area requirements, with some states having no requirements for special education certification (Graham, Li, & Curran Buck, 2000). Overall, the certification requirements for special education teachers vary from state to state, however research has shown that preservice programs for special education teachers' focus largely on the methods related to reading instruction rather than mathematics. In fact, Lucas-Fusco found that "on average, 6.36 class sessions per semester in methods courses for learning disabilities were devoted to methods of teaching reading, whereas only 0.57 sessions were devoted to mathematics instructional methods" (as cited in Parmar & Cawley, 1997, p. 190). Limits in mathematics preparation of elementary and middle school math teachers, has been shown to directly impact the ability to reduce achievement gaps in mathematics (Loveless and Coughlan, 2004). Moreover, Graham, Li, and Curran Buck (2000), conclude that the lack of mathematics content courses during pre-service education-especially for programs in elementary, middle, and special education- suggests that problems found with the teaching and learning of mathematics in the classroom can be traced back to the content background of teachers. Furthermore, Ma (1999) concluded that if elementary teachers in the field where to be successful, they must have a strong understanding of mathematics content for grades K-12. If not, mathematics education will be fragmented and lead to gaps within math competencies

In addition to a thorough understanding of mathematics content teachers must know and understand the curriculum standards that she or he will be responsible for teaching in the classroom. As “teaching begins with a teacher’s understanding of what is to be learned” (Shulman, 1987, p. 7). This is problematic in that Maccini and Gagnon (2002) found that five percent of general education teachers and forty-five percent of special education teachers who teach math were not familiar with the National Council of Teachers of Mathematics Standards. In addition, the study found that only 59% of special education teachers and 78% of general education teachers felt confident in teaching the standards to students with disabilities. This lack of comfort and knowledge of mathematics standards can only lead to additional fragmentation in mathematics instruction.

Resulting from the call for increasing teachers’ mathematics preparation, the National Council of Teachers of Mathematics (as cited in Cavanagh, 2006) is encouraging teacher preparation institutions to include more math instruction in their training programs. Future teachers must have a thorough understanding of mathematics content, if they hope to meet the mathematical educational needs of their students. Moreover, as students with learning disabilities continue to gain access to the general education math curriculum, both general and special education teachers must have a strong understanding of the standards to provide the crucial supports and accommodations that students must have to be successful.

Math Instruction

Research-Based Instruction

According to Watkins & Slocum (2004), if we expect to reach all students and teach all of the objectives and standards, instruction must be planned very carefully. One way this can be accomplished is by developing precisely planned instructions or lessons, which are laid out in lesson scripts. Lesson scripts are written narratives outlining what teachers should say to teach or convey academic information, questions teachers should ask their students, and as a result, the correct answers students should provide (Gunter & Reed, 1997). By providing instruction via lesson scripts teachers can be certain that all students have access to the same content and instruction. To ensure instructional alignment, when developing lesson scripts, researchers recommend that teachers start with the standard they are trying to teach and build from it. Elliot and Thurlow (2000) refer to this as backmapping; whereas English (2000) refers to this as backloading. Both terms refer to the process used to establish a match between what is expected to be learned based on standards and the curriculum. This process requires teachers to start developing their lessons plans by identifying the state standards that student are expected to learn. Next, teachers should examine the standards to determine the elements of instruction. When examining the standards, it will become apparent that there are many skills packaged within each standard. Next, it is important for teachers to identify and teach the prerequisites skills that are needed before teaching new concepts covered in the standard. The development of lesson scripts returns to what many would argue is a standards-based, teacher approach to mathematics instruction. In fact, many researchers are now calling for a return to a pattern of teaching in which teachers are in control of content presentation and management. With this control, teachers systematically introduce new concepts or skills and provide guided and independent practice. This call for systematically introducing content is based on years of educational research and literature that has been proven to be effective (Rosenhine & Stevens, 1986). Included within this body of research, is a review of 100 correlational and experimental studies examining effective instruction (Rosenshine, 1997). These studies included classroom observations designed to identify instructional procedures that were associated with successful teaching. Rosenshine and Stevens (1986) reviewed these studies and identified six instructional procedures that correlate with effective instruction:

1. Review
2. Presentation
3. Guided practice
4. Corrections and feedback
5. Independent practice
6. Weekly and monthly reviews.

Similar research has supported these instructional procedures (Brophy & Good, 1986), including research that focuses exclusively on effective mathematics instruction (Mercer & Miller, 1992).

According to Rosenshine and Stevens (1986), effective teaching occurs when teachers take the time to review skills and knowledge presented in prior lessons and/or introduce prerequisite skills and knowledge. This is supported by cognitive learning theory, which has found that prior knowledge plays a key role in the acquisition of new knowledge and skills (Ausubel, Novak, & Hanesian, 1978; Anderson, 2005). It is believed that the human brain organizes information into categories for easier information retrieval and new learning. Therefore, according to Ausubel, et al. (1978) for meaningful learning to occur, teachers should create a variety of strategies to help learners relate their prior knowledge to the new information being introduced. When evaluating the impact of sequencing and prior knowledge on learning mathematics through spreadsheet applications, Clarke, Ayres, and Sweller (2005) found that ninth grade students who had less experience with spreadsheet applications benefited more from sequential instruction than from concurrent instruction. Students with low levels of spreadsheet knowledge benefited more if initial instruction focused on spreadsheet skill acquisition prior to math instruction. Kalyuga and Sweller (2005) conducted a study to determine if different levels of mathematical expertise required different levels of instructional support. Using computer-based assessment software the researchers identified students' knowledge levels and provided instruction and practice at the identified levels.

Students who received instruction based on their prior knowledge levels demonstrated higher knowledge gains than students who did not.

Effective teaching also occurs when teachers present material in small steps, model procedures, and check students for understanding (Rosenshine & Stevens, 1986). This approach is supported by information processing theory, which has found that learners are only capable of processing small chunks of information due to limitations in short-term memory (Dirscoll, 2005). Therefore, it is important for teachers to present information in small steps, model, and check for learning. This is supported by Mastropieri, Scruggs, & Shiah (1994), who after reviewing thirty research studies in the area of mathematics, found that variation of modeling, demonstrations, and feedback improved and maintained the acquisition of math skills.

Effective teachers spend more time on guided practice and allow students to respond and receive feedback. This too is not a new finding; in fact the effectiveness of feedback in learning can be traced back to studies conducted by Thorndike in 1911. More recently, Mory (2004) has summarized the history of research on the effectiveness of feedback. When evaluating the effects of immediate or delayed feedback in the acquisition of addition, subtraction, multiplication and division facts, Brosvic, Epstein, and Dihoff (2006) found that immediate feedback over delayed feedback aided 3rd grade students in the acquisition of math facts. Moreover, the role that guided and independent practice plays in eradicating learning errors and misconceptions before they cause lasting effects has been well document (Hunter, 1994; Joyce, Weil, & Calhoun, 2004). According to Hunter (1994), guided practice can help ensure that students can complete tasks independently without practicing continual errors. In a study conducted by Hudson (1997) it was found that guided practice following short lecture segments helped students with learning disabilities retain content information better than independent practice alone.

Since Rosenshine and Stevens (1986) identified effective instructional procedures in 1986, several researchers have successfully incorporated the instructional procedures into their mathematics research or instruction (Maccini & Ruhl, 2000; Mercer & Miller, 1992). In fact, Maccini and Ruhl (2000) used modeling, guided practice, independent practice, and feedback to teach secondary students with learning disabilities a strategy designed to improve their problem solving abilities. In addition, Mercer and Miller (1992) develop lessons for teachers to use to teach mathematics known as the Strategic Math Series. The Strategic Math Series lessons contained systematic instruction that included the following instructional procedures: modeling, guided practice, independent practice, and feedback.

Web-based Instruction.

According to Elliot and Thurlow (2000), there are four factors that lead to a successful standards based classroom: (1) students know the standards and what is expected, (2) students are provided with multiple opportunities to learn the standards, (3) assignments are designed to reflect and integrate facts, concepts, and strategies, and (4) each assignment is an assessment itself. Although there have been several web-based attempts to provide teachers with standards-based instructional supports that can aid them in developing a successful standards based classroom, many of the attempts have failed to provide truly aligned resources. These attempts have primarily focused on providing teachers with various Internet sites aligning state standards with content and instructional supports. In fact, one such attempt is Marco Polo. Currently twenty-five states across the country have partnered with Marco Polo, a curriculum alignment web-based resource (Marco Polo, 2003). These partnerships allow states to create their own curriculum alignment web sites for teachers that are designed to link back to Marco Polo where teachers can assess lessons. The state of Alabama, one state that is utilizing Marco Polo's resources, has also created its own online resource, Alex: Alabama Learning Exchange, which links state standards to various web resources located on other web sites (Alabama State Department of Education, 2004). The state of Indiana, Indiana Standards Resources, has taken it one step further by providing in addition to a lesson, two assessments that can be downloaded by teachers to evaluate students' skills specific to the standard (Indiana State Department of Education, 2003). Access to two assessments per indicator allows teachers to utilize the pre/post test method of instruction. San Diego Public Schools provide teachers with a variety of supports online including curriculum maps, pacing guides, and individual lesson examples (Cavanagh, 2006). The sample lessons are two to three page demonstrations of how to use the adopted math textbook for instruction on a specific standard. Unfortunately, all of these resources have only served to further increase the amount of time teachers spend preparing their daily instruction and fails to provide the instructional tools needed for true curriculum alignment.

Pearson Digital has created one of the first comprehensive web-based systems aimed at providing teachers with extensive standards-based instructional supports (Pearson Digital, 2006). K-6 Digital Learning Resources is a lesson development tool which provides teachers with videos, software, internet links, electronic text, and assessments related to national content standards. Teachers can utilize prepared lessons, customize an existing lesson, or build their own with the multimedia materials associated with a specific standard. In addition, the system supplies teachers with ongoing assessment tools that are structured as traditional and non-traditional tests (multiple choice, fill-in-the-blank, short answer, and essay). Teachers use the data from the assessments to identify additional multimedia resources based on student needs.

Tutorial Instruction

One way to help students learn and understand state standards, provide multiple opportunities to learn the standards, integrate facts, concepts, and strategies within learning, and provide ongoing assessments is through the use of computer-assist instruction (CAI) in which students are provided instructional tutorials. CAI is defined as instruction delivered via a computer (The Access Center, 2006). CAI was first introduced in the 1950s and 60s in the form of "electronic page turners" which simply turned from one page to the next as an individual selected an answer (Kaput, 1992). A meta-analysis conducted in 1985 of 250 studies found that computer assisted instruction significantly raised student achievement scores (Kulik, Kulik, & Banger-Drowns, 1985). The study, which was repeated in 1991 with comparable findings, found that less instruction was needed when interacting with the computer and students were more positive about the instructional material (Kulik & Kulik, 1991). Research has also shown that impact of CAI on low achievers and students with special learning needs is more significant than the impact on typical peers (Niemiec & Walberg, 1985). Today, technological advances have extended the concepts of the first CAI programs to provide teacher with sophisticated web-based educational applications.

New developments in CAI for math instruction are aimed at providing schools and teachers with web-based tools for preparing students for high-stakes tests (Martindale, Pearson, Curda, & Pilcher, 2005). This is supported by the National Council of Teachers of Mathematics (2000), which stated that, “technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students’ learning.” (p. 3). The Florida Department of Education released in 2004 the FCAT Explorer, a web-based tutorial system that allowed students to practice state benchmarks. Researchers found that 5th grade students who used FCAT Explorer scored significantly higher on the math state assessment compared with their peers who did not use the program. In addition, results indicated that the program was more effective in elementary grades when compared to secondary grades. The researchers suggested this could be due to the lack of time the CAI was used in the classroom and perceived unimportance by secondary teachers. In addition, they concluded that by high school many students had established a pattern of performance that teachers perceived as having little control over.

Curriculum publishers have joined states in the development of web-based tutorial systems. Pearson Digital has developed Successmaker Enterprise, which contains standards-based instruction that is sequenced based on student responses (Pearson Digital). The tutorials were developed based on national standards in reading and math, then correlated to individual states standards. Each tutorial provides students with instruction and opportunities to demonstrate mastery. If students fail to achieve mastery the system assigns students tutorials that allow them to gain key prior knowledge skills related to the initial concept. In addition to access of web-based tutorials, the program reports student progress to the teacher via the web. Teachers are then able to take the data and adjust classroom instruction or print progress reports to share with parents. Larson Math has created a subscription based tutorial system that provides middle schools with web-based tutorials, which focus on pre-algebra and algebra concepts (LarsonMath, 2006). Each tutorial is developed to meet a national math standard, therefore, can be aligned with state standards. The Larson Math tutorials first provide students with step-by-step instructions, students then practice with feedback, and finally are evaluated with assessment questions.

Today's interactive CAIs allow students to advance at their own pace, while receiving immediate and continuous feedback regarding their answers. The instructional design of a tutorial follows a specific path of instruction, questions, and feedback. Gagne's stages of information processing are often used as a framework for the design of instructional tutorials (Wager & Mory, 1993). Gagne (1985) identifies nine stages of instruction:

1. Gain attention
2. Identify learning objectives
3. Identify key prior knowledge concepts and review new concept
4. Ask questions requiring students to perform new skill
5. Provide feedback and elaboration of the answer
6. Assess for understanding (Continue questions)
7. Provide feedback, elaboration, and cues
8. Evaluate whether the student can generalize the skill
9. Elaborate on the new skill

Gagne (1985) stated that students should be initially provided with an explanation of the learning objectives as a way to gain attention. Conveyed learning objectives allow students to establish an expectation for their own performance. Once attention and expectations are established prior knowledge concepts related to the new concept are reviewed. Instruction that follows the review of prerequisite skills typically contains directions, examples, and cues for retrieval. Once students receive instruction on the new skill they encounter questions to "(1) establish and maintain attention, (2) facilitate encoding, and (3) provide for rehearsal" (Wager & Mory, 1993, p. 58).

A key component of tutorials is the use of feedback. Each question is followed by feedback, which identifies whether the student's response was correct or incorrect and serves to identify any misconceptions. Research has shown that feedback in a computer environment is very important "for enhancing achievement, especially in terms of immediacy, amount of information provided, and the type of task involved" (Martindale et al. 2005, p. 351). Kulik et. al. (1985) found that immediate feedback had a positive significant effect on learning when compared to delayed feedback. Feedback typically includes not only whether the answer is correct or incorrect, but also provides an explanation for why the answer is incorrect. This type of feedback is referred to as elaborate feedback, which identifies whether the student's selection was correct or incorrect and then provides instruction on the correct answer (Ross & Morrison, 1993; Khine, 1996). Research has found that elaborate feedback is significantly more beneficial to students than feedback, which identifies only whether the response was correct or incorrect (Waldrop, Justin, & Adams, 1996; Gilman, 1969; Roper, 1977). In addition, research has found that when students are learning a new concept, feedback in conjunction with cues and hints produces greater learning than when the tutorial identifies the correct or incorrect answer only.

CHAPTER THREE

Methods

Problem

Despite legislative mandates calling for standards-based reform, assessment results and research continue to show that the mathematics achievement gaps between subgroups within and outside the United States still exist (National Assessment of Education Progress, 2005). The inability to close the mathematics achievement gaps results from a lack of curriculum alignment between classroom instruction and assessment outcomes and expectations (Elliott & Thurlow, 2000; English, 2000).

In the fall of 2006, a pilot study was designed to evaluate the effectiveness of the Blending Assessment with Instruction Program (BAIP) in grades 4, 5, 6, 7, and 8. BAIP is an intervention designed to provide teachers with lessons and student tutorials that are aligned with state mathematics indicators. The present study evaluates the effectiveness of BAIP in improving the mathematics performance of fifth-grade students. The following research questions were analyzed.

Questions

Research Questions

Specifically, the study investigated the following research questions:

1. Do significant differences exist between 2006-2007 state assessment scores for the six selected indicators for fifth-grade students who received the BAIP interventions and those who received traditional math instruction?

2. Do significant differences exist between the scores on the 2006-2007 state mathematics assessments for fifth-grade students who received the BAIP intervention and those who received traditional math instruction?
3. Do significant differences exist between the posttest scores of fifth-grade students who qualified for free and reduced-cost lunch, students with disabilities, and general education students who received the BAIP intervention?
4. Is there a significant correlation between the total number of tutorials completed by fifth-grade students and the students' 2006-2007 state assessment scores?
5. Is there a significant correlation between selected indicator tutorial scores (number correct out of 8) and the 2006-2007 selected indicator scores on the state assessment?

Null Hypotheses

Therefore, the following null hypotheses were tested:

1. No significant differences exist between 2006-2007 state assessment scores for the six selected indicators for fifth-grade students who received the BAIP interventions and those who received traditional math instruction.
2. There are no significant differences between the scores on the 2006-2007 state mathematics assessments for fifth-grade students who received the BAIP intervention and those who received traditional math instruction.
3. There are no significant differences between the posttest scores of fifth-grade students who qualified for free and reduced-cost lunch, students with disabilities, and general education students who received the BAIP intervention.

4. There is not a significant correlation between the total number of tutorials completed by fifth-grade students and the students' 2006-2007 state assessment scores.
5. There is not a significant correlation between selected indicator tutorial scores (number correct out of 8) and the 2006-2007 selected indicator scores on the state assessment.

Intervention

Description

The interventions employed in the study include (a) 12 fifth-grade lessons designed for teachers that are aligned with Kansas' math indicators and (b) 16 fifth-grade online indicator-based tutorials designed as supplemental instructional resources for independent use by fifth-grade students (see Appendix A and B for a sample of a lesson and tutorial).

The 12 lessons and 16 tutorials, selected for the study and referred to as selected indicators, correspond with six Kansas state indicators that were selected by subject-matter experts. The selection processes consisted of (a) identifying the state mathematics indicators that might be the most challenging, most critical, or most common on fifth-grade mathematics state assessment and (b) identifying state indicators that were most likely going to be taught during January and February, the period of the study. Following is a brief description of the 6 fifth-grade Kansas indicators that were selected for this study:

- Standard 1, Benchmark 3, Indicator a4 – Number/Computation - The student determines if a real-world problem calls for an exact or approximate answer using whole numbers from 0 through 100,000 and performs the appropriate computation using various computational methods.
- Standard 1, Benchmark 4, Indicator k4 – Number/Computation- The student identifies, explains, and finds the greatest common factor and least common multiple of two or more whole numbers through the basic multiplication facts from 1 x 1 through 12 x 12.
- Standard 3, Benchmark 1, Indicator a1a - Geometry - The student solves real-world problems by applying the properties of plane figures and the line(s) of symmetry.
- Standard 3, Benchmark 2, Indicator a1cf - Geometry - The student solves real-world problems by applying appropriate measurements and measurement formulas: c) weight to the nearest whole unit (pounds, grams, and nonstandard units), f) months in a year and minutes in an hour.
- Standard 3, Benchmark 3, Indicator k3 - Geometry -The student recognizes three-dimensional figures from various perspectives.
- Standard 4, Benchmark 2, Indicator k3de - Data - The student identifies, explains, and calculates or finds the d) median and e) mean of a whole number data set of up to twenty whole number data points from 0 through 1,000.

Intervention Format

Lesson Format

The lessons were developed for teachers to integrate into their curriculum and were tied to indicators that operationally define each state mathematics standard. The BAIP lesson design is based on five frameworks that have been shown to be essential for effective instruction: (a) contextual, (b) teaching, (c) lesson, (d) application, and (e) validation (Rosenshine & Stevens, 1986).

The contextual framework serves as an introduction to the lesson by providing the teacher with the basic information about the state standard, benchmark, and indicator the lesson pertains to (see Figure 1).

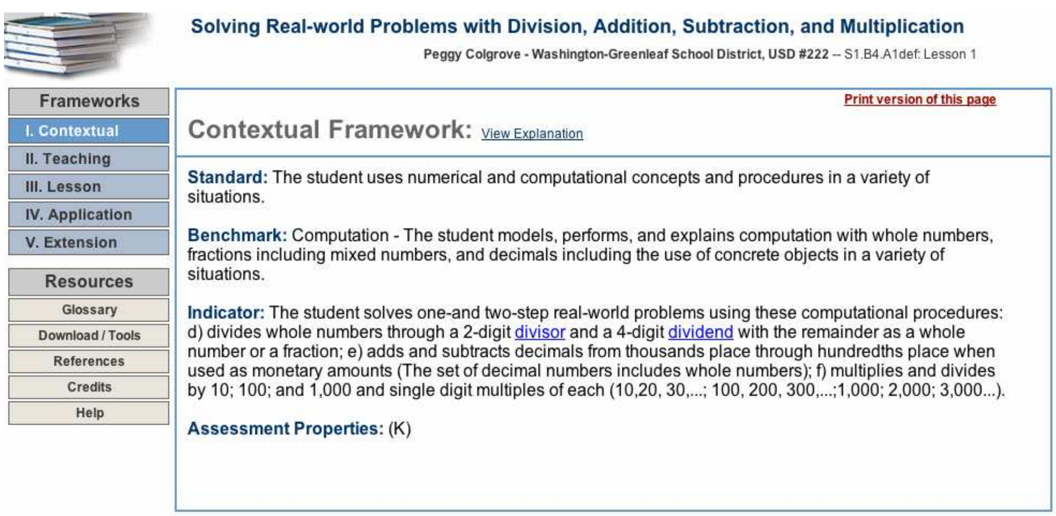

Figure 1. A screen shot of the contextual framework of a fifth-grade lesson.

The teaching framework provides the teacher with further details about the indicator and serves as an instructional tool to increase the teacher's knowledge about that specific indicator. According to Little (2003), to effectively teach all students, teachers need the content knowledge of mathematics standards and outcomes.

The lesson framework begins by identifying key prior knowledge concepts that students need to have mastered and strategies for reviewing these concepts. The identification and introduction of prior knowledge concepts serves to link students' understanding and experiences of what they already know with the new concepts being introduced (Falk, 2000). According to the National Council of Teachers of Mathematics (NCTM, 2000), "in a coherent curriculum mathematical ideas are linked to and build on one another so that students' understand and knowledge deepens and their ability to apply mathematics expands" (p. 2). Therefore, the lesson identifies and provides the teacher with instructional strategies on prior knowledge concepts and skills that are related to the lesson.

Next, the lesson framework provides the teacher with an age-appropriate application of the new skill or concepts being introduced. This age-friendly description of the skill may be used to motivate and capture students' interest (Robinson, Robinson, & Maceli, 2000). Finally, the lesson framework provides the teacher with specific strategies for introducing concrete models of the skill or concepts and then step-by-step demonstrations. Each of these strategies is described explicitly in terms of teacher prompts and corresponding student responses. These prompts and responses serve two purposes. First, they result in cueing and corralling, which requires students to be actively engaged in the lesson (Little, 2003). Second, students’ responses allow the teacher to continuously monitor the students’ skill acquisition.

The application framework follows a three-step process of guided practice, independent practice, and open-ended validation questions. BAIP lessons provide the teacher with all the materials necessary to perform these steps, including practice worksheets and a grading rubric that can be used when evaluating the open-ended validation questions provided in the lesson. Additionally, prompts are provided for the teacher to utilize when guiding students through initial practice.

The extension framework provides the teacher with additional activities for students with learning disabilities and students in need of academic enrichment. These activities range from critical skills that students might need reviewed to advanced applications of concepts covered in the indicator.

The BAIP Web site interface allows the teacher to access training on the lesson model to learn how each framework and feature works. The Web lessons are presented within an e-learning design format. Each BAIP lesson is self-contained in that it incorporates the information and resources necessary to teach it , so teachers do not have to go to other Web sites to search for and review resources as part of using and /or modifying the BAIP lessons. Teachers may review other Web sites if additional ideas are needed or wanted, but it is not essential to teaching a BAIP lesson.

Table 1 illustrates the organization and content components of the lesson design. Each component identified is an interactive feature of the online version of a lesson.

Table 1
Lesson Design Format

Framework	Content Components
Contextual Framework	Standard
	Benchmark
	Indicator
	Assessment Properties
Teaching Framework	Instructional Translation:
	Concept
	Skill
	Essential vocabulary
	Application
Lesson Framework	Prior Knowledge:
	Step-by-step review of prerequisite skills for the lesson
	Application: Connect to age-appropriate life experience

	Model New Concept:
	Concrete or semi-concrete example
	Step-by-step demonstration/illustration
Application Framework:	Practice:
	Guided practice
	Independent practice
	Validation:
	Reflection: Students articulates their understanding of the indicator and what they know
	Assessment: Constructive response item/open-ended question
Extension Framework	Activities for students in need of enrichment
	Activities for students with learning disabilities
	Attributions (references)
	Instructional Support:
	Vocabulary
	Handout
	PowerPoint

Tutorial Format

The BAIP student tutorials provide students with an independent study tutorial to assist them in understanding and learning the skills and concepts covered on state standards and indicators. This type of alignment and practice is not a new phenomenon. According to Martindale et al. (2005), when technologies, such as Web-based resources, are used appropriately, they contribute to effective learning. In fact, when evaluating a Web-based instructional tool designed to provide interactive practice aligned with Florida's Sunshine State Standards, it was found that fifth-grade students who used the tool scored significantly higher on the Florida Comprehensive Assessment Test than those who did not use the tool in the area of mathematics (Martindale et al., 2005). In addition, McDonald and Hannafin (2003) found that third-grade students who interacted with a Web-based review program scored higher on the State of Virginia's Standards of Learning Exam than students who did not interact with the program.

To ensure alignment, the BAIP tutorials incorporate assessment items that mimic the items and item format used on the Kansas State assessments. This format provides students with additional opportunities to experience and respond to assessment items that are similar to items that will be encountered on state assessments.

BAIP tutorials include four assessment items that are aligned to a particular indicator. To begin a tutorial, students select an indicator related to a standard. Once the indicator is selected, the mathematics content covered in the indicator is introduced in student-friendly language under the heading of "key math idea." Following the "key math idea," the student is presented with an example of how the content relates to a real-life situation. Next, the student is presented with an assessment item, at which time he is given the opportunity to select an answer. After answering the item, the student is electronically notified of whether the answer selected is correct or incorrect. The notification provides the student with an instructional explanation of why the answer chosen is correct or why the answer chosen is incorrect (see Figure 2).

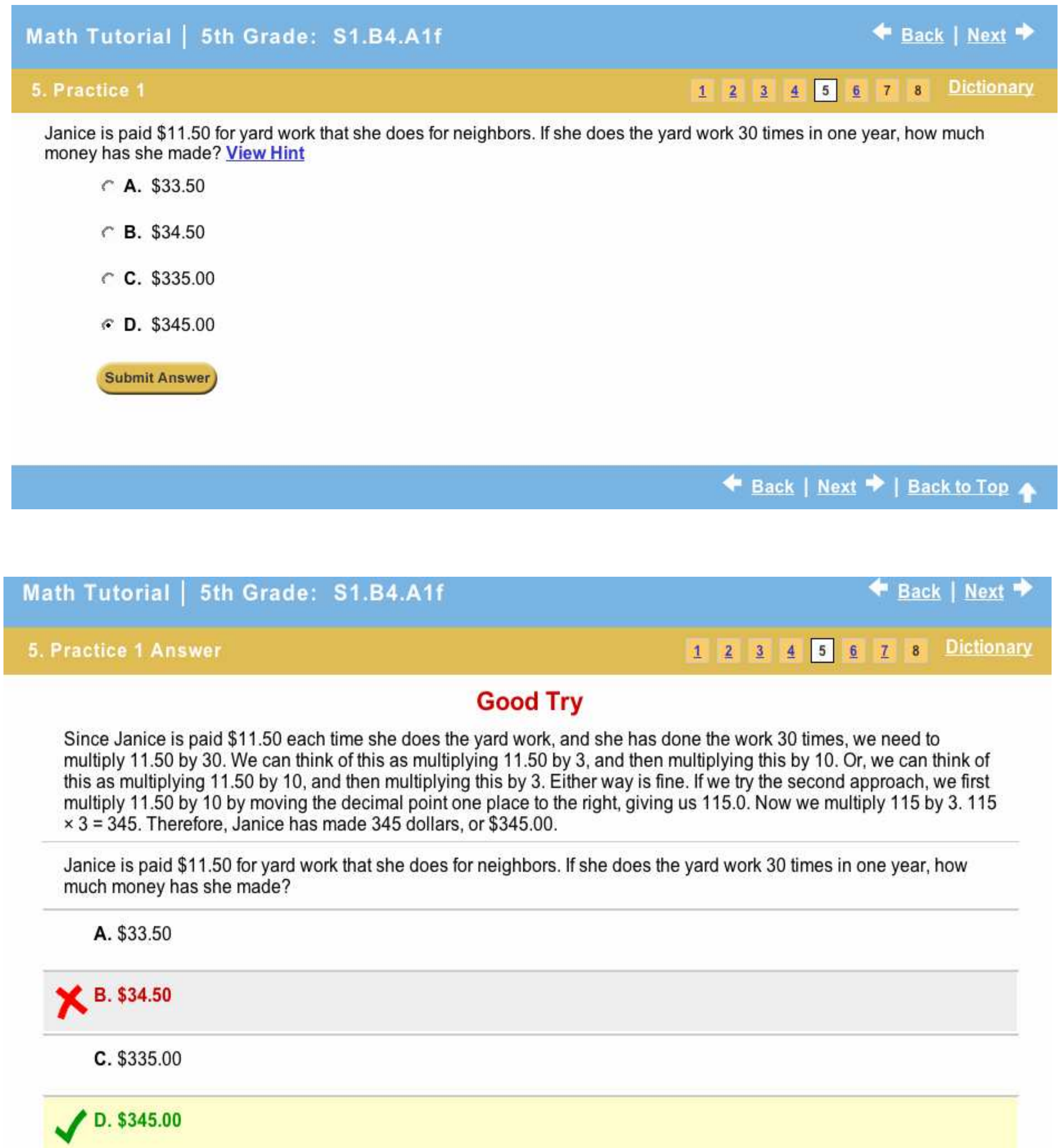

Figure 2. Screen shots of a fifth-grade practice problem and answer.

Once the student has read the explanation, she is provided with a brief review of the concepts being covered in the tutorial she is currently working on. Next, the student has another opportunity to solve an assessment item. After attempting to answer the item, the student is informed of whether the answer was correct or incorrect and given an explanation of how to answer the item correctly. The tutorial continues using this format as two additional assessment items are presented and explained to the student. A step-by-step description of the tutorial process is shown in Table 2.

Once a student has answered the four items on the tutorial, the student's teacher is electronically notified that the tutorial has been completed and is informed of how well the student preformed. The tutorial tool allows students to retake a tutorial as often as they like.

Table 2

Steps Within Each Web-Based Tutorial

Steps	Descriptions
Selection Screen	The student is presented with a list of concepts covered in a standard and asked to select a concept.
Description	A brief description of the indicator associated with the standard that will be learned and practiced is provided.
Age-Appropriate Skill Application	The student is presented with a scenario or situation in which the concepts covered in the tutorial is applied.
Instructional Problem	The student is asked to answer a question

	based on the concepts covered in the indicator introduced on the previous screen.
Instructional Explanation	An explanation of the mathematics process that must be followed to figure out the correct answer for the problem presented on the previous screen is provided.
Practice Problem-1	A new mathematics problem over the same content is presented, and students are asked to answer it. Students are told if they answered the question correctly or not. At this time, an explanation on how to solve the mathematics problem is provided.
Practice Problem-2	A new mathematics problem over the same content is presented, and students are asked to answer it. Students are told if they answered the question correctly or not. At this time, an explanation on how to solve the mathematics problem is provided.

Practice Problem-3	A new mathematics problem over the same content is presented, and students are asked to answer it. This question is designed to help ensure students have learned the concepts and are able to generalize what they have learned. Students are told if they answered the question correctly or not.
End of Tutorial	If students get all four questions correct, they are routed to the selection screen to pick a new indicator. If they do not get all four questions correct, data are sent to the teacher and the student is re-routed to the beginning of the same tutorial.

Development

Lessons Writing

Phase I. To locate and identify potential lesson writers, Kansas mathematics state assessment data were analyzed to identify districts throughout the state that had improved their state assessment mathematics scores for three consecutive years. An invitation to participate as lesson writers was subsequently extended to teachers in qualifying districts.

To begin, teachers who were selected to write lessons were paired into groups of two, with one teacher at the grade level for which the lesson would be written and the other teacher at a grade level below. This teacher pairing was intended to ensure that the lessons followed a scope-and-sequence format. Participating teachers were provided training via Web-based, face-to-face, and conference call formats. Each writer was provided and asked to follow a lesson template that was based on findings in the literature on research-based effective instruction. In addition, lesson writers were provided with a sample lesson to be used as a guide when developing lessons.

To begin the lesson development process, project coordinators at the University of Kansas identified the math indicator that a lesson would cover and then assigned each pair of writers to write a lesson coving it. Upon completion of a lesson, writers were asked to email the lesson and all corresponding materials to the project coordinator. Once the project coordinator reviewed the lesson to ensure that the lesson had all of its components, the project coordinator emailed the lesson to a subject-matter expert (SME) at the University of Kansas. The SME was responsible for reviewing and editing the lesson. When the SME was finished, the lesson was returned to the project coordinator who then made the necessary edits. Finally, the lesson was prepared and placed onto a Web site designed for teacher access (see Appendix C for the lesson production process).

Phase II. After the first year of lesson development, it became apparent that additional lesson writers were needed if the project was to be completed in a timely manner. As a result, an invitation designed to recruit additional lesson writers was placed in a local newspaper and in the Kansas National Education Association's (KNEA) newsletter. This invitation led to an additional 100 lesson writers. The new lesson writers were allowed to develop lessons independently or in groups of two. The same process for editing, reviewing, and posting the lessons onto the BAIP Web site that was used during Phase I was used during Phase II. A total of 278 lessons (two lessons for each assessed indicator) were developed and placed onto the Web.

Tutorial Writing

Four individuals who had extensive experience in test preparation, test development, and textbook writing were recruited to write mathematics tutorials that correlate with state indicators. The tutorial writers were trained on a tutorial format that was designed by an SME at the University of Kansas. Writers received a sample tutorial along with sample problems to be used as a guide when writing math tutorials. Each writer was assigned to write tutorials for a particular grade level, based on their experience and expertise. Writers received a thorough description of the state indicators they were asked to write tutorials for.

Once a tutorial was written, the writer emailed the tutorial to a project coordinator, who ensured that the tutorial was complete. Next, the project coordinator sent the tutorial to an SME, who suggested revisions, as appropriate. The project coordinator made the suggested revisions. Finally, the tutorial was prepared and placed onto the Web (see Appendix D for the tutorial production process). A total of 410 tutorials (two for each assessed indicators) were written and placed on the Web. All of the individuals who wrote lessons or tutorials were compensated for their work.

Research Instruments

Measures Associated with BAIP

BAIP pre- and posttest. A 40-item pre- and posttest was developed by math experts and utilized to determine the effectiveness of BAIP at improving student mathematics performance (see Appendix E for a copy of the pretest and posttest). The Center for Educational Testing and Evaluation (CETE) at the University of Kansas provided samples of validated test items for each of the selected indicators. The sample items were given to the test developers who were asked to create 10 questions for each selected indicator, using the sample items as a guide. Half of the items were used for the pretest; the other half was used for the posttest. Once the test items were created, they were placed into the CETE's formative assessment tool.

State Mathematics scores. In addition to the 40-item pre and posttests, state assessment scores in the areas of mathematics from the 2005-2006 and 2006-2007 school years were collected from the CETE and analyzed to determine if the BAIP intervention was effective in improving students' mathematics achievement.

BAIP Assessment 2007. BAIP Assessment 2007 was developed by identifying state mathematics assessment items on the 2006-2007 State Mathematics Assessment that were related to the six indicators focused on during this study. Once those items were identified, student responses to those items from the 2006-2007 State Mathematics Assessment were collected and used to form the BAIP Assessment 2007. Therefore, the BAIP Assessment 2007 is comprised of the answers to 31 state assessment items for the 2006-2007 State Mathematics Assessment.

Student tutorial scores. The overall scores for each student on each selected indicator tutorial were collected. Each student tutorial consisted of four multiple-choice questions. Each student was asked to complete two tutorials on each selected indicator tutorial, for an overall score based on eight items per indicator.

Treatment Validity

Instructional checklist. According to Hall and Hord (2006), “a critical step in determining whether a new approach is making a difference is to determine first if the innovation is being used” (p. 159). Therefore a five-item multiple-choice checklist was created and made available at the BAIP Website to determine if the lessons were being implemented (see Appendix F). The data obtained from the checklist will be used for treatment validity purposes.

Social Validity Measure

Teacher satisfaction. Teachers participating in the study were asked to respond to several questions designed to obtain their perceptions, satisfaction, and formative suggestions for improvement purposes. The questions were grouped around four themes of use: general, lesson, tutorial, and management system (see Appendix G). The data obtained from the survey will be reported in an anecdotal format.

Research Design

As the 2006-2007 academic year was already underway when the study took place, it was no feasible to randomize the assignment of participants into an experimental or comparison group. Therefore, a quasi-experimental design was used to determine the impact BAIP had on improving the mathematics achievement of fifth-grade students.

Independent Variables

Independent variables included subgroups of students and BAIP intervention. The subgroups of students consisted of three levels: general education students, students with disabilities, students who qualified for free/reduced-cost lunch, and students with disabilities who qualified for free and reduced-cost lunch. The BAIP intervention consisted of two levels: (a) students who received the BAIP intervention (b) and students who did not receive the BAIP intervention.

Dependent Variable

Dependent variables in the study included (a) the students' BAIP posttest score – the number of items answered correct by each student on the 40-item test; (b) the students' scores on the 2006-2007 state mathematics assessment – each student's percentage score; and (c) the students' scores on the BAIP Assessment 2007 – the number of items answered correctly by each student on the 31 items that were taken from the 2006-2007 State Mathematics Assessment and related to the six selected indicators.

Procedures

Experimental Group

The study began during the third week of January 2007 and ended during the third week of March 2007. During the pretest data collection phase, a 40- item pretest was administered to students in the experimental group via the internet. To accomplish this, teachers were required to log onto the CETE's Web site and print off "session tickets" for each student. The tickets contained the students' name and login information (see Appendix H for teacher instructions on how to access the computerized assessment tool). Students were then instructed to log onto CETE's Web site and complete the pretest.

Prior to implementing the BAIP intervention, teachers participated in a training session designed to teach them how to integrate BAIP lessons and tutorials into their classroom instruction**.** The training session consisted of reviewing a PowerPoint presentation designed to provide teachers with an overview of the project, instructions on how to navigate through the lessons and tutorials, and information regarding the field testing procedures (see Appendix I for the PowerPoint presentation). If teachers had questions after viewing the PowerPoint presentation, they were encouraged to participate in one of two conference calls designed to go over the presentation in a step-by-step fashion. During the conference call, teachers were given the opportunity to ask questions. Finally, teachers were provided with a help line phone number that they could call to receive additional guidance and support throughout the study.

During the intervention phase, teachers were required to teach 12 lessons and allow students time to complete 16 tutorials in class that corresponded with the fifth-grade selected indicators selected for the study. Teachers accessed the lessons online and were asked to document the use of each lesson by completing an Instructional Checklist after teaching each lesson.

Students were required to complete the tutorials that corresponded with the selected indicators. Students accessed the tutorials by logging onto the BAIP Web site using their username and password. Performance and participation data were collected remotely via the tutorial management system.

At the completion of the intervention phase, students were given a 40-item posttest via paper-pencil format. A paper-pencil format was utilized, as there was evidence that there were problems with computer accessibility. The posttest consisted of separate tests, one for each of the selected indicators. Copies of the tests were mailed to participating school districts. In addition, scantron sheets, with the student's identification number, grade, and selected indicator, were also mailed. Teachers were instructed to administer the posttest immediately after the lessons and tutorials for a particular selected indicator were implemented (see Appendix J for teacher instructions). Once the study was completed, the teachers were asked to complete an electronic satisfaction survey to evaluate their perceptions of the usefulness of the BAIP intervention.

The districts that participated in the study finished implementing the BAIP lessons and tutorials during the third week of March 2007. State assessments took place during the last week of March and/or first week of April in 2007.

Comparison Group

To obtain a comparison group, the state assessment database was canvassed to identify school districts that were similar in size, location (rural and urban), percentages of students who qualify for free and reduced-cost lunch, and percentage of students with disabilities (see Table 3 for percentages). Districts found to have similar characteristics as the experimental districts were used as the comparison group. Thus, to ensure equivalent experimental and comparison groups, district demographics were collected and analyzed to create comparable experimental and comparison groups before beginning the study. The students in the comparison group were not exposed to the BAIP intervention. Instead, they were instructed using the traditional fifth-grade math curriculum adopted by the district they attended.

Table 3

Percent of Students Who Qualify for Special Education and Free and Reduced-Cost Lunch

District	Group	Special Education	Free/Reduced-Cost Lunch
	Experimental	9.72%	26.64%
A	Comparison	9.93%	24.33%
	Experimental	12.12%	46.94%
B	Comparison	12.24%	41.50%
	Experimental	12.18%	24.88%
C	Comparison	12.00%	30.68%
	Experimental	20.19%	57.46%
D	Comparison	20.70%	51.41%

Subjects

Districts were recruited to participate in the study through a statewide effort. Invitations to participate were extended to district assessment coordinators and other district personnel during a state presentation at the Annual Kansas State Assessment Meeting in Topeka Kansas in the fall of 2006, in the Kansas Department of Education newsletter, and through email correspondence with classroom teachers who developed content for the BAIP intervention. Districts then volunteered to participate in the study.

Experimental Group Demographics

Four school districts and two private schools agreed to participate in the study. Three of the districts are located in rural areas whereas the remaining public school district and three private schools are located in urban areas. A total of 198, fifth-grade students and 12 fifth-grade teachers agreed to participate in the study (see Table 4 for a breakdown of participants).

Table 4

Number of Districts, Teachers, and Students in the Experimental Group

District	Setting	Teachers	Students with Disabilities	Students Who Qualify for Free and Reduced-Cost-Lunch	Total Number of Students
A	Urban	4	7	8	74
B	Rural	2	4	13	39
C	Rural	3	4	23	46
D	Rural	1	4	2	15
E	Private	1	0	3	20
F	Private	1	1	0	4

School District A was an urban school district with 74 students in fifth grade, of which 11% qualified for free/reduced-cost lunch and approximately 9.5% qualified as students with disabilities. School District B was a rural school district with 39 students in fifth grade, of which 33% qualified for free/reduced-cost lunch and 10% qualified as students with disabilities. School District C was a rural school district with 46 students in fifth grade, of which 50% qualified for free/reduced-cost lunch and approximately 9% qualified as students with disabilities. School District D was a rural school district with 15 students in fifth grade, of which 13% qualified for free/reduced lunch and 27% qualified as students with disabilities. School District E was a private school with 20 students in fifth grade, of which 15% qualified for free/reduced-cost lunch and none qualified as students with disabilities. School District F was a private school district with 4 students in fifth grade, of which 25% of the students qualified as students with disabilities and none qualified for free/reduced-cost lunch.

Comparison Group Demographics

State assessment data from four school districts were gathered for the purpose of serving as a comparison group. One of the districts was located in an urban area, and the remaining three districts were located in rural areas. A total of 202 fifth-grade students were included in the comparison group (see Table 5 for a breakdown of participants).

Table 5

Number of Districts and Students in the Comparison Group

District	Setting	Students with Disabilities	Students Who Qualify for Free and Reduced-Cost Lunch	Total Number of Students
A	Urban	6	24	101
B	Rural	1	9	43
C	Rural	3	15	38
D	Rural	2	10	20

School District A was an urban school district with 101 students in fifth grade, of which 24% qualified for free/reduced-cost lunch and approximately 6% qualified as students with disabilities. School District B was a rural school district with 43 students in fifth grade, of which 21% qualified for free/reduced-cost lunch and 2% qualified as students with disabilities. School District C was a rural school district with 38 students in fifth grade, of which 39% qualified for free/reduced-cost lunch and approximately 8% qualified as students with disabilities. School District D was a rural school district with 20 students in fifth grade, of which 50% qualified for free/reduced-cost lunch and 10% qualified as students with disabilities.

Statistical Analysis

Hypothesis 1

An analysis of covariance (ANCOVA), with the 2005-2006 state mathematics score serving as the covariate, was conducted to determine that there were no significant differences on the BAIP Assessment 07 for fifth-grade students who received the BAIP interventions and those who received traditional math instruction.

Hypothesis 2

An ANCOVA, with the 2005-2006 state mathematics scores serving as the covariate, was conducted to determine that there were no significant differences between the scores on the 2006-2007 state mathematics assessments for fifth-grade students who received the BAIP intervention and those who received traditional math instruction.

Hypothesis 3

An ANCOVA, with the pretest score and 2005-2006 state assessment scores serving as the covariates, was conducted to determine that there were no significant differences between the posttest scores of fifth-grade students who qualified for free and reduced-cost lunch, students with disabilities, and general education students who received the BAIP intervention.

Hypothesis 4

A Pearson product-moment correlation coefficient was computed to determine that there was no significant correlation between the total number of tutorials completed by fifth-grade students and the students' mean score on the 2006-2007 state assessment scores.

Hypothesis 5

A Pearson product-moment correlation coefficient was computed to determine that there was no significant correlation between selected indicator tutorial scores (number correct out of 8) and the 2006-2007 selected indicator scores on the state assessment.

CHAPTER FOUR

Results

This study was designed as part of a formative pilot study to enhance the Blending Assessment with Instruction Program (BAIP) prior to implementation statewide. Specifically, the main objectives were to obtain teacher perceptions on the usability of BAIP, identify the program's instructional value and the appropriateness of its infrastructure for improvement purposes, and begin determining the impact BAIP has on student outcomes in mathematics.

The overall pilot study included grades four, five, six, seven, and eight. This chapter focuses on fifth-grade teacher perceptions, as measured through surveys, and fifth-grade student outcomes, as measured by pre- and posttest scores and performance on Kansas Mathematics Assessments. The chapter concludes with a brief overview of the results from the overall pilot study.

Descriptive Statistics

A total of 400 fifth-grade students participated in the study: 198 students in the experimental group and 202 students in the comparison group. Table 6 shows the subgroups within the comparison and experimental groups.

Table 6

Number of Participants Within Each Subgroup

Subgroups	Experimental	Comparison
Free and Reduced-Cost Lunch	49	58
Special Education	20	12
General Education	129	132
Total	198	202

At the beginning of the study, a large urban school district with a sizable special education population agreed to participate. However, due to the time of year and previous curriculum commitments, the district decided to withdraw from the pilot test. This decision affected the number of students in the special education subgroup. As a result, the three subgroups that were originally identified, free and reduced-cost lunch, special education, and general education, were regrouped into two groups: (a) students in general education and (b) students who qualify for free and reduce- cost lunch and/or students with disabilities.

Districts' participation in the pilot study was voluntary. Teachers were selected to participate by the curriculum coordinators in the volunteering districts. Teachers who participated in the experimental group were instructed to implement 12 lessons and 16 tutorials that correlated with 16 state assessment sub indicators, starting the third week of January and ending the third week of March.

Although the teachers in the experimental group were encouraged to teach all 12 lessons and have students complete all 16 identified tutorials, this was not feasible in some districts due to time constraints and prior instructional commitments in mathematics. Teachers were allowed to select which of the 12 lessons they would teach and which of the 16 indicators they would assign based on the instructional needs of their students. In addition, they were allowed to determine how much classroom instructional time they would devote to teaching each of the lessons. To report which lessons were actually taught, teachers were instructed to complete a lesson checklist after teaching each lesson. There were two lessons for each of the six selected indicators, resulting in a maximum of 12 checklists per teacher. The completed lesson checklist was used as documentation that the lesson was implemented. Table 7 shows the number of checklists completed by each of the teachers in the experimental group for each of the select indicator lessons.

Table 7

Number of Checklists Completed by Teachers

Teacher	s1.b3.a4	s1.b4.k4	s3.b1.a1a	s3.b3.k3	s3.b2.a1cf	4.2.k3de	Total
1	0	0	2	2	2	2	8
2	2	2	2	2	1	2	11
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	1	1	0	0	0	0	2
7	2	0	1	0	1	1	5
8	2	2	0	0	0	0	4
9	2	2	0	0	0	0	4
10	2	2	2	2	2	1	11
11	2	1	0	0	0	0	3
12	1	0	0	0	0	1	2

Note. s1.b3.a4 = Standard 1, Benchmark 3, Indicator A4, s1.b4.k4 = Standard 1, Benchmark 4, Indicator K4, s3.b1.a1a = Standard 3, Benchmark ,1 Indicator A1a, s3.b3.k3 = Standard 3, Benchmark 3, Indicator K3, s3.b2.a1cf , = Standard 3, Benchmark 2, Indicator A1cf, 4.2.k3de = Standard 4, Benchmark 2, Indicator K3de

Results from checklist submissions indicated that 3 out of the 12 teachers taught eight or more of the lessons. Therefore, to improve treatment validity, only data from students in the classrooms from Teachers 1, 2 and 10 were used to evaluate Hypotheses 1, 2, and 3, resulting in a total of 112 students, 56 in the experimental group (12 qualifying for free and reduced-cost lunch or special education and 44 general education) and 56 in the comparison group (14 qualifying for free and reduced-cost lunch or special education and 42 general education) The latter was formed by randomly selecting 56 students from two comparison districts. Table 8 shows the number of participants used to analyze hypotheses one, two, and three.

Table 8
Number of Teachers and Students used to Evaluate Hypotheses 1, 2, and 3

Teacher	Students-Experimental	Students-Comparison
1	21	21
2	20	21
10	15	14
Total	56	56

Hypothesis 1

An analysis of covariance (ANCOVA), with the 2005-2006 state mathematics score serving as the covariate, was conducted to determine if there were significant differences between the BAIP Assessment 2007 scores for fifth-grade students who received the BAIP intervention and those who received traditional math instruction.

The independent variable, groups, included two levels, students who received the BAIP intervention and students who received traditional mathematics instruction.

The dependent variable was the BAIP Assessment 2007 score, which was derived from students' scores on select indicator items on the 2006-2007 state mathematics assessment. Table 9 shows the means and standard deviations for the 2005-2006 state mathematics score and the BAIP Assessment 2007 for the two groups of students.

Results of a preliminary analysis evaluating the homogeneity of slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly among the groups, $F(1, 108) = .415$, $p = .52$. The ANCOVA was not significant, $F(1, 109) = .994$, $p = .321$, $\eta^2 = .009$. Table 10 displays the results.

The group that received the BAIP intervention had the largest adjusted mean ($M = 24.34$), and the group that received traditional mathematics instruction had a smaller adjusted mean ($M = 23.64$).

Table 9

Mean Scores and Standard Deviations for 2005-2006 State Mathematics Score and BAIP Assessment 2007

Source	2005-2006 state mathematics score		BAIP Assessment 2007	
	M	*SD*	*M*	*SD*
Students who received the BAIP Intervention	72.57	12.79	24.00	4.38
Students who received traditional mathematics instruction	76.05	17.42	23.98	5.07

Table 10

Analysis of Covariance of BAIP Assessment 2007 as a Function of Groups, with 2005-2006 State Mathematics Score as the Covariate

Source	*df*	*SS*	*MS*	*F*	η^2
Covariate	1	984.30	984.30	72.36	.399
Groups	1	13.52	13.52	.99	.009
Error	109	1482.68	13.60		
Total	112	66931.00			

* $p < .05$. **$p < .01$.

Hypotheses 2

An ANCOVA, with the 2005-2006 state mathematics score serving as the covariate, was conducted to determine if there was a significant difference between the 2006-2007 state mathematics score for fifth-grade students who received the BAIP intervention and those who received the traditional mathematics instruction.

The independent variable, groups, included two levels: students who received the BAIP intervention and students who received traditional mathematics instruction. The dependent variable was the 2006-2007 state mathematics score. Table 11 shows the means and standard deviations for the 2005-2006 and 2006-2007 state mathematics scores.

Results of a preliminary analysis evaluating the homogeneity of slopes assumption indicated that the relationship between the covariate and the dependent variable did not differ significantly among the groups, $F(1, 108) = 2.74$ $p = .30$. The ANCOVA was not significant, $F(1, 109) = .454$, $p = .00$, partial $\eta^2 = .004$. Table 12 displays the results.

The group that received traditional instruction had the largest adjusted mean ($M = 79.83$), and the group that received the BAIP intervention had a smaller adjusted mean ($M = 78.60$).

Table 11

2005-2006 and 2006-2007 State Mathematics Mean Scores and Standard Deviations

Source	2005-2006		2006-2007	
	M	*SD*	*M*	*SD*
Students who received the BAIP Intervention	72.57	12.79	77.57	13.00
Students who received traditional mathematics instruction	76.05	17.42	80.86	13.32

Table 12

Analysis of Covariance of 2006-2007 State Mathematics Score as a Function of Groups, with the 2005-2006 State Mathematics Score as Covariate

Source	*df*	*SS*	*MS*	*F*	η^2
Covariate	1	8889.25	8889.25	95.47	.467
Groups	1	42.30	42.30	.45	.004
Error	109	10149.32	93.11		
Total	112	722130.00			

* $p < .05$. **$p < .01$.

Hypotheses 3

An ANCOVA, with the pretest score and 2005-2006 state mathematics score serving as covariates, was conducted to determine there was a significant difference between the posttest score of fifth-grade students who qualified for free and reduced-cost lunch and/or students with disabilities, and students who did not qualify for free and reduced-cost lunch and/or students with disabilities.

The independent variable, groups, includes two levels: students who qualified for free and reduced-cost lunch and/or students with disabilities (n = 12), and those who did not qualify for free and reduced-cost lunch and/or students with disabilities (n = 44). The dependent variable was the posttest score. Table 13 shows the means and standard deviations for the 2005-2006 state mathematics score, pretest score, and posttest score for the two groups.

Results of a preliminary analysis evaluating the homogeneity of slopes assumption indicated that the relationship between the covariates and the dependent variable did not differ significantly among the groups, $F(2, 50) = .857$, $p = .437$.. The ANCOVA was not significant, $F(1, 52) = .622$, $p = .434$, partial $\eta^2 = .012$. Table 14 displays the results.

The group that qualified for free and reduced-cost lunch and/or special education had the smaller adjusted mean ($M = 28.33$), and the general education group had the larger adjusted mean ($M = 29.63$).

Table 13

Mean Scores and Standard Deviations for the 2005-2006 State Mathematics Score, Pretest, and Posttest

Source	2005-2006		Pretest		Posttest	
	M	*SD*	*M*	*SD*	*M*	*SD*
Students who qualified for free and reduced-cost lunch and/or special education	73.66	16.47	27.33	5.28	29.17	6.82
Students who did not qualify	74.92	14.30	25.89	5.83	29.41	5.49

Table 14

Analysis of Covariance of Posttest Scores as a Function of Groups, with Pretest and 2005-2006 State Mathematics Score as Covariates

Source	*df*	*SS*	*MS*	*F*	η^2
Pretests (covariate)	1	231.87	231.87	9.43	.153
2005-2006 (covariate)	1	20.58	20.58	.836	.016
Groups	1	15.31	15.31	.622	.012
Error	52	1279.32	24.60		
Total	56	50072.00			

* $p < .05$. **$p < .01$.

Hypotheses 4

A Pearson product-moment correlation coefficient was computed to determine if there was a significant correlation between the total number of tutorials completed by fifth-grade students and the students' 2006-2007 state mathematics scores.

A correlation coefficient was computed between the number of tutorials completed and 2006-2007 state mathematics score. The results of the correlational analysis indicated that there was not a significant correlation between the number of tutorials completed and the 2006-2007 state mathematics score $r(196) = .05$, $p = .486$.

Hypotheses 5

A Pearson product-moment correlation coefficient was computed to determine if there were significant correlations between selected indicator tutorial scores (number of correct responses out of eight) and the BAIP Assessment 2007 selected indicator scores (total number of correct responses).

A total of 64 corerelations were computed; results are presented in Table 15 Of the 64 correlations, 8 were of particular interest. The eight correlations examined the relationship between correct item responses on tutorials and the correct item responses on corresponding standards, benchmarks, and indicator items on the 2006-2007 state mathematics assessment, referred to in this study as the BAIP Assessment 2007. Five out of eight correlations between correct item responses on the tutorials and correct item responses on items on the BAIP Assessment 2007 were statistically significant. Twenty-four additional significant correlations were found. In general, the results suggested that as correct item responses on the tutorials increased, correct item responses on the BAIP Assessment 2007 tended to also increase.

Table 15

Correlations for Select Indicator Tutorial Scores and BAIP Assessment 2007 Indicator Scores

Measure	*M*	*SD*	S1.B3 .a4-A	S1.B4. k4-A	S3.B1. a1a-A	S3.B2. a1-A	S3.B2. a1-A	S3.B3. k3- A	S4.B2. k3-A	S4.B2. k3-A
S1.B3.a4- T	2.92	2.03	**.003**	.129*	.028	.072	.072	.015	.138	.138
S1.B4.k4- T	3.15	1.86	.176*	**.209***	.043	.322**	.322**	.129	.205*	.205*
S3.B1.a1a- T	2.41	1.52	-.046	.193	**.027**	.232*	.232*	.177	.169	.169
S3.B2.a1c- T	4.06	2.32	.195	.292*	.019	**.365***	.365*	.205	.070	.070
S3.B2.a1f- T	3.84	1.97	.250*	.305**	.008	.347**	**.347****	.223	.281*	.281*
S3.B3.k3- T	4.23	2.33	.224	.227	.280*	.414**	.414**	**.112**	.242	.242
S4.B2.kd –T	3.45	1.87	.206	.195	.106	.268*	.268*	.186	**.415****	.415**
S4.B2.k3e - T	3.45	2.45	.201	.290*	.149	.413**	.413**	.013	.506**	.506**

**p* < 05. ** *p* < .01.

Note. T = Corresponding Tutorial Score, A = Corresponding BAIP Assessment 2007 Indicator Score

Teacher Satisfaction

Eight out of the 12 fifth-grade teachers participating in the study responded to several questions designed to obtain their perceptions, satisfaction, and formative suggests for improvement purposes. The questions were grouped around four themes of use: general, lesson, tutorial, and the management system. Six teachers were female and two were male. The average number of years taught for the eight teachers was 7.13. Seven of the teachers taught general education and one taught special education.

Teacher responses to questions pertaining to “general use” indicate that teachers believe that BAIP is a needed resource and is effective at improving the mathematics performance of students in the fifth grade. Teachers shared that they would like to access and implement BAIP in the future and would recommend BAIP to other districts and teachers.

When asked about their perceptions and satisfaction with BAIP lessons and tutorials, teachers agreed that the BAIP lesson format, components, and tutorials were helpful during classroom instruction. Teachers shared that they were extremely pleased with the built-in feedback system which provided them with immediate performance data on tutorials. Finally, teachers shared that the BAIP tool and management system was easy to navigate and use.

Overall Pilot Test Findings

In comparing the results of this study focusing on fifth-grade to the overall results of the pilot test at each grade level, differences appeared at the sixth and seventh grade levels. Data collected at the sixth and seventh grade levels identified a statistically significant mean difference in the 2006-2007 state assessment score between students who received the BAIP intervention and those who did not. Students who received the BAIP intervention ($N = 125$ at the sixth grade level and $N = 155$ at the seventh-grade level) scored higher than students who did not receive the intervention (sixth-grade mean difference 7.821, $p <.001$ and seventh-grade mean difference 4.683, $p<.001$). Moreover, sixth grade and seventh grade select indicator results indicated statistically significant performance differences on select indicator scores. In particular, students who received the BAIP intervention at the sixth grade level scored higher on items that relate to the six selected indicators on the 2006-2007 state assessment and student who received the BAIP intervention at the seventh-grade level scored higher on items that relate to five out of six of the select indicators on the

2006-2007 assessment. Once again, students who received the BAIP intervention scored higher than students who did not receive BAIP.

When evaluating difference between student performance on the pretest and posttest, differences were found between subgroups. A statistical significance was found between students with disabilities when compared to their non-disabled peers (mean difference 4.3, $p<.028$). This finding indicates that students with disabilities out performed non disabled students who received BAIP instruction. At eighth grade a statistical significant correlation exists between the total number of tutorials completed and the students' mean score on the overall 2006-2007 state assessment ($r = .219$, $p = .002$), however when evaluating the overall correlation between the entire studies population no significant correlation was found ($r = 121$, $p =.001$). When examining the correlations between select indicator tutorial scores and the 2006-2007 select indicator score on the state assessment, significant correlations were found at the sixth and seventh grade levels. At the sixth grade level, five of the six select indicators had a significant positive correlation (2.1.k4, $r = .238$, $p = .008$; 3.1.k7, $r = .298$, $p = .001$; 3.4.k3, $r = .195$, $p = .029$; 4.1.k2, $r = .313$, $p < .001$). At the seventh grade level, four of the six select indicator tutorial scores had a positive correlation with the select indicator scores on the 2006-2007 state assessment (1.1.a1, $r = .219$, $p = .006$; 1.4.k5, $r = .268$, $p = .001$; 3.3.a3, $r = .188$, $p = .019$; 4.2.k1, $r = .245$, $p = .002$).

Overall, eighteen teachers in grades 4, 5, 6, 7, and 8 responded to questions designed to obtain perceptions, satisfaction, and formative suggests for improvement purposes. The average number of years taught for the eighteen teachers was 12.6. Fifteen of the teachers taught general education and three taught special education. Responses to the questions were consistent with fifth-grade teacher responses, which indicated that BAIP resources are needed and are effective at improving student mathematics performance. Teachers believed that BAIP improved their students' math skills and would recommend the BAIP intervention to other districts and teachers.

Overall, teachers believed that the BAIP lesson format and components were helpful during classroom instruction. They were pleased with the built-in feedback system that provided immediate performance data on tutorials. Finally, teachers believed that the BAIP tool and management system was easy to navigate and use.

CHAPTER FIVE

Discussion

The formative data collected during the pilot study will be used to enhance the Blending Assessment with Instruction Program (BAIP) before the program is made available statewide. The three main objects of this pilot study were to (a) gather teacher perceptions on the usability of BAIP, (b) identify the programs instructional value and infrastructure appropriateness for improvement purposes, and (c) begin determining the impact BAIP has on student outcomes in mathematics.

Teachers in the pilot test were encouraged to implement 12 lessons and 16 tutorials between the end of January and the end of March. The teachers were provided with directions and instructions on how to implement the lessons and tutorials. However, due to the time of the year, students' educational needs, and the fact that the purpose of the study was to gather data to improve BAIP, teachers were allowed to use discretion regarding which of the 12 lessons and 16 tutorials they would implement. In addition, they were allowed to determine how the lessons and tutorials would be incorporated into their classroom instruction. Such an approach resulted in differences between the amount of content covered and the length of instruction for each lesson.

Although the results of this study did not show a statistical significant difference between BAIP and the overall mathematics performance of fifth-grade students on state mathematics assessments, the study did find differences between the mean scores for students that received BAIP and those that did not. Results indicate that students who received the BAIP intervention had slightly higher mean scores on state assessment items that were related to select indicators. In addition, when analyzing the pretest and posttest scores for students in the classrooms of Teachers 1, 2, and 10, results showed an increase between the students' mean pretest and posttest scores (Teacher 1's students' pretest mean score was 27.52 and the posttest score was 31.48; Teacher 2's students' pretest mean score was 24.10 and the posttest score was 26.20; and Teacher 10's students' pretest mean score was 27.13 and the posttest score was 30.60).

The difference between the mean pretest and posttest scores supports McGehee and Griffith's (2001) finding that the availability of curriculum aligned with tested curriculum positively influences student performance. However, to strengthen the results, further follow-up studies need to be conducted to address and control for the treatment validity issues inherent in this study.

The study found statistically significant correlations between the number of correct item responses on tutorials and the correct item responses on corresponding items on the 2006-2007 state mathematics assessment. This finding indicates that as students correctly responded to items on the tutorials, they correctly answered the same type of items on the 2006-2007 state mathematics assessment. The significant correlations found in this study extend previous research reported by Martindale, Pearson, Curde, and Pilcher (2005), who found that fifth-grade students who used a web-based instructional tool aligned with Florida's Sunshine State Standard scored higher on the Florida Comprehensive Assessment Test. Findings in the present study also expanded Niemiec and Walberg's (1985) findings that computer-assisted instruction is effective in raising achievement scores.

The results from the teacher satisfaction survey are of particular interest as the purpose of this pilot test was to determine the program's instructional value and usability, and the appropriateness of the infrastructure. Results indicate that the teachers implementing BAIP believed that the intervention helped to prepare their students for the state assessments. In addition, teachers believed that the BAIP lessons contained all the elements needed for classroom instruction. Teachers surveyed agreed that the lesson handouts and PowerPoint slides were effective during instruction. Teachers were pleased with the feedback system embedded in BAIP, which provided immediate feedback concerning student performance on tutorials. One teacher shared that she liked the independent re-teaching and review that the tutorials provided students.

Data obtained from the four open-ended questions on the teacher survey, emails, and phone conversations with teachers throughout the field test resulted in identification of various opportunities for improvement of the program. In particular, teachers stated that automatically generated login and usernames for the tutorials were often too difficult to decipher and too difficult for students to remember and use. In addition, there were concerns regarding the readability level of the tutorials for struggling learners. Teachers also identified ways to improve the uploading of graphics as wells as identified grammar errors and typos.

In summary, results from the correlational analyses, differences between pretest and posttest mean scores, and the formative data gathered through teacher surveys, emails, and phone calls provided valuable information regarding the instructional value and usability, and the appropriateness of the infrastructure of BAIP. These data, in turn, will be used to make revisions to the program.

Limitations and Concerns

The small sample size, participation retention rates for one school district, and concerns about treatment validity have led to some limitations in terms of the generalizability the findings. To obtain participants for the study, school districts from across the state of Kansas were invited to participate. Volunteer participation resulted in a limited representation of fifth-grade students. In addition, as part of the volunteer process, participating school districts were required to have Internet and computer accessibility. This requirement further affected the participation rate, as school districts with limited accessibility were not able to participate. Additionally, district with computer labs found that the labs were already scheduled for administration of formative assessment tied to the state assessment. Because the study began during the second semester of the 2006-2007 academic school year when classroom assignments were already established, random assignment to experimental and control classrooms was not possible. Therefore, students from the school districts that agreed to participate were automatically placed in the experimental group whereas students outside of the participating school districts served as the comparison group. A sample based on volunteers is referred to as a non-probability sample, and generalization of the findings are limited (Smith & Glass, 1987). Individuals who volunteer for a study may have reasons why they are more motivated to volunteer and, may, therefore, not be representative of the general population. For example, districts that agreed to volunteer to participate in the study may have been motivated to do so based on poor performance on the 2005-2006 state assessment (mean score on the 2005-2006 state assessment for students participating in BAIP was 72.99 whereas mean scores on the 2005-2006 state assessment for students not participating in BAIP was 78.60).

Issues regarding retention began to surface soon after the study began. Several of the participating school districts did not have the computer availability that was necessary, so midway through the study modifications had to be made. As a result, some teachers instructed their students to complete tutorials using a paper-pencil format. This approach minimized student participation, as the effectiveness of the tutorials as they were implemented was collected electronically through a built-in reporting system. In addition, technology limitations resulted in a modification between the pretest and posttest formats. These modifications resulted in the development and distribution of a paper-pencil posttest, rather than the computer-based distribution format used during the pretest. The paper-pencil format led to fewer posttest responses, as school districts were responsible for administering, organizing, and mailing in posttest scantron sheets. In fact, technology difficulties resulted in one large rural school district's total failure to complete and submit posttest scores for their students.

To ensure that the BAIP intervention was being implement in the classrooms, teachers were instructed and reminded via email to complete a lesson checklist after implementing each lesson. Despite these instruction and reminders, only three teachers completed eight or more checklists. Therefore, only scores from the students in three classrooms were included in the ANCOVA analyses. Limits in checklist completions caused further restraints on the sample size and the ability to generalize findings.

Areas of Future Research

To address the limits and concerns of the current study, additional research needs to be conducted to determine the effectiveness of BAIP at improving the mathematics performance of fifth-grade students. In particular, additional efforts should begin by improving recruitment efforts and treatment validity so that future findings may be generalized. This recommendation is in compliance with the suggestions of Hall and Hord (2006), who stated that "a critical step in determining whether a new approach is making a difference is to determine first if the innovation is being used" (p. 159). Observations and surveys designed to address the level of intervention use, developed by Hall and Hord, could be incorporated in future studies to gauge the level of intervention use.

In addition, the statistical differences found between grade levels in the overall pilot tests should be further evaluated. As, the statistical difference found between grade levels in the pilot test indicates there may have been difference in teachers' mathematics knowledge at different grade levels or variance on the intensity of the instruction or adherence to the BAIP model or the number of teaching concepts taught. It may be that teachers in grades six and seven adhered more closely to the instructional features of BAIP than at other grade levels. Therefore implementation of BAIP should include more stringent fidelity procedures to control treatment validity. To address variations in instruction or adherence to the BAIP model, efforts need to be made to develop stringent criterion for BAIP implementation to ensure that the method of BAIP instruction is at a routine level. Such criterion would lead to a natural form of pedagogy and result in adherence to the BAIP model.

To definitively determine the effectiveness of BAIP in improving students' mathematics performance, further studies should include all 276 lessons and 410 tutorials. In addition, future studies should be conducted for a full academic year to allow teachers ample time for administration and instructional decision making regarding which standards should be taught. Such studies could be longitudinal to determine if there is a cumulative effect on student performance. By expanding the study for a full academic year, separate analyses may be conducted to determine the effect BAIP has on improving the mathematics achievement of different subgroups, such as gifted students, student with disabilities and students who qualify for free and reduced-cost lunch.

Given the growing need to improve the academic achievement of low-performing students from culturally diverse backgrounds, students with disabilities, and students at risk, future research should be designed to confirm or refute the notion that particular instructional elements improve academic learning and student achievement for these subgroups of students. To pursue this area of research, studies must evaluate the instructional components incorporated into BAIP - -derived from Rosenshine and Stevens's (1989) research on effective instruction and Gagne's research on the stages of instruction -- to determine the impact that the research-based components have on improving the mathematics performance of different subgroups within the population. This line of research would extend Maccini and Ruhl's (2000) work, which found that modeling, guided practice, independent practice, and feedback improve the problem-solving abilities of students with learning disabilities and Mercer and Miller's (1992) research evaluating the effectiveness of systematic instruction, which incorporates the same instructional components.

Additional research also needs to be conducted to determine the impact BAIP lessons and tutorials have on improving the mathematics knowledge of classroom teachers. This line of research is imperative as experts such as Ball (2003) and Ma (1999) have identified the role that teachers' mathematics knowledge has on student performance. Research efforts can begin by creating mathematics pretests and posttests designed to gauge teachers' mathematic knowledge before and after interacting and teaching the lessons. In addition to content knowledge, it is important for teachers to know and understand the mathematic curriculum standards they are responsible for teaching. Therefore, future research should examine how the alignment between curriculum standards and the BAIP lessons and tutorials impact teachers' knowledge regarding curriculum standards. To accomplish this, surveys that have been designed to analyze teacher knowledge regarding mathematics standards could be incorporated before and after teachers use BAIP lessons and tutorials.

As legislative mandates continue to call for increased academic accountability and demands associated with measuring student performance on large-scale assessments, future research efforts must extend beyond BAIP to focus on creating and providing additional mathematics interventions. One option is to utilize technology and direct research efforts towards identifying and implementing mathematic interventions for students that may be accessed independently by students at home and at school through an Internet connection. This type of research focus would create additional options and opportunities for guided and/or independent practice at different instructional levels available to students 24 hours a day.

Finally, research efforts should focus on and find efficient ways for teachers to monitor and make data-based decisions regarding students' needs and classroom instruction. Such monitoring could be made available through computer software and/or programs. Therefore, efforts should be geared towards improving teachers' abilities and effectiveness towards making instructional decisions based on student performance data.

Implications for Education

The results from this study expand current research and findings regarding the effectiveness of web-based instructional tools designed to provide mathematics practice aligned with assessments (Martindale, Pearson, Curda, & Pilcher, 2005). The findings also expand the literature that has found that the availability of curriculum aligned with tested curriculum positively influences student performance (Elliot & Thurlow, 2000). However, further research in necessary to evaluate the impact that the instructional components within BAIP have on improving students' academic performance. In addition, to obtain a stronger indication of the impact BAIP has on students' mathematics performance, future studies need to include all 276 lessons and 410 tutorials that have been developed. The study should also be expanded to include students and teachers from other states and be designed to be carried out during an entire academic year.

The results of this study suggest that, when possible, teachers should incorporate technological resources that are aligned to mathematics standards into their classrooms. This suggestion is based on the results of the correlational analyses, which indicated that students who answered more items correctly on the tutorials tended to answer more items correctly on the state assessment.

In addition, results from the teacher survey indicate that teachers need additional support to improve their confidence in their abilities to teach mathematics standards. Thus, according to the teacher satisfaction survey, when teachers were asked if they felt confident in their ability to prepare all students to take the mathematics assessment, none of the eight teachers felt highly confident in their ability. In fact, three disagreed or highly disagreed when responding to the statement Before implementing BAIP, I was confident in my ability to prepare all of my students for the state math assessment. These findings suggest that teachers may need access to additional training, material, guidance, and support in the area of mathematics in order to improve their confidence in their ability to prepare students for the state assessment.

Since mathematics is an important skill that extends beyond the school setting and, ultimately, affects a student's future earning potential, studies that contribute to the literature and development of educational materials would potentially enhance the quality of life for all students, including students with disabilities.

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Appendix A

5th Grade – Sample Lesson

Geometry

S3.B1.A1A

Application Level

Written by: Freda Kafka, USD#259

Title: Solving real-world problems involving plain figures and lines of symmetry

Contextual Framework:

Standard: The student uses geometric concepts and procedures in a variety of situations.

Benchmark: Geometric Figures and Their Properties - The student recognizes geometric shapes and compares their properties in a variety of situations.

Indicator: The students will solve real-world problems by applying the properties of (2.4.A1g): Plane figures (circles, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, pentagons) and the line(s) of symmetry; e.g., twins are having a birthday party. The rectangular birthday cake is to be cut into two pieces of equal size and with the same shape. How would the cake be cut? Would the cut be a line of symmetry? How would you know?

Assessment Properties: (K)

Teaching Framework:

Instructional Translation:

(A. Indicator) During this lesson, students will solve real world problems by applying the properties of plane figures, and identifying the line(s) of symmetry. (e.g. Bill and Susan wanted to draw a square in the middle of the playground and divide it in to equal fourths to play four square how many different ways could it be divided and how many lines of symmetry?)

(B. Prior Knowledge) Students have been introduced to and should be able to identify the following plane figures: circles, squares, rectangles, triangles, ellipses, rhombus, parallelograms, hexagons, pentagons, as well their properties. The students also have been introduced to the line(s) of symmetry and review lines and line segments.

(C. Need to know) Students will need to know the properties of the following plane figures; circles, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, pentagons, along with applying them to real world shapes, and using these properties to solve real world geometry problems.

(D. Applied Example) Upon completion of this lesson, students will be able to solve real world geometry problems using the properties of plane figures and the line(s) of symmetry. For example, given the following geometry word problem: "Travis and Scott wanted to make a vegetable garden in the shape of a square. They wanted to divide the garden in half, and make each side the same shape and size. How would each half be shaped? How many ways of using various lines of symmetry are possible? How would you know?" students should be able to identify the appropriate shapes and the number of combinations of lines of symmetry.

Teaching Concept:

Students will gain an understanding of using plane figure shapes, and lines of symmetry in a real world geometry problem and its application to real world shapes.

Skills:

(1) Students will explain and construct real world geometry problems, (2) identify plane figures properties, (3) solve real world geometry word problems using plane figures properties, and lines of symmetry, (4) understand and identify the properties and how they relate to real world shapes, and (5) process and work out the real world geometry word problem.

Essential Vocabulary:

Circle: A plane figure which all the points are the same distance from the center, and have no corners.

Congruent figures: Figures that are the same in size and shape.

Ellipses: An Oval or a stretch circle that it is the locus of points for which the sum of their distances from two fixed points (the foci) is constant.

Ellipsis, ellipses, and ellipse: Resembles a squashed circle and is a closed curve figure.

Hexagons: A polygon with six sides.

Line of symmetry: A line which a figure can be folded so that both sides are congruent.

Line segment: Part of a line that has two end points or edges on a plane figure.

Line: A straight line that is endless in both directions.

Parallel lines: A line that runs the same direction without crossing.

Parallelograms: A quadrilateral with two pairs of opposite parallel sides.

Pentagons: A polygon with five sides.

Plane figure: A figure which lies on a flat surface.

Polygon: A close plane figure make of close line segments.

Properties: A quality to define or describe a plane figure.

Quadrilateral: A polygon with four sides.

Rectangle: A quadrilateral with four right angles and opposite sides parallel and the same length.

Rhombus/Rhombi: A quadrilateral with two pairs of parallel sides and all sides the same sizes, and the same length.

Similar figures: Figures that have the same shape but are not the same sizes.

Squares: A quadrilateral that has four equal sides and four right angles.

Triangles: A polygon with three sides.

Application:

During this lesson, students will solve real world problems by applying the properties of plane figures, and identifying the line(s) of symmetry

Lesson Framework:

Prior Knowledge:

During this stage of the lesson students will review plane figures and their attributes which is needed in order to master the objective of solving real world geometry word problem. There are critical geometry terms that students need to acquire, and review before using geometry to solve real world word problems, (1) lines, line segments, parallel lines, lines of symmetry, (2) polygons, plane figures, (3) quadrilateral, congruent, and similar figures, and (4) Right angles.

Teaching Concept 1: Lines, line segments, intersecting lines and parallel lines (PowerPoint 1)

Teacher prompt: Draw a line, line segment, intersecting lines, and parallel lines, and their definitions. Hand out four index cards and explain to students that they are going to make a geometry vocabulary book and they will add to it as the lessons goes.

Teacher prompt: Draw a square on the board and ask the students how many line segments they see that creates the square? Note the distinction between a line and a line segment.

Student response: Four lines

Teacher prompt: Explain to students that shapes and shapes are made up by line segments. Ask students to look around the room and name an object that is made up of lines.

Student response: Students name objects

Teacher prompt: Explain to students that there are different kinds of lines and line segments, some objects have straight lines, and some have lines that run beside each other, and some have lines that cross each other.

Teacher prompt: Explain to students the difference between a line and a line segment by using the definition on the board. Ask students to draw a line, and then write a definition in their own words on an index card. Explain to students the definition of a line segment and have students draw a line segment on the index card and write the definition in their own words. Also, have them draw a model of the term. Ask students to explain what the difference between a line and line segment is?

Student response: A line is endless or goes on and on (Introduce infinite/infinity), but a line segment has two end points or has two stopping points.

Teacher prompt: Ask students to draw a shape or object using line segments on the back of their index card label line segment.

Teacher prompt: Explain to students that lines that run next to each other we call parallel lines. We call them parallel lines because the word parallel means running the same direction. Parallel lines run the same direction and they never cross or touch each other. Ask the students if they can identify any parallel lines in the classroom?

Student response: Students name objects

Teacher prompt: Ask students to draw on an index card a set of parallel lines, label it, and write their definition. Ask students to explain what parallel lines are?

Student response: A set of lines that run in the same direction and never met, cross, or touch.

Teacher prompt: Ask students to draw a shape, or object using parallel lines. Give an example.

Teacher prompt: Draw an x on the board. Explain to students that lines that cross each other like an x are called intersecting lines, because the word intersecting means to cross over. Explain to students when two roads or streets meet and cross we call them intersections, because they cross each other. Ask the students if they can identify any intersecting lines in the classroom?

Student response: Students name objects or shapes.

Teacher prompt: Ask students to draw on an index card a set of intersecting lines, and write the definition in their own words. Ask students to explain what intersecting lines are? Ask them to name a model in our environment. E.g. intersection of two streets on a map.

Student response: A set of lines that cross over.

Teacher prompt: Draw squares, rectangles, triangles, rhombi, parallelograms, hexagons, pentagons, and explain to students that they are called plane figures and each one is made up of lines. Ask students to identify the different kinds of lines in each plane figure.

Student response: Line segments and parallel lines

Teaching Concept 2: Polygons and Quadrilaterals (PowerPoint 2)

Teacher prompt: Write the word Polygon on the board and the definition. Explain to students that a shape or plane figure that is closed and obstructed with line segments is called a Polygon. Draw a Rectangle on the board and ask students to identify how many line segments there are?

Student response: Four line segments

Teacher prompt: Describe the angles. Describe how opposite sides relate.

Student response: 4 90° angles, opposite side parallel and equal lengths.

Teacher prompt: Ask students to identify any plane figures or objects in the classroom that are polygons and draw some them on the board. Ask the students to explain why each shape is a polygon or is not a polygon.

Student response: To be a polygon an objects or plane figures has to have close line segments be closed and made with line segments.

Teacher prompt: Draw a square, rectangle, triangle, rhombus, parallelogram, hexagon, pentagon, and ask students to identify how closed line segments each plane figure has?

Student response: Square, rectangle, rhombus, parallelogram all have 4, triangle has 3, hexagon has 6, and pentagon, has 5.

Teacher prompt: On another index card and ask students to draw an example of real world objects that are polygons and write the definition of a polygon in their own words.

Teacher prompt: Circle the following polygons on the board: square, rectangle, rhombus, and parallelogram. Ask students to look at the plane figures on the board and explain what they all have in common. Ask the students if they are the same shape? Dothey look alike? Do they have the same number of closed line segments?

Student response: No, they look different. They are not the same shape but they have the same number of line segments and are closed.

Teacher prompt: Write the following definition on the board: Quadrilateral is a polygon with four sides. Explain to students that any plane figure (polygon) that has four line segments is called a Quadrilateral. Direct students´ attentions to the board and ask them to name any of the plane figures that are Quadrilateral. Note that quad means four and relate quad cities etc.

Student response: The square, rectangle, rhombus, and parallelogram are all quadrilaterals because they all have four line segments and are closed.

Teacher prompt: Are triangles, hexagons, and pentagons quadrilaterals?

Student response: No, because a triangle has 3 line segments, and a hexagon has 6 line segments and a, pentagon has 5 line segments.

Teacher prompt: On another index card and ask students to draw an object that would be a quadrilateral polygon, and write the definition in their own words.

Teaching Concept 3: Similar figures and Congruent figures (PowerPoint 3)

Teacher prompt: On the board write the definitions of similar and congruent.

Teacher prompt: Draw a large triangle and a smaller triangle on the board. Ask students how they are a like and how they are different?

Student response: They both are triangles, and one is larger than the other.

Teacher prompt: Explain to students when two plane figures are the same shape but not the same sizes they are similar to each other. Draw two squares on the board one bigger than the other ask students are they exactly alike?

Student response: No, one is bigger.

Teacher prompt: Ask students what we call two plane figures that are the same shape, but not the same size?

Student response: We call them similar shapes.

Teacher prompt: Draw two squares that are the same sizes. Ask the students if they are exactly alike?

Student response: Yes.

Teacher prompt: When a plane figure is exactly the same sizes and shape we call them congruent which means they have the same shape, perimeter, and area inside.

Teacher prompt: Draw two pentagons the same size on the board and ask the students if they are exactly alike?

Student response: Yes, they are exactly alike.

Teacher prompt: What do we call two shapes that are exactly alike?

Student response: Congruent.

Teacher prompt: Ask students to draw on one card similar shapes and write the definition in their own words. On the other index card draw two congruent shapes and write the definition in their own words.

Teaching Concept 4: Properties of plane figures (PowerPoint 4, PowerPoint 5)

Teacher prompt: Write the following definition on the board: Properties - a quality to define or describe a plane figure (Attributes). Explain to students that the words properties and attributes mean to describe what a plane figure looks like. Explain to students we are going to describe what circles, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, pentagons look like and how we can tell them apart. We can use these properties to identify shapes of objects, and also to solve geometry problems.

Teacher prompt: Hand out geometry plane figure blocks (circles, squares, rectangles, triangles, ellipses, rhombus, parallelograms, hexagons, pentagons) with 9 index cards.

Teacher prompt: Explain to students that each of the plane figures have certain attributes (properties) that describe what they are like. Ask students to take the square and rectangle. Ask students how many line segments (edges) a square and rectangle have? Are the line segments parallel lines or intersecting lines? How many corners do the square and the rectangle have? Is the square and rectangle a polygon and are they quadrilateral? What is the flat space called?

Teacher prompt: Discuss edges vs. area.

Student response: A square is a polygon that is quadrilateral, and it has 4 parallel line segments with four Connors.

Teacher prompt: Ask students to draw a square and rectangle on the index card and write their properties.

Teacher prompt: Ask students to take the triangle. Ask students how many line segments (edges) a triangle has? Are the line segments parallel or intersecting? How many corners does the triangle have? Is the triangle a polygon and is it quadrilateral?

Student response: A triangle is a polygon with 3 line segments with 3 corners.

Teacher prompt: Ask students to draw a triangle on the index card and write the properties of a triangle.

Teacher prompt: Ask students to take the Rhombus. Ask students how many line segments a Rhombus have? Are the line segments parallel lines or intersecting lines? How many corners does the Rhombus have? Is the Rhombus a polygon and is it quadrilateral?

Student response: A Rhombus is a polygon and a quadrilateral with two parallel sides.

Teacher prompt: Ask the students to draw a Rhombus and write the properties on the index card.

Teacher prompt: Ask students to take the parallelogram. Ask students how many line segments (edges) a parallelogram has? Are the line segments parallel or intersecting? How many Connors does the parallelogram have? Is the parallelogram a polygon and is it quadrilateral?

Student response: A parallelogram is a quadrilateral with two pairs of opposite parallel sides.

Teacher prompt: Ask the students to draw a parallelogram and write the properties on the index card.

Teacher prompt: Ask students to take the hexagon. Ask students how many line segments a hexagon have? Are the line segments parallel? How many corners does the hexagon have? Is the hexagon a polygon and is it quadrilateral?

Student response: A hexagon is a polygon with six sides it is not quadrilateral and does not have parallel lines (edges).

Teacher prompt: Ask the students to draw a hexagon and write the properties on the index card.

Teacher prompt: Ask students to take the pentagon. Ask students how many line segments (edges) a pentagon has? Are the line segments parallel lines? How many corners does the pentagon have? Is the pentagon a polygon and is it quadrilateral?

Student response: A pentagon is a polygon with 5 line segments, and is not quadrilateral and has no sides that are parallel. It has 5 angles.

Teacher prompt: Ask the students to draw a pentagon and write the properties on the index card.

Teacher prompt: Ask students to take the circle and the ellipse. Explain to students that circle and the ellipses are different than the other plane figures. A circle has no lines and no corners, and an ellipsis is an oval or a stretch circle. Either is not a polygon. A circle has the same distance around from the center of the circle all the way around. Ask the students to describe a circle and an ellipsis? Ellipse discussion needs to be added.

Student response: A circle and ellipsis have no lines, corners, and it is not a polygon.

Teacher prompt: Ask students to draw a circle and an ellipsis, and write their properties.

Teaching Concept 5: Line of Symmetry (PowerPoint 6)

Teacher prompt: Write the following definition on the board: Line of symmetry is a line which a figure can be folded so that both sides are congruent. Draw a circle, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, pentagons on the board. Write the definition of line symmetry on the board. Explain to students that you can divide some shapes into congruent parts that are lines of symmetry. Direct the students´ attention to the square on the board. Ask students how many lines we could find to divide the square into congruent parts? Divide the square using lines of symmetry, and draw four different lines of symmetry. Discuss the shapes of the four parts.

Student response: We could divide the square 4 with four different lines of symmetry.

Teacher prompt: On two index cards ask students to draw as many lines of symmetry as they can with the rectangles, triangles, parallelograms, hexagons, and pentagons. Write the number of lines of symmetry for each shape.

Teacher prompt: Explain to students that they now have a geometry vocabulary book, which can be used to remind them of the properties of each shape.

Application: (Connect to age appropriate life experience): (PowerPoint 7)

Design a mural for your classroom wall in the shape of a rectangle and inside the rectangle make a design using the following plane figures: triangles, quadrilaterals, at least two lines of symmetry, at least one pair of similar polygons, at least one pair of congruent polygons.

Teacher prompt: Handout construction paper, and rulers. Explain to students they are going to design a wall mural for their classroom. The wall mural will be in the shape of a rectangle. Inside the rectangle the following shapes will be added: triangles, quadrilaterals, at least one pair of similar polygons, and one pair of congruent polygons.

Teacher prompt: Ask students to draw a rectangle that measure 10 inches horizontally, and 8 inches vertically.

Teacher prompt: Ask student what the definition of similar means?

Student response: Both are the same shapes, but they are not the same sizes.

Teacher prompt: Ask students to draw two similar polygons, and label them as similar.

Teacher prompt: Ask students to give examples of a quadrilateral?

Student response: Square, rectangle, rhombus, parallelogram

Teacher prompt: Ask students to draw four examples of quadrilaterals, and label them.

Teacher prompt: Ask student what the definition of congruent means?

Student response: They have the same area and shape.

Teacher prompt: Ask students to draw two congruent triangles, and label them as congruent.

Modeling New Concept:

During this section of the lesson, students will be provided a concrete example of the new concept and step by step demonstrations of how to construct real world geometry problems. The student will solve real-world problems by applying the properties of Plane figures (circles, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, pentagons) and the line(s) of symmetry.

Concrete Example: (PowerPoint 8, PowerPoint 9)

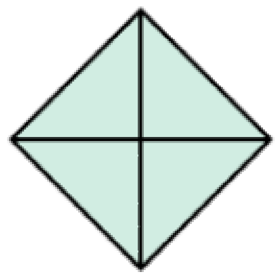
Teacher prompt: Hand out centimeter graph paper to students. Explain to students that they are going to design an area rug for the classroom. The rug will be in a shape of a rhombus and each centimeter square is one foot. The rug will be 8ft by 12ft. The design of the rug will have a line(s) of symmetry so when you divide the rug in half each side matches, and each side has the same shapes. You will use triangles to make the rug.

How many triangles would you have? Would all the triangles be congruent? How many lines of symmetry could you have?

Student response: You would have four triangles, and 2 lines of symmetry.

Teacher prompt: Are there lines of symmetry that would not produce triangles?

Student response: Yes, they would produce squares



Step-by-Step Demonstration: (PowerPoint 10, PowerPoint 11, PowerPoint 12, PowerPoint 13)

Demonstration #1:

Teacher prompt: Write the following real world geometry problem on the board and solve together.

Jessie, Mario, Anthony, and Mark are ordering one square cheese pizza to be shared. They want to cut the pizza into four equal sizes with the same shape. How would the pizza be cut? How many cuts would you need to make? Would the cuts be a line of symmetry? How would you know? After reading the word problem ask students to under line all the questions. Explain to the students these questions tell us what we need to find and help us solve the problem. Ask students what is the question asking us to find?

Student response: How many slices the pizza would we need to make four equal sizes? How many lines of symmetry? How we would know we are correct?

Teacher prompt: Hand out drawing paper. Ask the students to draw a square looking pizza, as you draw one on the board.

Teacher prompt: Ask the students what is the first step we should do?

Student response: Divide the pizza into four equal parts.

Teacher prompt: What is the second step? Students prompt: To find how many lines of symmetry there are.

Teacher prompt: Ask students to cut the pizza into four equal parts, and write down how many lines of symmetry there are. Then, ask the students for their answers.

Student response: The pizza would need 2 cuts (1 horizontally, and 1 vertically), and have two lines of symmetry.

Teacher prompt: Emphasize that 2 cuts and two lines make 4 pieces. Ask students how they would know that their answer is correct?

Student response: A square is quadrilateral; all sides are equal and if you cut down the middle horizontally and then vertically you have four equal sizes; also if you cut down the middle horizontally and vertically you have 2 lines of symmetry because all parts are congruent.

Demonstration #2:

Teacher prompt: Write the following real world geometry problem on the board and solve together.

Sally and Karen wanted to bake an unusual birthday cake in the shape of pie for their new friend Martha. The cake has a hexagon shape. Each girl wanted two pieces. How many cuts would they have to make to get exactly two pieces each? What plane figure would each piece be? How many lines of symmetry would the cake have? How would you know your answer is right?

Teacher prompt: Ask each student to copy the real world geometry problem. Hand out a piece of drawing paper. Ask the students to list the steps to answer the question.

Student response: Underline the questions

Teacher prompt: Yes, underline all the questions. What are the questions?

Student response: How do you cut to get congruent pieces? What shapes would the pieces be? Are any line(s) of symmetry?

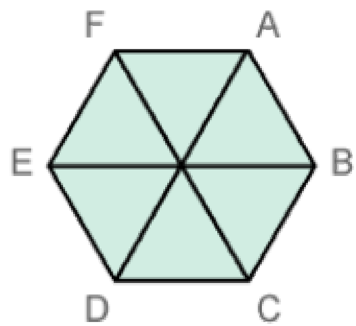
Teacher prompt: Have the students draw a hexagon (students need help with drawing give power polygon shapes for the students to trace. Ask the students if there are 3 girls and each girl wants two pieces then how many pieces should we cut.

Student response: $3 \times 2 = 6$, so 6 pieces.

Teacher prompt: Yes, Ask the students to cut the hexagon cake into 6 pieces and make sure all are congruent. Ask students what shape each cut shape make? Are all the shapes congruent? Ask the students to draw all the lines of symmetry there are? How many lines of symmetry are there?

Student response: All six pieces are in the shape of triangles and they are congruent. There are three lines of symmetry.

Teacher prompt: Clarify the lines of symmetry by using the labeled shape below and talking about line segments. Also, discuss how to read line segments.



Application Framework:

Practice:

During this stage of the lesson, with the aid of a handout, students will have the opportunity to solve real-world problems by applying the properties of Plane figures through guided practice and independent practice. In addition, teachers will validate students´ mastery through reflection and assessment.

Guided Practice: (Preview Handout 1)

Handout Question #1: Direct the students to word problem #1 under guided practice.

Teacher prompt: Read the problem and ask the students to underline the questions.

Teacher prompt: Ask students what are the questions asking us to solve?

Student response: How many cuts would they have to make to get four triangles? Would all four triangles be congruent? How many lines of symmetry would there be?

Teacher prompt: Ask students to draw a Parallelogram, and solve the problem.

Teacher prompt: Ask students how many cuts they would have to make in the cloth to get four triangles?

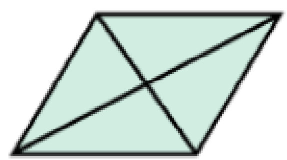
Student response: Two cuts.

Teacher prompt: How many triangles would they have?

Student response: Four

Teacher prompt: How many lines of symmetry would they have?

Student response: Two lines of symmetry.



Handout Question #2: Direct the students to word problem #2 under guided practice.

Teacher prompt: Read the problem and ask the students to underline the questions.

Teacher prompt: Ask students what are the questions asking us to solve?

Student response: How many cuts would they have to make to get four squares? Would all four squares be congruent? How many lines of symmetry would there be?

Teacher prompt: Ask students to draw a Parallelogram, and solve the problem. Ask students how many cuts they would have to make in the cloth to get four squares?

Student response: Two cuts.

Teacher prompt: How many squares would they have?

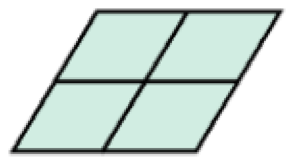
Student response: Four

Teacher prompt: Would the all four squares be congruent?

Student response: Yes

Teacher prompt: How many lines of symmetry would they have?

Student response: Two lines of symmetry.



Handout Question #3: Direct the students to word problem #3 under guided practice.

Teacher prompt: Read the problem and ask the students to underline the questions.

Teacher prompt: Ask students what are the questions asking us to solve?

Student response: How many cuts would they have to make to get two trapezoids and two triangles? Would all three shapes be congruent? How many lines of symmetry would there be?

Teacher prompt: Ask students to draw a Pentagon and solve the problem. Ask students how many cuts they would have to make in the cloth to get all four shapes?

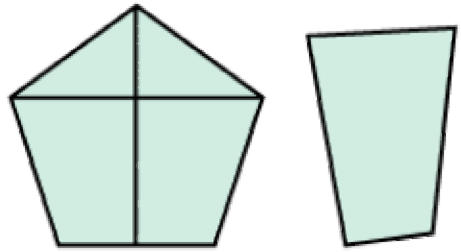
Student response: Three cuts

Teacher prompt: Would the all four shapes be congruent and if not why?

Student response: No, because the shapes are different. Two triangles would be Congruent and the two trapezoids would be. Discuss the properties of the trapezoid.

Teacher prompt: How many lines of symmetry would they have?

Student response: One



Independent Practice: (Preview Handout 2)

Direct students to solve the word problems on the independent practice handout.

Validation:

Students articulate their understanding of the indicator and what they know by explaining the process in solving a plane figure word problem.

Reflection:

Students articulate their understanding of the indicator and what they know by explaining the process of solving a real-world problem by applying the properties of Plane figures (circles, squares, rectangles, triangles, ellipses, rhombi, parallelograms, hexagons, trapezoids, pentagons) and the line(s) of symmetry;

If they struggle (Re-teaching):

Prompts/Questions:

How many cuts would you have to make? Would the shapes be congruent? How many lines of symmetry would there be?

Concrete Example:

Examples:

Mrs. Wilson art class wanted to paint a mural on the wall. The wall was in shape of a square they wanted to divide the square into four rectangles. How many lines would they have to draw in order to have four rectangles? Would the rectangles be congruent? How many lines of symmetry would they have?

If they are successful:

Reinforce:

Assessment:

Constructive Response Item/Open-Ended Question:

Have student write in their math journals and describe the following solid shapes using the terms faces, edges, and vertices. (Cubes, rectangular prisms, cylinders, cones, spheres, triangular prisms, rectangular pyramids, triangular pyramids) using the terms faces, edges, and vertices.

Criteria for grading:

Do students understand how the terms faces, edges, and vertices? (3 points)

Do students understand the difference between a prism, pyramid, cone, sphere, and a cylinder? (5 points)

Extension Framework:

Activities for Children in Need of Enrichment:

Have students who need enrichment identify the following solid shapes and describe them in terms of faces, edges, and vertices (corners). Have students also relate real world object to this terms.

Activities for Children with Special Learning Needs:

Students who need with understanding, describing and identifying the following solid shapes (Cubes, rectangular prisms, cylinders, cones, spheres, triangular prisms, rectangular pyramids, triangular pyramids)should be place in a group of students who can peer tutor them when working in a group. Also these students should use power solids to help with identifying. Review the properties of plane figures and group the students with higher level students and to work together.

3.1.a1a

Name

Guided Practice

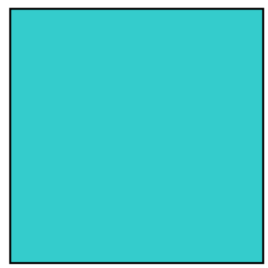
Answer the questions below:

1. Mrs. Smith math class was making kites by using cloth and plane figures. Each piece of cloth was a plane figure shape and each group would have to share one piece of cloth to make their kites. 4 students in Mrs. Smith class wanted to make their kites in shape of a triangle, but they only had one piece of cloth in shape of a Parallelogram. How many cuts would they have to make to get four triangles? Would all four triangles be congruent? How many lines of symmetry would there be?

Review Practice

Identify the number of sides, line segments, and corners of the shapes below?

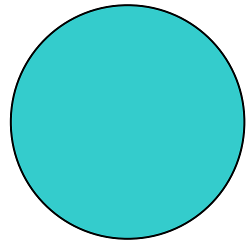
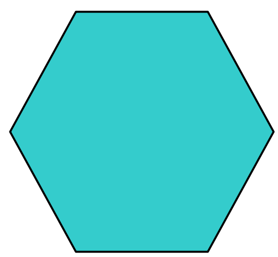
1.



Sides __________

Line Segments _________

Corners ________

2. Mrs. Smith math class was making kites by using cloth and plane figures. Four other students in Mrs. Class wanted to make a kite using the same shape material that was shaped like a Parallelogram. They wanted to make each of theirs in shape of squares. How many cuts would they have to make to get four squares? Would all four squares be congruent? How many lines of symmetry would there be?	2.  Sides __________ Line Segments _________ Corners ________
3. Mrs. Smith math class was making kites by using cloth and plane figures. Three students were left to make kites. They wanted to use the piece of cloth in shape of a pentagon. Two of the students wanted their kites to shape as a rectangle, and one wanted their shape to be a triangle. How many cuts would they have to make to get the 3 shapes? Would all three shapes be congruent? How many lines of symmetry would there be?	3.  Sides __________ Line Segments _________ Corners ________

Independent Practice

Answer the following questions.

1. Students write their own word problem using a hexagon.	2. Students write their own word problem using a pentagon.
3. Students write their own word problem using a Rhombus.	4. Students write their own word problem using a triangle.

Answer Key mat_5_3_1_a1a_2

Guided Practice

1. Two cuts to make four triangles, they would all be congruent, two lines of symmetry

2. Two cuts to make four squares, they would all be congruent, two lines of symmetry

3. Three cuts, they would not be congruent, one line of symmetry

Review Practice

1. Sides: 4

   Line segments: 4

   Corners: 4

2. Sides: 0

   Line segments: 0

   Corners: 0

3. Sides: 6

   Line segments: 6

   Corners: 6

Independent Practice

1. answers will vary

2. answers will vary

3. answers will vary

4. answers will vary

Teaching Concept #1

3.1.a1a

Lines

1. Draw a line segment on the index card and write the definition in your own words. Also, draw a model of the term.
2. Ask students to draw a plane figure shape using line segments on the back of their index card label line segment
3. Draw on an index card a set of parallel lines, and write their definition.

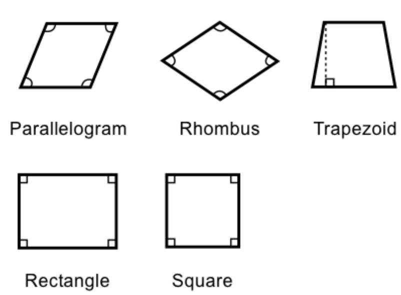
Slide 1

Teaching Concept #2

3.1.a1a

Polygons and Quadrilaterals

With a index card draw a real world object that would be a quadrilateral polygon, and write the definitions in their own words.



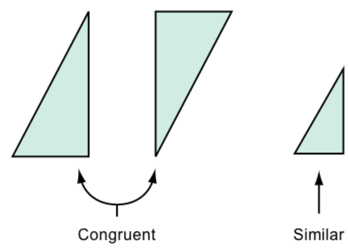
Slide 2

Teaching Concept #3

3.1.a1a

Similar figures and Congruent figures

- With two index cards and draw on one card similar shapes and write the definition in your own words. On the other index card draw two congruent shapes and write the definition in their your words.



Slide 3

Teaching Concept #4

3.1.a1a

Properties of Plane Figures

1. Draw a square and rectangle on the index card and write their properties.

2. Draw a triangle on the index card and write the properties of a triangle.

3. Draw a Rhombus and write the properties on the index card.

Slide 4

Teaching Concept #4

3.1.a1a

Properties of Plane Figures

1. Draw a parallelogram and write the properties on the index card.
2. Draw a hexagon and write the properties on the index card
3. Draw a pentagon and write the properties on the index card.
4. Draw a circle and an ellipsis, and write their properties.

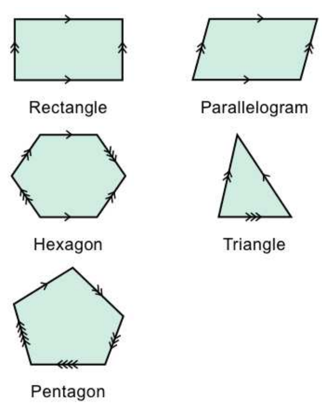
Slide 5

Teaching Concept #5

3.1.a1a

Line of Symmetry

- With two index cards and ask students to identify all the lines of symmetry in a rectangle, triangle, parallelogram, hexagons, pentagon, and write the definition in your own words.



Slide 6

Application #1

3.1.a1a

Plane Figures

1. Using graph paper draw two congruent rectangles the size of 2 cm by 4cm
2. Draw two similar quadrilaterals
3. Draw a set of congruent triangles, and a pair of similar pentagons, and to complete the lesson find all the lines of symmetry in the triangles and pentagons
4. Draw a circle and an ellipse and find all the lines of symmetry.

Slide 7

Concrete Example #1

3.1.a1a

Example

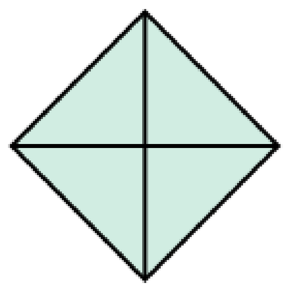
- Design an area rug for the classroom with graph paper following the steps below:
  - The rug will be in a shape of a rhombus and each centimeter square is one foot.
  - The rug will be 8ft by 12ft.
  - The design of the rug will have a line of symmetry so when you divide the rug in half each side matches, and each side has the same shapes.
  - You will use triangles to make the rug.

Slide 8

Concrete Example #1

3.1.a1a

Answer



Slide 9

Step-by-Step #1

3.1.a1a

Solving Real World Geometry Problem #1

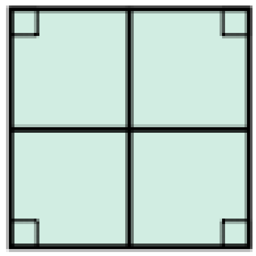
- Jessie, Mario, Anthony, and Mark are ordering one square cheese pizza to be share together. They want to cut the pizza into four equal sizes and with the same shape.
  - How would the pizza be cut?
  - How many cuts would you need to make?
  - Would the cuts be a line of symmetry?
  - How would you check your answer?

Slide 10

3.1.a1a

Step-by-Step #1

Answer



Slide 11

3.1.a1a

Step-by-Step #2

Solving Real World Geometry Problem #2

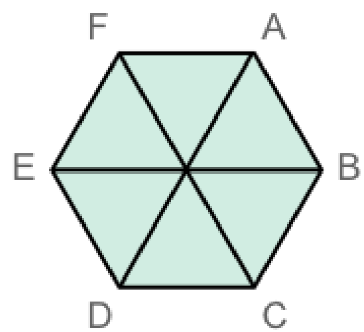
- Sally and Karen wanted to bake an unusual Birthday cake in shape of pie for their new friend Martha. The cake has a hexagon shape. Each girl wanted two pieces.
  - How many cuts would they have to make to get exactly two pieces each?
  - What plane figure would each piece be?
  - How many lines of symmetry would the cake have?
  - How would you check your answer?

Slide 12

3.1.a1a

Step-by-Step #2

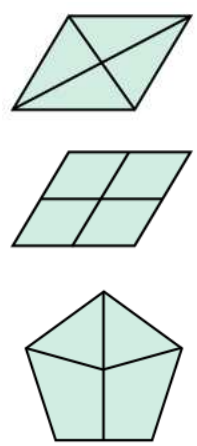
Answer



Slide 13

3.1.a1a

Guided practice



Slide 14

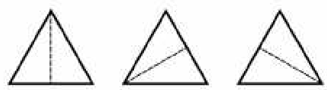
Appendix B

5th Grade - Sample Tutorial

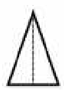
Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

1. Key Math Idea 1 2 3 4 5 6 7 8 Dictionary

If a shape has line symmetry, a line can be drawn that divides the shape into 2 halves that can be folded over each other along the dividing line so that the sides of the 2 halves line up exactly. For example, a triangle with 3 equal sides has 3 lines of symmetry.



If this triangle is folded along any of these lines, the two halves will line up exactly.
However, a triangle with only 2 equal sides has only 1 line of symmetry.



A triangle with no equal sides will have no lines of symmetry. Remember, it is not enough for the 2 pieces to be equal in size and shape. They must perfectly reflect each other. In other words, they will fit over each other just by being folded over the line of symmetry. If you have to rotate one piece to make it fit exactly over the other, that is NOT line symmetry.

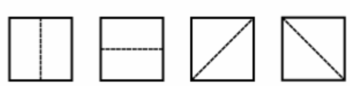
Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

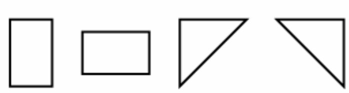
2. Age Appropriate Skill Application 1 2 3 4 5 6 7 8 Dictionary

Li is making a paper airplane from a square piece of paper. How many ways can she fold the paper along a line of symmetry?

Li can fold the paper along 4 lines of symmetry. Here are the 4 lines.



Here is the result of folding along each of these 4 lines.



Notice that the two halves fit over each other perfectly.

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

3. Instructional Item 1 2 3 4 5 6 7 8 Dictionary

Zoe baked sugar cookies in the shape of an ellipse for her classmates. Zoe wants to share a cookie with her friend by cutting it along a line of symmetry. Exactly how many lines of symmetry could be used to cut the sugar cookie into two pieces of equal size and shape?

- **A.** 4 Lines of symmetry
- **B.** 3 Lines of symmetry
- **C.** 2 Lines of symmetry
- **D.** 1 Line of symmetry

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

3. Instructional Item Review 1 2 3 4 5 6 7 8 Dictionary

Correct!

Zoe baked sugar cookies in the shape of an ellipse for her classmates. Zoe wants to share a cookie with her friend by cutting it along a line of symmetry. Exactly how many lines of symmetry could be used to cut the sugar cookie into two pieces of equal size and shape?

A. 4 Lines of symmetry

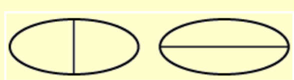
Why is option A incorrect? An ellipse only has 2 lines of symmetry.

B. 3 Lines of symmetry

Why is option B incorrect? An ellipse only has 2 lines of symmetry.

C. 2 Lines of symmetry

Why is option C correct? An ellipse has 2 lines of symmetry, as can be seen here:



D. 1 Line of symmetry

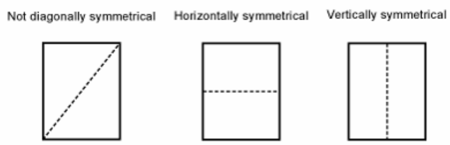
Why is option D incorrect? An ellipse has 2 lines of symmetry. One is horizontal and the other is vertical.

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

4. Review of Concept 1 2 3 4 5 6 7 8 Dictionary

A shape that has line symmetry (also called reflection symmetry) can be divided into 2 equal pieces that are the same size and shape, AND can be folded over each other without any overlap. It is not enough that the pieces look alike; they must reflect each other. For example, a rectangle such as the one below could be divided diagonally into two pieces, and the two pieces would cover each other exactly. The pieces must match exactly without doing anything to them besides folding along the dividing line, called the line of symmetry. Therefore, this rectangle does not have diagonal line of symmetry. It does, however, like all rectangles, have horizontal and vertical line symmetry.



Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a Back | Next

5. Practice 1 1 2 3 4 5 6 7 8 Dictionary

Tania notices that the hour hand of a circular clock lies along a line of symmetry when it points to 12:00. It will also lie along a line of symmetry when it points to how many of the other 11 hours? View Hint

- **A.** None
- **B.** 1
- **C.** 3
- **D.** 11

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a

Back | Next

5. Practice 1 Answer

1 2 3 4 5 6 7 8 Dictionary

Correct!

A circle has an infinite number of lines of symmetry. Any line that divides the circle into 2 equal parts will also be a line of symmetry, and an infinite number of lines will divide a circle into 2 equal parts. Therefore the hour hand will always lie along a line of symmetry, including when it is pointing to the other 11 hours. You can see examples of this below.

Tania notices that the hour hand of a circular clock lies along a line of symmetry when it points to 12:00. It will also lie along a line of symmetry when it points to how many of the other 11 hours?

A. None

B. 1

C. 3

✓ **D. 11**

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a

Back | Next

6. Practice 2

1 2 3 4 5 6 7 8 Dictionary

The candy bar below can be easily divided in half along the middle line. Does the middle line represent a line of symmetry?

View Hint

- **A.** No, because the candy bar has no lines of symmetry.
- **B.** No, because the candy bar's line of symmetry is a vertical line, not a horizontal line.
- **C.** Yes, this line is one of 2 lines of symmetry that the candy bar has.
- **D.** Yes, this is the candy bar's only line of symmetry.

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a

Back | Next

6. Practice 2 Answer

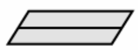
1 2 3 4 5 6 7 8 Dictionary

Correct!

This candy bar has no lines of symmetry. If you folded one half over the other, the two halves would not line up exactly.

If this was a rectangle, which has right angles, the candy bar would have line symmetry.

The candy bar below can be easily divided in half along the middle line. Does the middle line represent a line of symmetry?



A. No, because the candy bar has no lines of symmetry.

B. No, because the candy bar's line of symmetry is a vertical line, not a horizontal line.

C. Yes, this line is one of 2 lines of symmetry that the candy bar has.

D. Yes, this is the candy bar's only line of symmetry.

Back | Next | Back to Top

Math Tutorial | 5th Grade: S3.B1.A1a

Back | Next

7. Check Your Learning

1 2 3 4 5 6 7 8 Dictionary

A game is played on a field such as the one shown below. There is a base on each corner, and the distance between any two adjacent bases is 15 feet. A player can run from one base to any other base as long as he or she runs along a line of symmetry. How many lines of symmetry connect bases?

- **A.** 2
- **B.** 3
- **C.** 5
- **D.** 6

Back | Next | Back to Top

Correct!

Three lines of symmetry connect bases in this hexagon (6 sided polygon) with equal sides.

It is true that a hexagon with equal sides has a total of six lines of symmetry, but these three other lines do not connect bases.

A game is played on a field such as the one shown below. There is a base on each corner, and the distance between any two adjacent bases is 15 feet. A player can run from one base to any other base as long as he or she runs along a line of symmetry. How many lines of symmetry connect bases?

A. 2

B. 3

C. 5

D. 6

Appendix C

Lesson Production Process

(Development to Web)

Step 1: Lesson coordinator identifies indicator for lesson

Step 2: Lesson coordinator sends lesson writer templates, via email, for assigned indicator

Step 3: Lesson writer develops lesson, PowerPoint, worksheet

Step 4: Lesson writer submits lesson via email to Lesson coordinator

Step 5: Lesson reviews lesson to verify it contains lesson components and send the lesson onto a Subject Matter Expert for review

Step 6: Subject Matter Expert reviews lesson and provides handwritten feedback

Step 7: Subject Matter Expert returns lesson to Lesson Coordinator

Step 8: If corrections are minor the lesson coordinator makes the corrections that were suggested by the subject mater expert. If the needed corrections are extensive, the lesson is sent back to the writer for corrections

Step 9:Once the edits are made to the lessons, the lesson is emailed back to the lesson writer for approval. If the lesson needed major edits and was sent back to the lesson writer, the lesson coordinator waits for the lesson to be returned. Once the lesson is returned, steps 4 through 7 are followed.

Step 10: Once the lesson edits are made and approved by the lesson writers, the lesson is sent onto the editing team (team of undergraduate students that prepare the lesson for the web). The editing team draws any needed graphics and makes all of the changes necessary to prepare the lesson. As such, an editor completes the steps in the attached checklist.

Step 11: Once the lesson is edited for the web, the lesson coordinator rechecks the lesson to approve the editor's work and check graphics.

Step 12: The lesson coordinator then submits the lesson onto the production team. At which time the drawling of the graphics are sent to graphic artists to develop and the lesson is sent onto production, where the lesson is transferred into html language.

Step 13: The production team uploads the lesson to the BAIP web site.

Step 14: The lesson coordinator then logs onto the web site and reviews (alpha tests) the lesson and identifies any errors that may exists.

Step 15: The lesson coordinator reports the errors to the production team

Step 16: The production team then makes necessary changes

Step 17: The lesson is released to the public

Appendix D

Tutorial Production Process

(Development to Web)

Step 1: Tutorial coordinator sends tutorial templates with identified indicator to the tutorial writer

Step 2: Tutorial writer creates the tutorial

Step 3: Tutorial writer submits, via email, the tutorial to the tutorial coordinator

Step 4: The tutorial coordinator reviews the tutorial to verify it contains all of the tutorials components

Step 5: The tutorial coordinator then sends, via email, the tutorial onto a subject matter expert who reviews the tutorial

Step 6: The subject matter expert reviews the tutorial and provides handwritten feedback

Step 7: The subject matter expert returns the edited tutorial back to the coordinator

Step 8: The coordinator makes the suggested edits on the electronic version of the tutorial

Step 9: The coordinator then sends the tutorial onto the production team (group of undergraduate students)

Step 10: Production team prepares the tutorial for the web.

Step 10a: First, a production team member identifies and draws all the graphics that are needed for the tutorials

Step 10b: The drawings are labeled and sent onto the graphic designers who create the electronic graphic

Step 10c: The production team member modifies the tutorial by adding the needed html code

Step 10d: The team member then places the tutorial onto the web through the tutorial builder

Step 10e: The vocabulary for the tutorial is noted and placed on a separate document. The document is then sent to the vocabulary writer who develops the vocabulary definition. Once the definition is created, it is uploaded to the tutorial.

Step 10f: Once the graphics for the tutorial are created, they are uploaded to the tutorial. The production team member then logs on to determine if the graphics are correctly made and in the correct locations.

Step 11: Next, an individual is instructed to log onto the BAIP web site and review the tutorial, noting any needed changes.

Step 12: Any needed changes are sent to the tutorial coordinator who then goes into the tutorial builder and makes the needed changes.

Step 13: The tutorial is realized to the public.

Appendix E

5^{th} Grade – Pre Test and Posttest

Standard 1, Benchmark 3, Indicator a4

1. For which situation would you need to ESTIMATE? Finding...

A) the number of months in 38 years.
B) the number of centimeters in 24 meters.
C) the number of gallons of water in a lake.
D) the number of square feet in the rectangular floor of your classroom.

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2. In 1997, the population of Douglas County was 81,798. The population of Atchison County was 16,392. Estimate the APPROXIMATE difference between the populations, to the nearest one thousand people.

A) 60,000
B) 64,000
C) 65,000
D) 66,000

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3. Jill pays $348 a MONTH for rent. She could find the EXACT amount of rent she will pay in one year by...

A) multiplying $348 by the number of weeks in a year.
B) multiplying $348 by the number of months in a year.
C) rounding $348 to $350 and then multiplying by the number of months in a year.
D) rounding $348 to $350 and then multiplying by the number of days in a month.

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4. The mayor wants to know the EXACT number of cars that crossed a bridge between 9:00 a.m. and 12:00 p.m. To find the EXACT number of cars that crossed the bridge during the 3 hours between 9:00 a.m. and 12:00 p.m., the mayor should...

A) round the numbers to the nearest 10 and add them.
B) add the numbers with a calculator or paper and pencil.
C) add 2,300 + 300 + 1700 + 3200.

D) add 2,000 + 1,000 + 3,000 and adjust the total by adding another 1,000.

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5. A 3-level parking garage has 180 parking spaces on each level. Which statement explains one way to find the EXACT number of empty parking spaces currently in the garage?

A) Multiply 180 times 3, then add the number of cars currently parked in the garage currently.
B) Multiply 180 times 3, then subtract the number of cars parked in the garage currently.
C) Round 180 to 200 and multiply 200 by 3, then add the number of cars currently parked in the garage currently.
D) Round 180 to 200 and multiply 200 by 3, then subtract the number of cars currently parked in the garage currently.

Standard 1, Benchmark 4, Indicator k4

1. What is the greatest common factor (GCF) of 30 and 54?

A) 3
B) 6
C) 7
D) 10

---

2. What is the least common multiple (LCM) of 4, 9, and 12?

A) 144
B) 72
C) 48
D) 36

---

3. When considering the numbers 18 and 45, nine is the...

A) least common factor.
B) least common multiple.
C) greatest common multiple.
D) greatest common factor.

---

4. Which statement below is true?

A) Ten is the sum of 20 and 30.
B) Ten is the product of 20 and 30.
C) Ten is the least common multiple (LCM) of 20 and 30.
D) Ten is the greatest common factor (GCF) of 20 and 30.

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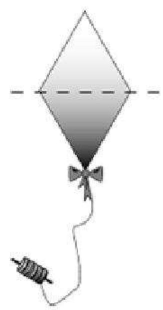
5. The greatest common factor (GCF) of any two numbers is...

A) a number that divides evenly into both numbers.
B) the greatest number that divides evenly into both numbers.
C) a number that both numbers divide into evenly.
D) the greatest number that both numbers will divide into evenly.

Standard 3, Benchmark 1, Indicator a1a

1. How many LINES OF SYMMETRY does the rhombus (shown below) have?

A) 8
B) 4
C) 2
D) 1



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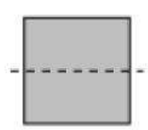
2. How many different lines of symmetry can divide the shape below into two pieces of the same size and shape?



A) 1
B) 2
C) 4
D) 8

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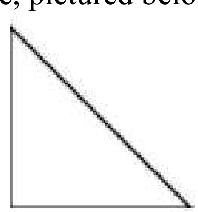
3. The right (90 degrees) triangle, pictured below, can be divided along a line of symmetry in how many ways



A) 3

B) 2
C) 1
D) 0

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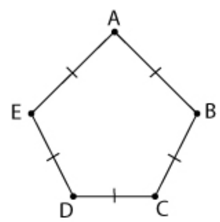
4. The school has a play area shaped like a regular pentagon. How many different lines could be drawn to divide the play area into two sections of equal size and shape?

A) 1
B) 5
C) 6
D) 10



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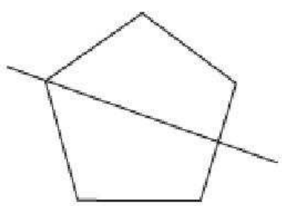
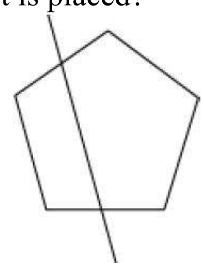
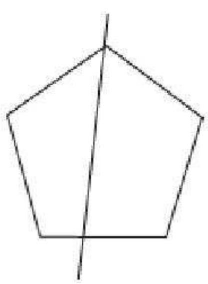
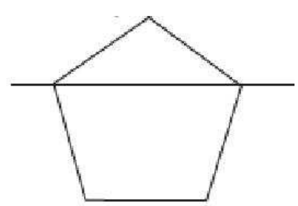
5. A pentagon-shaped kite has a support post placed along a LINE OF SYMMETRY. Which diagram shows where the post is placed?

A) 

B) 

C) 

D) 

Standard 3, Benchmark 2, Indicator a1cf

1. A decade is 10 years long. How many MONTHS are equal to 2 decades?

A) 24
B) 120

C) 240
D) 360

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2. Laura's sister was born 3 years ago. How many MONTHS has it been since Laura's sister was born?

A) 21 months
B) 30 months
C) 36 months
D) 60 months

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3. Jennifer babysat 3 hours on Tuesday and 2 hours on Thursday. How many MINUTES did Jennifer baby-sit?

A) 180 minutes
B) 120 minutes
C) 240 minutes
D) 300 minutes

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4. Jose bought a CD player that had a 54-month insurance plan. How many YEARS was the insurance plan for?

A) 4 1/2 years
B) 4 1/4 years
C) 4 3/4 years
D) 5 years

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5. Andrew used 540 MINUTES on his cell phone last month. How many HOURS did Andrew use his cell phone last month?

A) 6 hours
B) 9hours
C) 54 hours
D) 90 hours

6. A recipe calls for 4,000 grams of sliced potatoes. If each potato weighs about 500 grams, how many potatoes will be needed?

A) 2 potatoes
B) 4 potatoes
C) 6 potatoes
D) 8 potatoes

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7. Cement blocks weigh about 16 pounds each. A truck can haul a load of 3,200 pounds. How many blocks can a truck haul when fully loaded?

A) 100 cement blocks
B) 150 cement blocks
C) 200 cement blocks
D) 250 cement blocks

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8. Daisy's pet store ordered 50 bags of dog food. Each bag weighed 25 pounds. What is the total weight of the 50 bags of dog food?

A) 2 pounds
B) 25 pounds
C) 125 pounds
D) 1,250 pounds

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9. An elevator has a weight limit of 750 pounds. If the average weight of each person is 150 pounds, how many people can ride on the elevator at one time?

A) 4 people
B) 5 people
C) 6 people
D) 7 people

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10. A house cat weighs about 7 kilograms. A cheetah weighs about 58 kilograms. The cheetah is about how many times heavier than the cat?

A) 6 times heavier
B) 7 times heavier
C) 8 times heavier
D) 9 times heavier

Standard 3, Benchmark 3, Indicator k3

1. The TOP view of a three-dimensional figure appears as a rectangle.

The three dimensional figure is a _______

A) cone
B) cylinder
C) rectangular prism
D) rectangular pyramid

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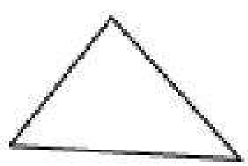
2. You are viewing the three-dimensional figure shown, from the bottom.



The three-dimensional object is a _______

A) cone.
B) triangular prism.
C) rectangular prism.
D) cylinder.

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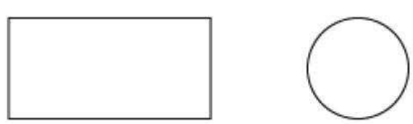
3. Shown is a TOP view and a SIDE view of a three-dimensional solid.

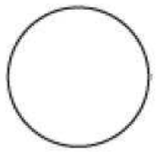


Side View　　Top View

The solid is a _______

A) sphere.
B) cylinder.
C) rectangular prism.
D) rectangular pyramid.

4. This three-dimensional figure, when viewed from ANY direction, looks circular in shape.



The three-dimensional figure is a _______

A) cone.
B) triangular prism.
C) cylinder.
D) sphere.

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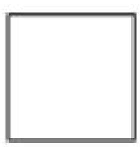
5. The diagram below shows a three-dimensional figure as viewed from the side, top or base.



The three-dimensional figure is a _______

A) cube
B) sphere
C) cone
D) rectangular pyramid

Standard 4, Benchmark 2, Indicator k3de

1. The set of numbers below represents the daily sales of a soft drink at a convenience store.

$73, $96, $98, $108, $115, $136, $193, $193, $202, $218

What is the MEDIAN amount of sales for the 10 days shown?

A) $117
B) $125.5
C) $143.2
D) $193

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2. What is the FIRST STEP in organizing a set of numbers to find the MEDIAN number for the set?

A) Add all of the numbers to find the total
B) Divide the total by 2
C) Add the minimum and the maximum values and divide by 2
D) List the numbers in order from least to greatest

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3. Following is the sales for the BIG C department store.

Furniture-$140,000
Clothing-$18,000
Shoes-$10,000
Housewares-$12,000
Jewelry-$20,000

What is the MEDIAN number of sales for the five departments?

A) $140,000
B) $20,000
C) $18,000
D) $10,000

---

4. A set of numbers is shown below.

11, 19, 19, 20, 22, 35

Which calculation shows how to find the median of the set of numbers?

A) Add the least and greatest numbers, then divide by 2
B) Add the two numbers that are equal, then divide by 2
C) Add the two middle numbers, then divide by 2
D) Add the two greatest numbers, then divide by 2

---

5. A set of numbers is shown below.
7, 10, 10, 11, 14, 20

Which number phrase shows how to find the MEDIAN of the set of numbers?

A) $\frac{10+11}{2}$
B) $\frac{10+10}{2}$
C) 20-7

D) $\frac{7+10+10+11+14+20}{6}$

---

6. The Smith family has the following ages:

Mother-49
Father-63
Son-22
Son-27
Aunt-34

What is the MEAN age of the family?

A) 34
B) 39
C) 41
D) 63

---

7. Which statement describes the MEAN of a set of data?

A) It is the most common data point
B) It is the number of data points

C) It is an average of all the data points
D) It is the middle data point

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8. The data set shown is the weight of seven professional football players.

230, 235, 236, 265, 295, 295, 383

What is the MEAN weight for the data set?

A) 153
B) 277
C) 295
D) 383

9. Louise wants to find the mean of 6 numbers. Which statement describes all the calculations Louise needs to complete to find the MEAN?

A) add the 6 numbers
B) multiply the 6 numbers
C) add the 6 numbers, then divide the result by 2
D) X add the 6 numbers, then divide the result by 6

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10. The following are the sales for one week at a large grocery store:

Meat-$160,000
Produce-$21,000
Dairy-$12,000
Flowers-$18,000
Paper Products-$19,000
Total-$230,000
Mean-$46,000

Why is the mean of $46,000 NOT the best measure of the average sales for this data set?

A) It does not represent the sale value of any of the departments.
B) The median would be less accurate.
C) The range would better represent the average of the departments.
D) The mean is not as accurate, because the $160,000 and $12,000 numbers cause the mean to be misleading.

Posttest

Standard 1, Benchmark 3, Indicator a4

Directions: Answer the following 5 questions by filling in the correct bubble on your scantron sheet.

1. Lake Victoria in Africa is 26,828 square miles. Gambia, the smallest country, is 4,361 square miles. Lake Victoria is <u>about</u> how many times larger than Gambia?

A) 4
B) 5
C) 6
D) 7

---

2. The table below shows some of the highest mountains in the world.

Mountain	**Height**
Asia: Mt. Everest	29,028 ft.
Asia: Mt. Annapurna	26,503 ft.
Spain: Mt. Mulhacen	11,411 ft.
Germany: Mt.	12,457

Grossglockner	ft.
Argentina: Mt. Aconcagua	22,835 ft.

What is the approximate difference in height between Mt. Annapurna and Mr. Grossglockner?

A) 12,000 feet
B) 14,000 feet
C) 15,000 feet
D) 17,000 feet

---

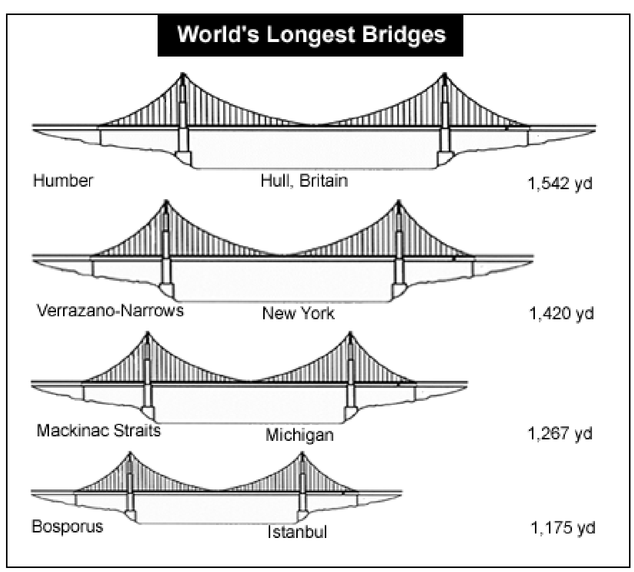
3. In Switzerland, the longest stairway is beside the Niesen Bahr Railway. It has 11,674 steps. If each step rises 6'', approximately how many feet difference is there between the bottom step and the top step?

A) 5000 feet
B) 5200 feet
C) 5400 feet
D) 6000 feet

---

4. The table shows the world's longest bridges. What is the approximate length in feet of Mackinac Straits Bridge?

A) 4500 feet
B) 4200 feet
C) 3600 feet
D) 3300 feet



5. The Colorado River carries about 391,780 tons of dirt downstream each day. A dump truck holds 5 tons of dirt. Approximately how many truck loads of dirt are carried downstream each day by the Colorado River?

A) 70,000
B) 75,000
C) 80,000
D) 85,000

Standard 1, Benchmark 4, Indicator k4

Directions: Answer the following 5 questions by filling in the correct bubble on your scantron sheet.

1. Which direction describes how to find the Least Common Multiple (LCM) of the three numbers listed?

A) List multiples of each number. Any number in each set is a common multiple
B) List factors of each number, the least number in all 3 sets is the LCM
C) List several multiples of each number, the least number listed in all 3 is the LCM
D) List the sum of the 3 numbers and divide by 3 to find the LCM

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2. Which BEST describes what the number 12 is to 3 and 4?

A) greatest common factor
B) least common multiple
C) difference
D) quotient

---

3. What is the greatest common factor (GCF) of 28 and 70?

A) 2
B) 4
C) 7

D) 14

---

4. What is the greatest common factor (GCF) of 20, 30, and 90?

A) 5
B) 10
C) 60
D) 180

---

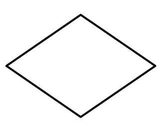
5. Multiplying two factors will result in a ____________ of both numbers.
Which word makes the sentence above true?

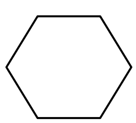
A) Dividend
B) Quotient
C) Multiple
D) Sum

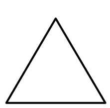
Standard 3, Benchmark 1, Indicator a1a

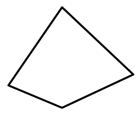
Directions: Answer the following 5 questions by filling in the correct bubble on your scantron sheet.

1. Which figure below does not have a line of symmetry?

A) 

B) 

C) 

D) 

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2. Which figure will have the most lines of symmetry?

A) pentagon
B) rectangle
C) isosceles triangle
D) circle

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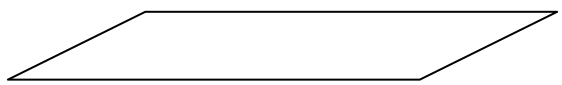
3. Isabelle wants to cut the piece of cloth shown below in half, using a line of symmetry.



How many different cuts along a line of symmetry could she make?

A) 0
B) 1
C) 2
D) 4

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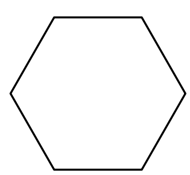
4. A carpet is shaped like a regular hexagon. How many lines of symmetry does it have?



A) 4
B) 6
C) 8
D) 12

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5. Which figure below has no (0) lines of symmetry?

A) parallelogram
B) equilateral triangle

C) rectangle
D) regular hexagon

Standard 3, Benchmark 2, Indicator a1cf

Directions: Answer the following 10 questions by filling in the correct bubble on your scantron sheet.

1. Machu Picchu, Peru was discovered in 1911. If it was discovered in January, how many more months must pass for it to be 100 years since it was discovered?

A) 12
B) 24
C) 36
D) 48

---

2. A movie is scheduled to last 75 minutes. If Tom watched the last 45 minutes, what part of the movie did he miss?

A) ¼ hour
B) ½ hour
C) ¾ hour
D) 1 hour

---

3. Carrie spent 2 ¼ hours at the movie. How many minutes was that?

A) 75 minutes
B) 120 minutes
C) 135 minutes
D) 150 minute

---

4. Susan is 5 years and 3 months old. The information form asks for her age as number of months. Which is correct?

A) 39
B) 51
C) 54
D) 63

---

5. A decade is 10 years. How many months is a decade?

A) 12 months
B) 60 months
C) 110 months
D) 120 months

---

6. An average cat weighs about 7 kg. Which cat below is nearest to the average weight of a cat?

A) Purr 6 ½ kg.
B) Tabby 7 ¼ kg.
C) Meow 7 ½ kg.
D) Tiger 7 ¾ kg.

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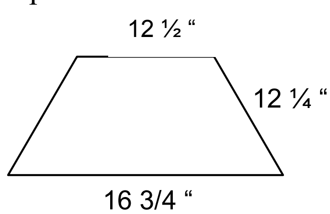
7. You want to put a frame around the picture. Which the best estimate of its perimeter to the nearest inch?



A) 40 inches
B) 50 inches
C) 52 inches
D) 54 inches

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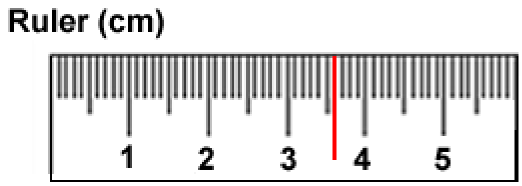
8. If a "stone" is equal to 5 pounds in weight, about how much would Sally weigh to the nearest pound?

A) 20 pounds
B) 25 pounds
C) 30 pounds
D) 35 pounds

9. The mark on the ruler shows how many centimeters to the nearest whole centimeter?



A) 3.0
B) 3 ½ or 3.5
C) 3.6
D) 4.0

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10. The average adult man weighs about 167 pounds. An elevator has a weight limit of 750 pounds. What is the greatest number of adult men that can ride safely in the elevator?

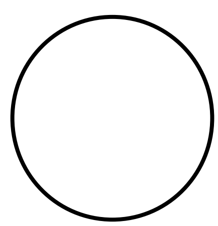
A) 3 adult men
B) 4 adult men
C) 5 adult men
D) 6 adult men

Standard 3, Benchmark 3, Indicator k3

Directions: Answer the following 5 questions by filling in the correct bubble on your scantron sheet

1. The diagram below shows a three-dimensional figure as viewed from the TOP.

Which BEST describes the three-dimensional figure?

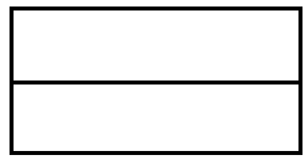


A) cone
B) cylinder
C) ellipse
D) sphere

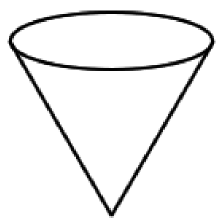
2. The diagram below shows a three-dimensional figure as viewed from the TOP.

Which BEST describes the three-dimensional figure?

A) cylinder
B) triangular prism
C) rectangular prism
D) rectangular pyramid



3. The diagram below shows a three-dimensional figure as viewed from the SIDE.



A) cylinder
B) ellipse
C) cone
D) sphere

4. Which of the following describes a rectangular prism?

A) 6 regular faces, 12 edges, 8 vertices
B) A 4-sided polygon
C) 8 sides, 8 vertices, 0 edges
D) 3 faces, 6 edges, 4 vertices

5. Which is the number of flat faces in a rectangular pyramid?

A) 3
B) 4
C) 5
D) 6

Standard 4, Benchmark 2, Indicator k3de

Directions: Answer the following 10 questions by filling in the correct bubble on your scantron sheet.

1. Following the price for shoes at five different stores, what is the median price?

$69, $48, $56, $49, $52

A) $48
B) $52
C) $56
D) $69

---

2. The following are the points scored for the last 6 games of the state basketball team. What is the median score?

82, 92, 70, 98, 84, 90

A) 70
B) 82
C) 84
D) 87

---

3. In five games Sam scored 6, 9, 8, 4, and 3 points. What is the median number of points for all of the games?

A) 3
B) 6
C) 8
D) 5

---

4. Which direction describes how to find the median score?

A) Arrange the scores in order, find the middle score
B) Choose the score that occurs most often
C) Subtract the least score from the greatest score

D) Add all of the scores together and divide by the number of scores

---

5. Which set of data will have the greatest median value?

A) 22, 49, 38, 63, 27
B) 22, 49, 63, 27, 83
C) 22, 49, 27, 63, 27
D) 31, 49, 22, 63, 27

---

6. Which direction describes how to find the mean?

A) Subtract the least score from the greatest score
B) Add all of the scores and divide by the number of scores
C) Select the score that occurred most often
D) Add the top and bottom score and divide by 2

---

7. The following set of numbers represents the weight of 6 young cattle. What is the median weight?

[204, 205, 238, 98, 105, 128]

A) 149.3
B) 166
C) 168
D) 204.5

---

8. Following are daily temperatures for 6 days in June. What was the median temperature?

[82^o, 92^o, 70^o, 98^o, 84^o, 90^o]

A) 86^o
B) 87^o
C) 28^o
D) 84^o

---

9. The following are the total weekend sales at Dove's Ice Cream Stand. What is the median number for the data?

[FRI: $150, SAT: $558, SUN: $255]

A) $150
B) $255
C) $481.50
D) $558

---

10. Which of following describes the word **median**?

A) Dividing the sum by the numbers of addends
B) The middle number in a set of data
C) The greatest minus the least number in the set of data
D) The number that appears most frequently

Appendix F

Instructional Checklist

1. What was the level of understanding among your students when you began teaching this lesson?
   - a. Limited understanding
   - b. General understanding
   - c. This was review for them
2. What was the level of understanding when you completed the lesson?
   - a. Most students seemed to have mastered the content
   - b. Most students seemed to have a general understanding
   - c. Additional instruction will be necessary to ensure proficiency
3. How much time did you devote to teaching the lesson?
   - a. One class period
   - b. Two class periods
   - c. Three class periods
   - d. More than three class periods
4. Did you encourage students to work on the tutorials?
   - a. Yes
   - b. No
5. What was your assessment of the lesson?
   - a. Very effective
   - b. Moderately effective

- c. Needs minor revisions
- d. Needs major revisions

Appendix G

Teacher Satisfaction Questions

BAIP General Use:

1. Learning math content is difficult for my students.
2. I feel I need more training to effectively teach math concepts covered on the state indicators.
3. The Blending with Assessment Instruction Program (BAIP) intervention improved my students' math skills?
4. The BAIP intervention improved the math skills of my students' with learning disabilities.
5. Before implementing BAIP, I was confident in my ability to prepare all of my students for the state math assessment.
6. The BAIP intervention prepared my students for the math state assessment.
7. I would like to access and implement the BAIP intervention in the future.
8. I would recommend the BAIP intervention to other districts and teachers.
9. Do you have additional comments and suggests:

BAIP Lesson Use:

10. The BAIP lessons contained all of the components necessary for classroom instruction.
11. The explicit instruction format (teacher prompts/student responses) was helpful
12. The lesson handout was helpful

13. The PowerPoint was effective when used during instruction

14. I found the student extensions for students in need of enrichment helpful

15. I found the student extensions for student with special learning needs helpful.

16. Do you have additional comments and suggests:

BAIP Tutorial Use

17. My students were able to complete the BAIP tutorials independently.

18. Students were able to log onto and take the assigned tutorials independently

19. Students responded positively to the feedback from the tutorial

20. Students often repeat tutorials.

21. Do you have additional comments and suggests:

BAIP Management System

22. The BAIP web site was easy to navigate

23. I found the immediate feedback from the student tutorials helpful

24. I found it easy to add classes

25. I found it easy to add students

26. Do you have additional comments and suggests:

27. Which lessons did you teach

- ☐ 5th grade
    - ☐ s1.b3.a4
    - ☐ s1.b4.k4
    - ☐ s3.b1.a1a
    - ☐ s3.b3.k3

☐ s3.b2.a1cf

☐ s4.b2.k3de

Appendix H

Accessing Computerized Assessment Tool

This user's guide is focused on how to prepare for and administer the BAIP Mathematics Test via the KCA system.

This guide is intended to help teachers do the following:

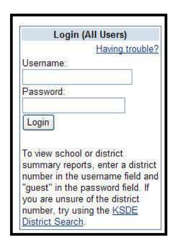
- Understand how the Kansas Computerized Assessments (KCA) are administered
- Access BAIP Mathematics Test reports

Step 1: Download the KCA Software

Before a student can take the KCA, the KCA software must be loaded onto the testing computers. The KCA software provides for Practice and Formative Tests as well as the "Real" KCA tests to be taken by students. On 12/18/06 KCA version 4.1 will be released. Check with your technology specialist to be sure the correct version of KCA is installed. The software can be downloaded from http://kca.cete.us/kca.html. In addition, the new KCA tutorials will need to have Flash v7r63 as a minimum to run the tutorials. You can upgrade to this Flash version by going to this link: http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash Your technology specialist in your school district can assist you with this process.

Step 2: Log in to the CETE website

Go to http://www.cete.ku.edu and log in. Contact your school principal or testing coordinator for your username and password. You may have multiple usernames and password as they are assigned by subject and grade level.



> There are 2 levels of user access for the CETE website:
> **Site Level** – has access to entire school
> **Grade Level** – has access to one grade level and one subject (math or reading).

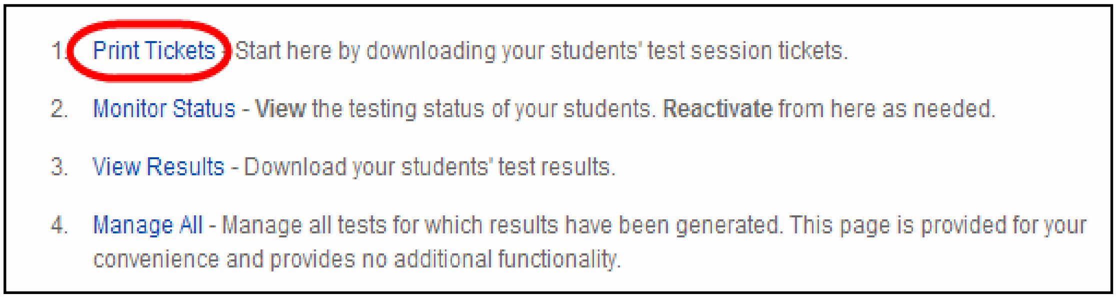
Step 3: Determine Who Will Issue Testing Tickets for Your Students

For each testing session, students will need to be issued a test session ticket. These tickets can be issued by a teacher, administrator or a testing coordinator. If the tickets will be issued for you, skip to step 6. Ask your building principal how your school will issue testing tickets.

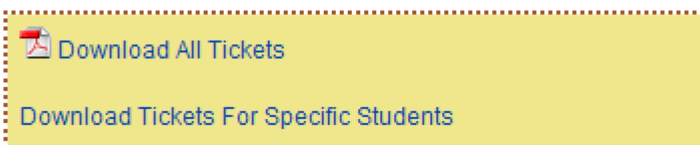
Step 4: Select Test and Students to be Tested

For each testing session, students will need to be issued a test session ticket. To begin, click on the "KCA Main Page" link.

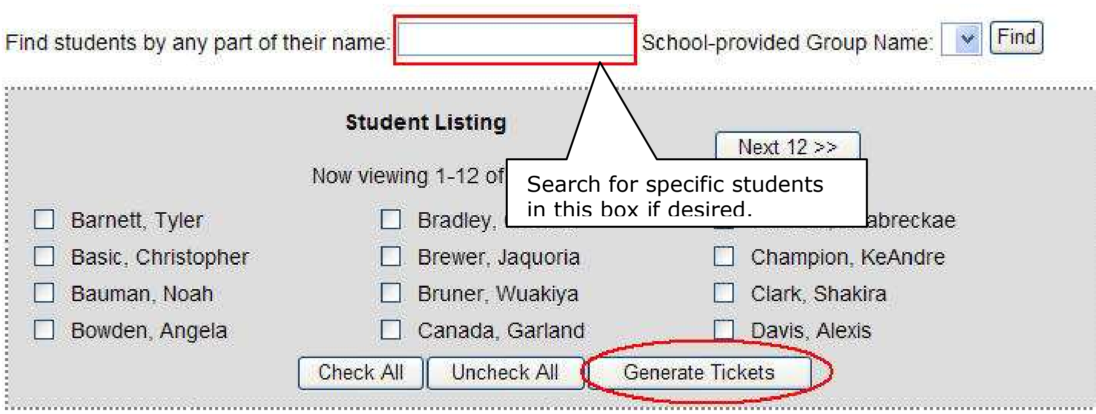
Click on BAIP Field Test
Click on "Print Tickets."



You may generate tickets for all students in your grade level or you may download tickets for specific students.

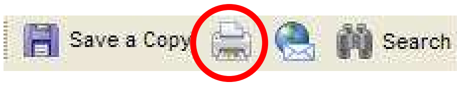


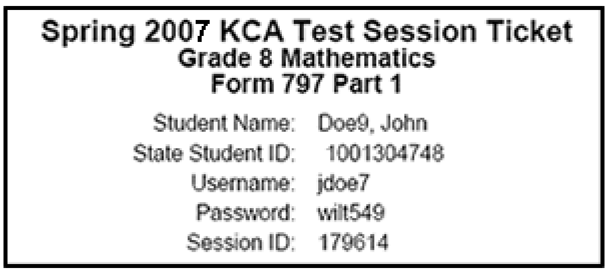
Click Generate Tickets after selecting the students for the assessment.



Step 5: Print Tickets

Once you select "Generate Tickets", a PDF file will open. The file contains directions, a testing roster, and student testing tickets. Click the print icon to print or the disk icon to save the file. After printing the tickets, you will need to cut apart the tickets and distribute them to the correct teachers.





Spring 2007 KCA Test Session Ticket
Grade 8 Mathematics
Form 797 Part 1

Student Name: Doe9, John
State Student ID: 1001304748
Username: jdoe7
Password: wilt549
Session ID: 179614

Example of a student testing ticket. A student's Test Session Ticket (think of it as a boarding pass) can only be used once.

Step 6: Read the Teacher Instructions/Tutorial/Examiner Manual

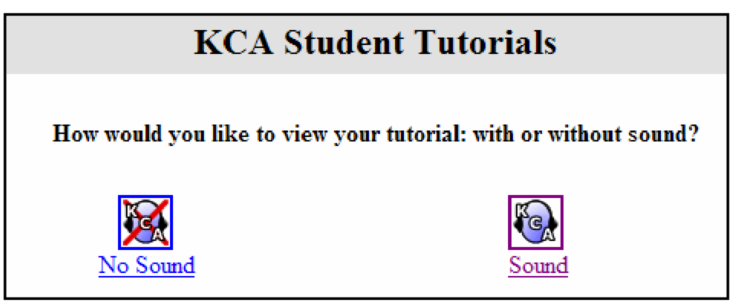
Before your students are assessed, it is important that you understand how to properly administer the KCA. The Teacher Tutorial is designed to assist teachers in learning about the features of the Kansas Computerized Assessment (KCA), and provide information regarding how to properly administer the KCA assessments. To access the tutorial, go to http://kca.cete.us/tutorials/teacher/index.html.

It is essential that persons who will administer the KCA review and be familiar with testing provisions detailed in the KSDE Examiner Manual that is located at http://www.ksde.org/assessment/examiner_manual.html. The manual contains important details regarding testing of special needs populations and they must be reviewed.

Step 7: Review KCA Tutorial and Practice Assessment With Students

Students need to be familiar with the format of the assessment and the tools available to them before taking the BAIP Mathematics Test.

The KCA Student Tutorial can be viewed at http://kca.cete.us/tutorials/studentTutorials.html or accessed through the KCA software. The tutorial will appear on the bottom left corner of the screen.

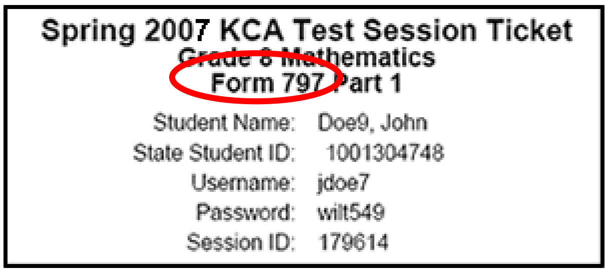


You have the option of viewing the tutorial with or without sound. You will be able to pick your grade level and subject for the tutorial. Tutorials can be individually administered or shown to a whole group.

(Note – the tutorial and practice assessment prepares students for both the "real" assessment as well as formative assessments.)

Step 8 : Administer the BAIP Pretest

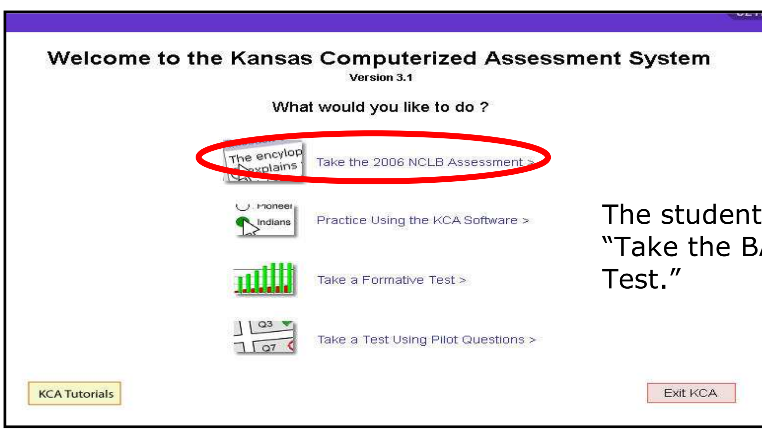
Now you are ready for students to take the BAIP Mathematics Test. Keep in mind these things as you prepare for KCA testing:
When students arrive at the KCA test site (computer lab, etc.) each student is then to be given her/his test session ticket (from step 5) for the part of the assessment each student will take during that test session.



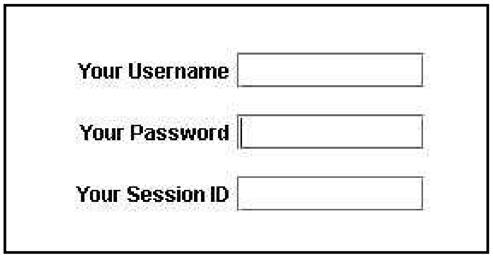
The students' Test Session Tickets identifies the Test Form they will be taking. Computer monitors may be large and sitting next to a student taking the same Form could be a problem. Give the following instruction as appropriate: "The person on your right and left must not have the SAME Test Form number on their session ticket as yours."

Students may use scratch paper while taking the BAIP Mathematics Test – have some available for students to use. The KCA mathematics engine does provide an on-screen calculator for the appropriate assessment parts. Students taking a mathematics test may use a local calculator if desired and allowed by the school (only provide for Parts 1 and 2 at all grades); however, students are **not** permitted use of a calculator on any portion of the Part 3 assessment. At grades 8 and 10, graphing calculators are permitted when taking Parts 1 and 2.

To begin testing, click on the KCA icon on the desktop.



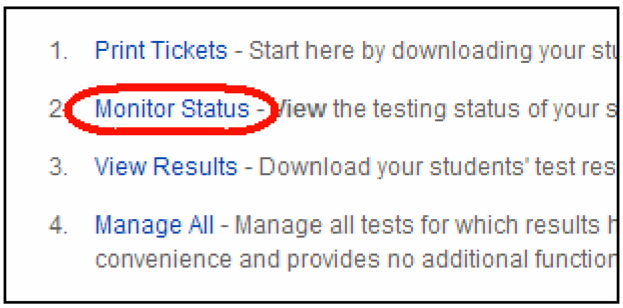
The student will need to select "Take the BAIP Mathematics Test."



The student will then be asked to log in using the information on their testing ticket.

Step 9 – Monitor Status

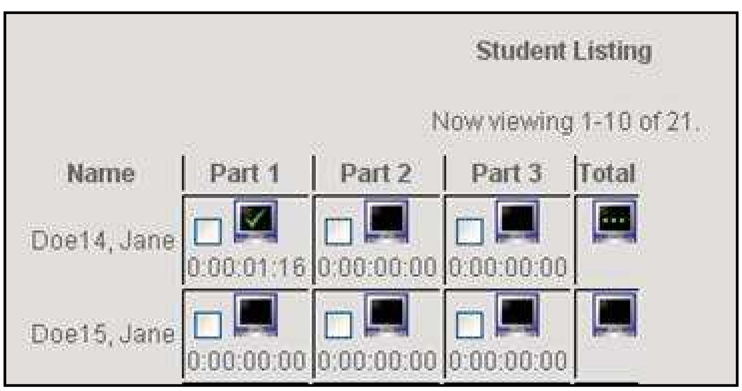
Want to know who has tested, who needs to finish, or who stopped in the middle of a test? CETE makes it easy to monitor your students during testing. Log back in to the CETE web site at http://www.cete.ku.edu. On the left side of the screen, click on KCA Main Page. Then click on Kansas NCLB Assessment (the "REAL" test).



Click on “Monitor Status.”

All of the students for the grade level and subject being tested will appear with the status of their testing. This section will also allow for reactivation of a student’s test in case a test session was ended mistakenly or due to forces beyond anyone’s control (power failure, etc.).

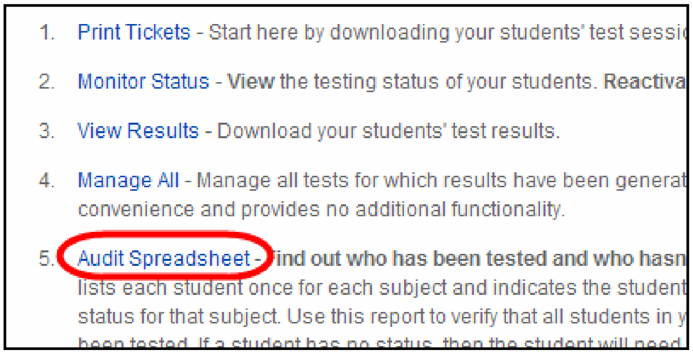
Pick the subject and test you want to monitor. All of the students will appear with the status of their testing. This section will also allow for reactivation of a student’s test in case a test session was ended mistakenly or due to forces beyond anyone’s control (power failure, etc.)



In order to reactivate a student testing session, click on the box next to the student’s testing session and click “Reactivate”. After reactivation, the original session ticket will be valid again.

Students who are "bounced" or "kicked out" of the system without officially ending the test part do NOT need to be reactivated if they have been taking the same test part for less than 90 minutes. This means a student CAN use her/his test session ticket AGAIN within 90 minutes of their starting the test without needing to be reactivated.

Another excellent tool to help you monitor the status of your KCA testing is the use the Audit Spreadsheet. To access the Audit Spreadsheet, click on "KCA Main Page." Then click on BAIP Mathematics Test.



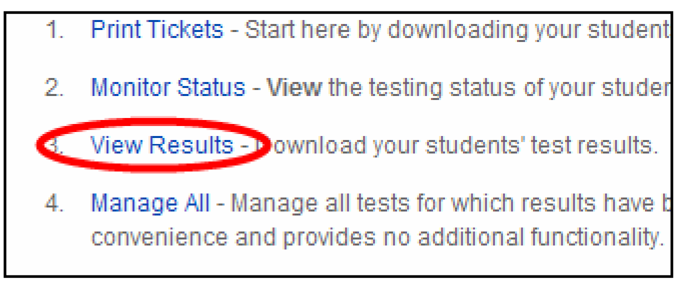
Click on "Audit Spreadsheet."

Click "Save" and then "Open." The spreadsheet opens in Excel.

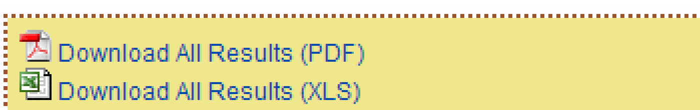
The spreadsheet (updated nightly) lists each student once for each subject and indicates the student's KCA or alternate assessment status for that subject. Use this report to verify that all students in your district, building, or class have been tested. If a student has no status, then the student will need to have either a KIDS exit record, a CETE Not Tested code, or a Paper and Pencil answer sheet submitted. There should be 3 completed KCA test parts for KCA-tested students and 15 alternate assessment ratings for alternate assessment students.

Step 10: Student Reports

Results from the KCA become available one week after testing to local educators when the student completes all parts of the KCA assessment. No results are reported when a Practice Test is taken as this is not its purpose. To access reports, click on the "KCA Main Page" link. Click on BAIP Mathematics Test.



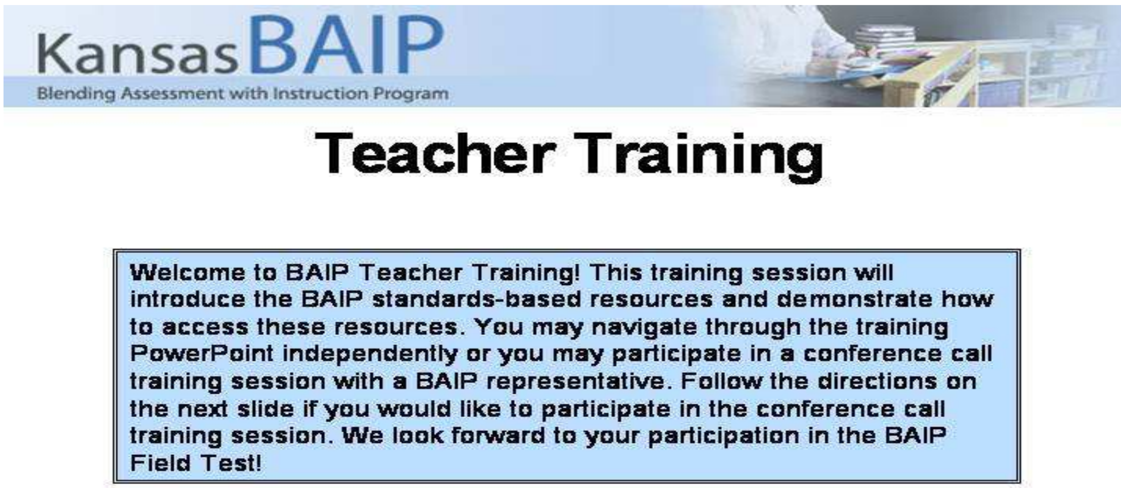
Click on "View Results."

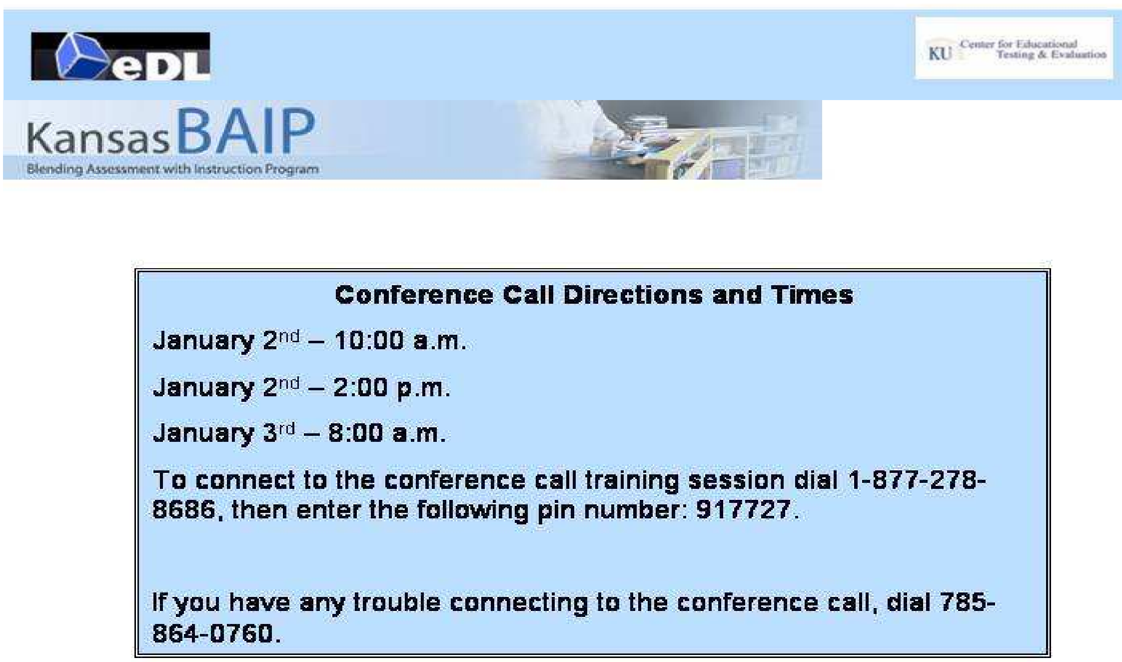


You can choose between PDF reports or XLS reports (Excel). Click on the desired format.

Appendix I

PowerPoint Training Presentation





Kansas BAIP
Blending Assessment with Instruction Program

BAIP Training Agenda

- Introduction to the BAIP Lessons
- Navigating BAIP Lessons
- Introduction to the BAIP Student Tutorials
- Navigating the BAIP Student Tutorials
- BAIP Field Test Responsibilities
- Contact Information

Kansas BAIP
Blending Assessment with Instruction Program

BAIP is designed to provide support to teachers in aligning their instruction with standards in Mathematics. BAIP is made powerful by aligning lessons with statewide assessments that are used to measure the achievement of students in mathematics. The lessons for teachers are supplemented by instructional tutorials for students that are aligned with each lesson and designed to develop competencies in the skills and knowledge required by standards in grades 4, 5, 6, 7, and 8.

Kansas BAIP
Blending Assessment with Instruction Program

Introducing the Frameworks

Each assessed indicator within grades 3, 4, 5, 6, 7, 8, and 10 have two instructional lessons. Each lesson has five main frameworks:

1. Contextual,
2. Teaching,
3. Lesson,
4. Application, and
5. Extension.

These frameworks contain the materials and instructional guides to teach the lesson without having to locate outside resources.

Kansas BAIP
Blending Assessment with Instruction Program

Lesson Content

Contextual Framework

- This framework provides basic information drawn from the state standard, benchmark, and indicator specific to this lesson.

Teaching Framework

- Teachers must have a clear and comprehensive understanding of the state math indicators they are responsible for in their classroom. Therefore, at the initiation of each lesson you are provided with a clear overview depicting the concepts, skills, essential vocabulary, and application pertaining to the lesson.

KansasBAIP
Blending Assessment with Instruction Program

Lesson Content

Lesson Framework

- Prior knowledge plays a critical role in helping students cognitively prepare for new information and vocabulary that will be presented during the lesson. Therefore, in the lesson framework you are provided with a detailed review of the essential prior knowledge skills related to the indicator.
- Next, it is important to provide examples of previous life experience to aid students in accessing prior knowledge that is related to the upcoming lesson. Therefore, the lesson contains an example of this type of experience that you can use during your instruction.
- It is critical for students to experience modeling and interpretation of new skill(s) through concrete examples. This assists the student in developing a conceptual understanding of the new skill(s), before they begin to learn or apply the skill(s) in an abstract fashion. Therefore, the lesson describes the steps of modeling the new concept.
- Once students participate in a modeling activity, it is critical to demonstrate the new skill(s) in a step-by-step manner. This demonstration includes responses from students to measure their grasp of the new subject.

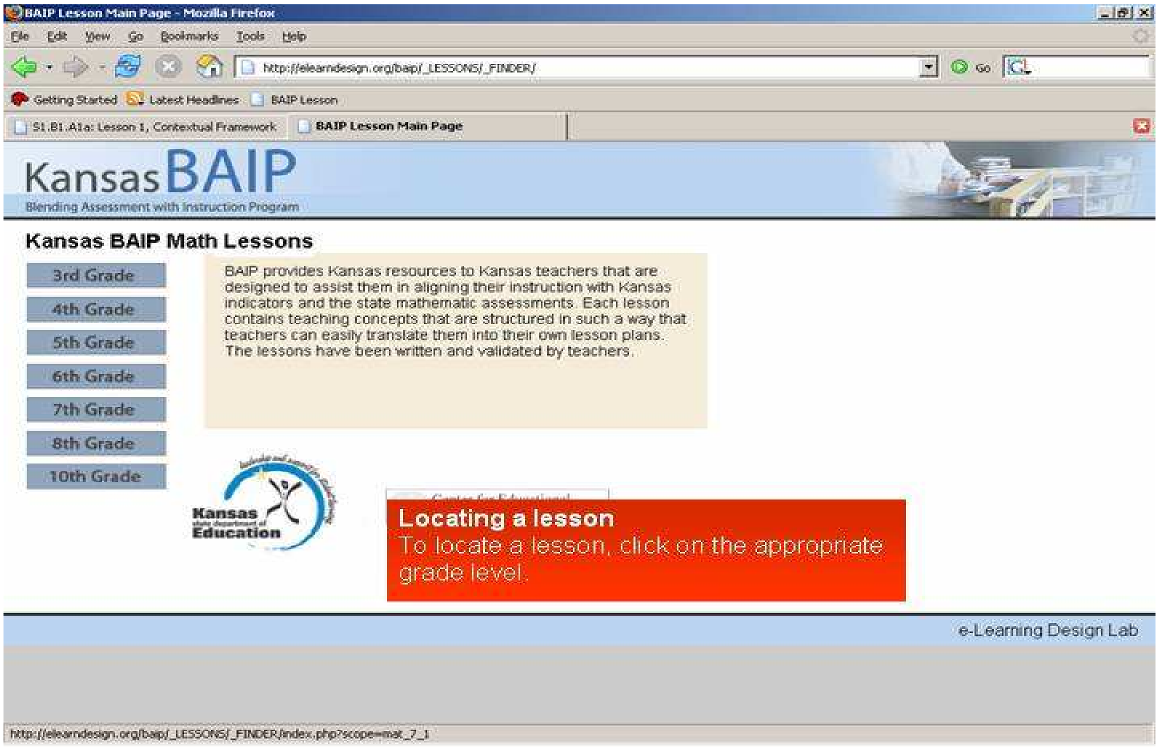
KansasBAIP
Blending Assessment with Instruction Program

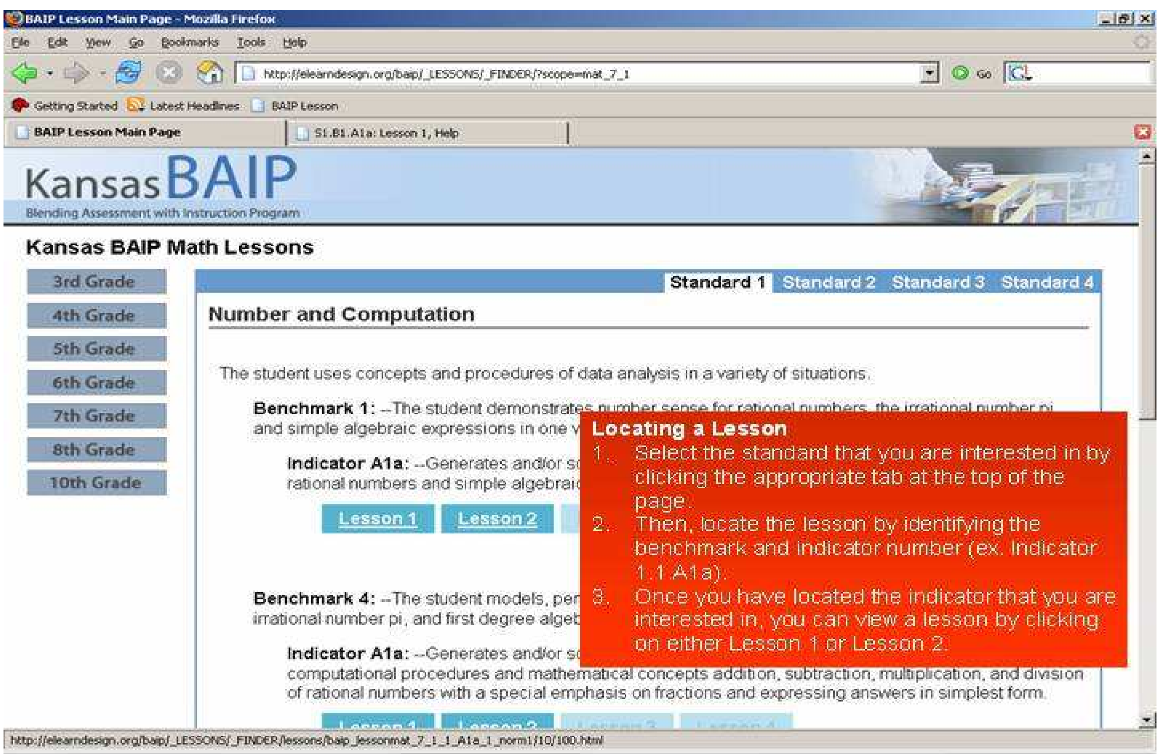
Lesson Content

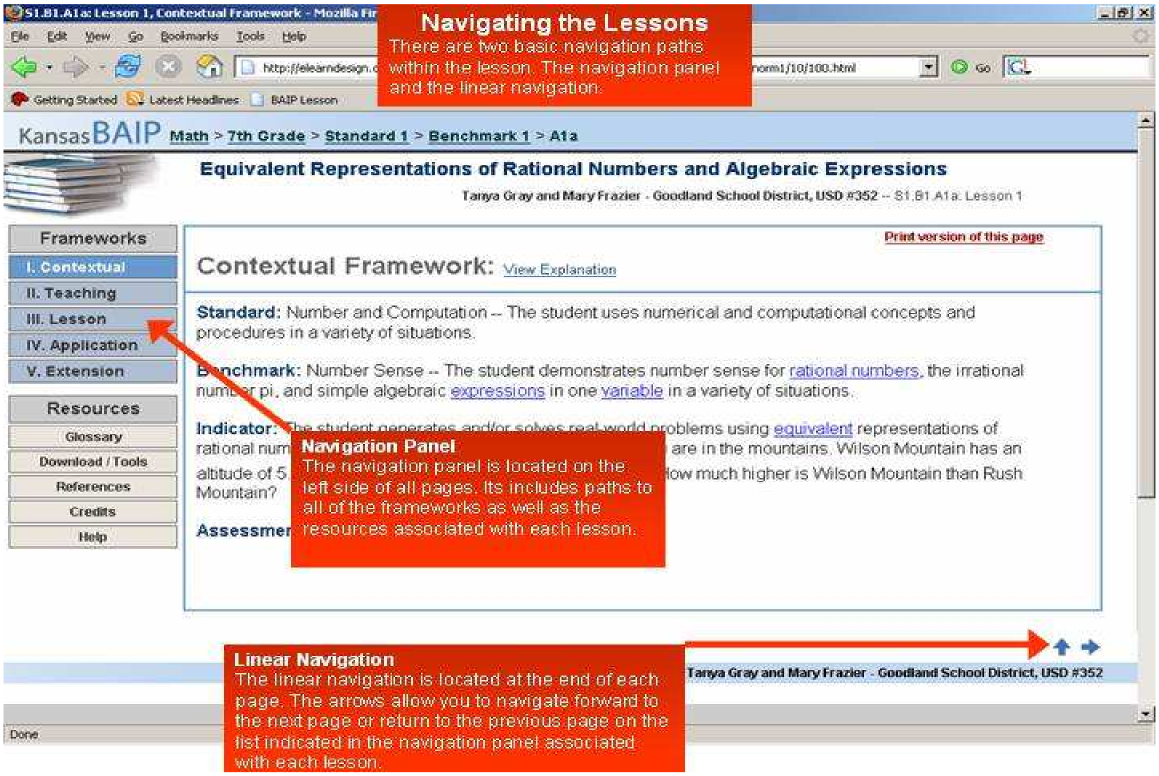
Extension Framework

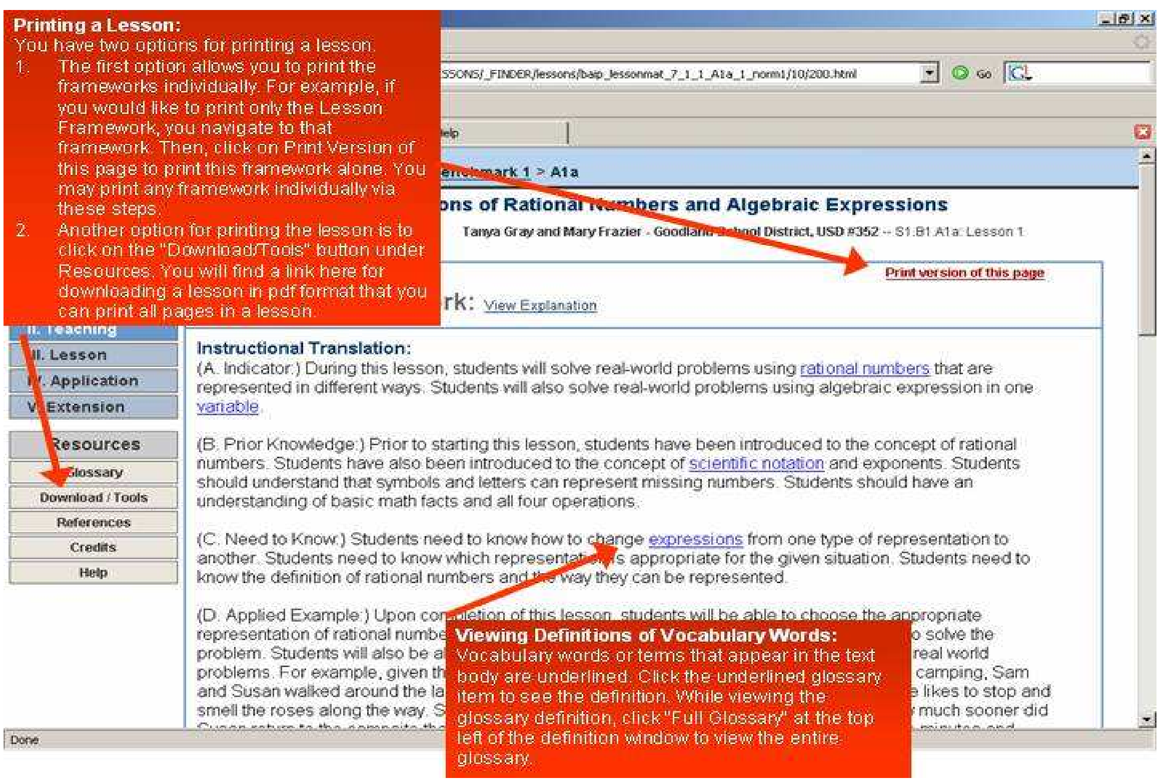
- The first set of activities is identified for students in need of enrichment. These activities are designed to provide teachers with additional resources for students who have mastered the lesson content. Although these activities are relate to concepts being taught during the lesson, the difficulty of the activity is above the concrete examples provided during the lesson.

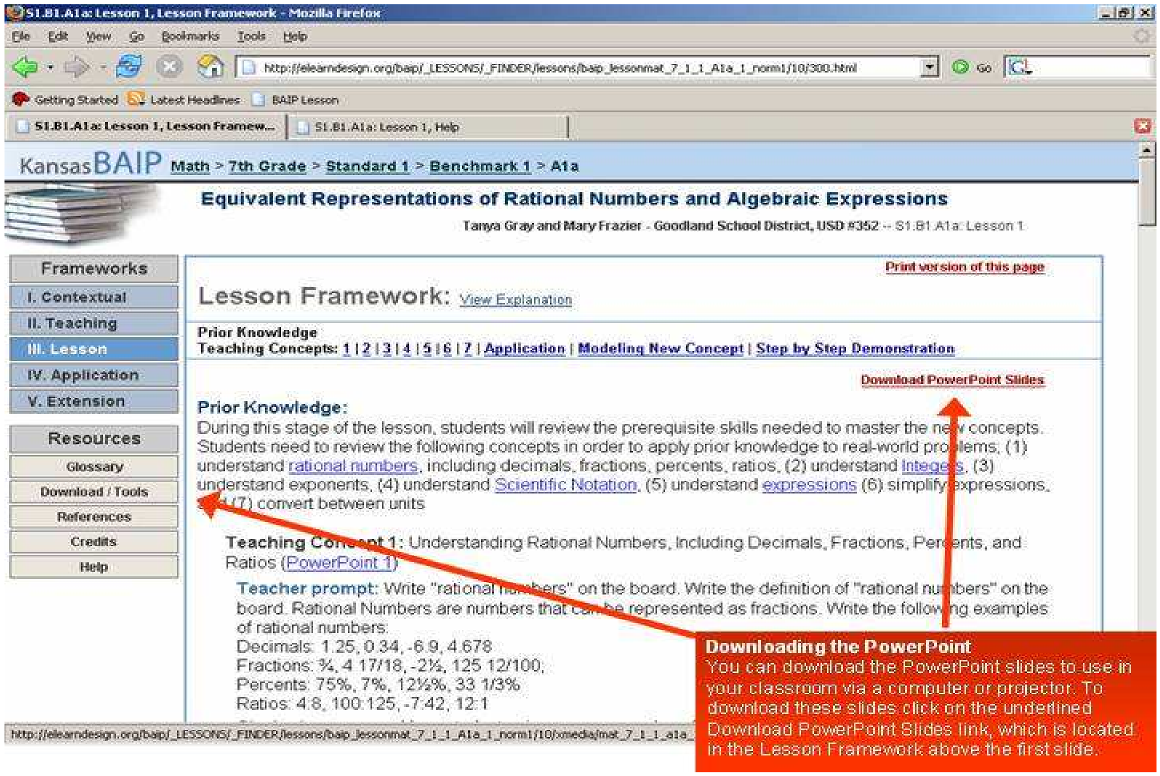
- Next, a set of activities is identified for students in need of additional instruction. These activities are designed to provide additional support to students who struggled during the lesson.

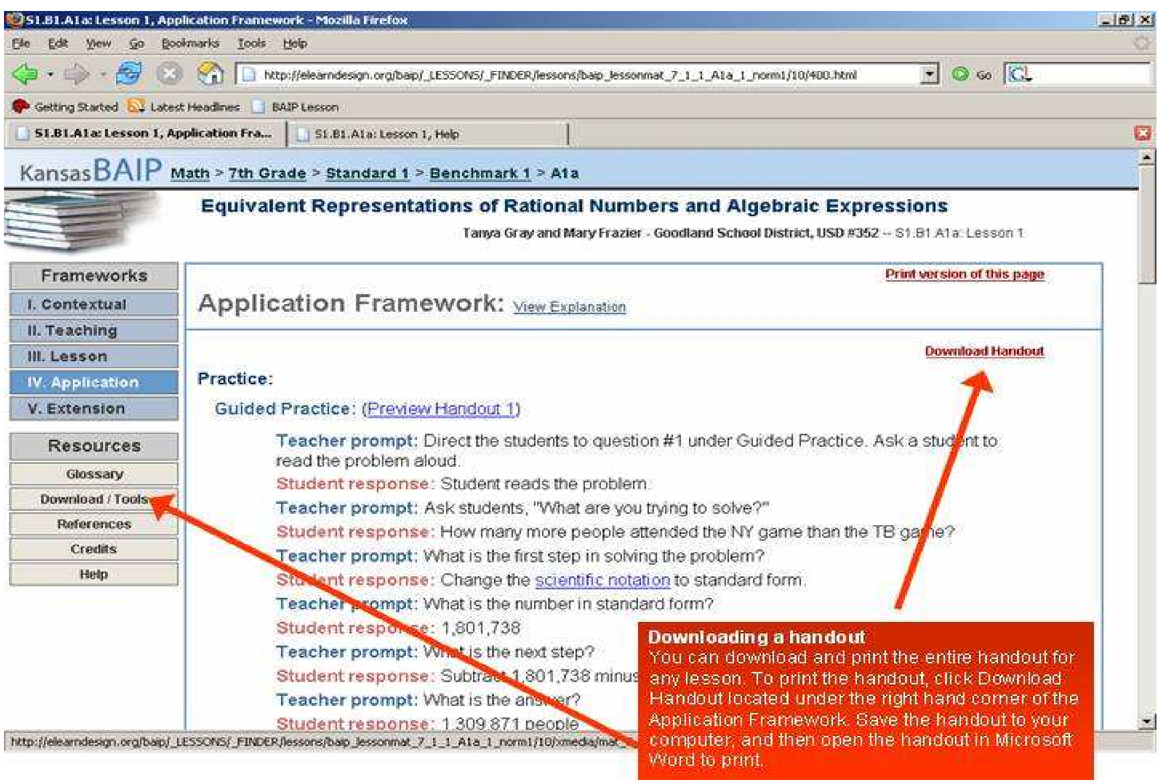

BAIP Lesson Main Page - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://elearndesign.org/baip/_LESSONS/_FINDER/
Getting Started Latest Headlines BAIP Lesson
S1.B1.A1a: Lesson 1, Contextual Framework
BAIP Lesson Main Page
Kansas BAIP
Blending Assessment with Instruction Program
Kansas BAIP Math Lessons
3rd Grade
4th Grade
5th Grade
6th Grade
7th Grade
8th Grade
10th Grade
BAIP provides Kansas resources to Kansas teachers that are designed to assist them in aligning their instruction with Kansas indicators and the state mathematic assessments. Each lesson contains teaching concepts that are structured in such a way that teachers can easily translate them into their own lesson plans. The lessons have been written and validated by teachers.
Kansas state department of Education
Locating a lesson
To locate a lesson, click on the appropriate grade level.
e-Learning Design Lab
http://elearndesign.org/baip/_LESSONS/_FINDER/index.php?scope=mat_7_1

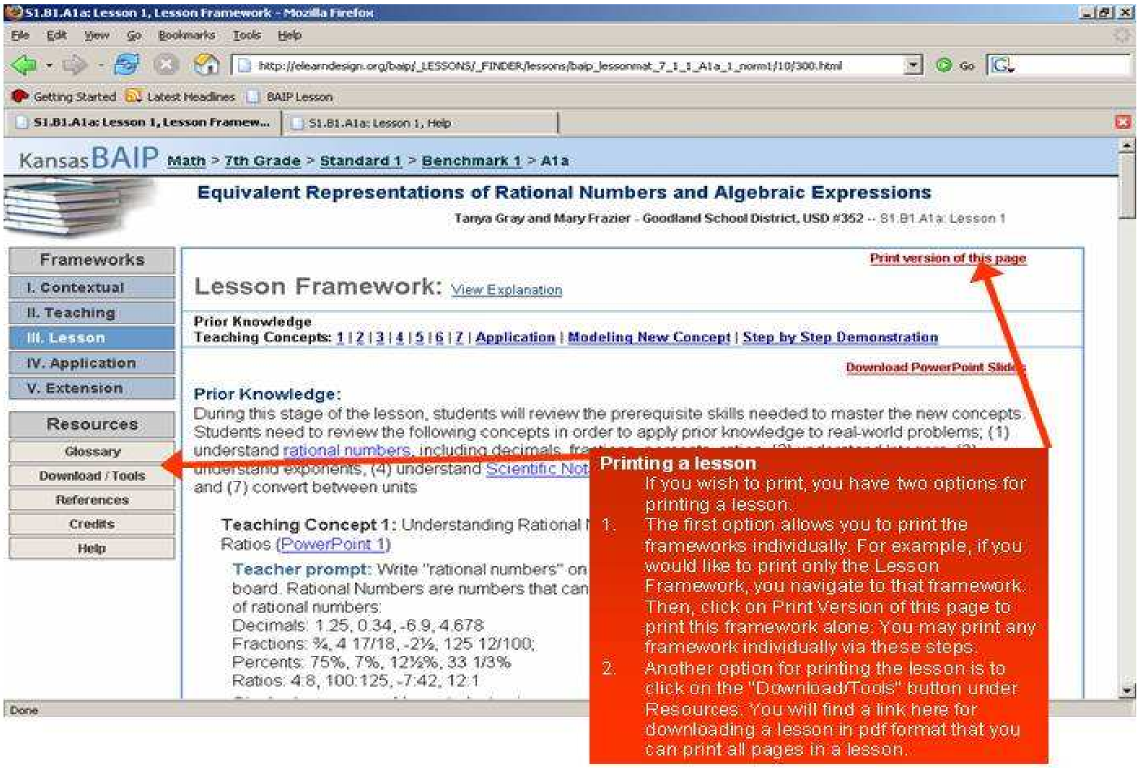

BAIP Lesson Main Page - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://elearndesign.org/baip/_LESSONS/_FINDER/?scope=mat_7_1
Getting Started Latest Headlines BAIP Lesson
BAIP Lesson Main Page
S1.B1.A1a: Lesson 1, Help
Kansas BAIP
Blending Assessment with Instruction Program
Kansas BAIP Math Lessons
3rd Grade
4th Grade
5th Grade
6th Grade
7th Grade
8th Grade
10th Grade
Standard 1 Standard 2 Standard 3 Standard 4
Number and Computation
The student uses concepts and procedures of data analysis in a variety of situations.
Benchmark 1: --The student demonstrates
and simple algebraic expressions in one v
Indicator A1a: --Generates and/or s
rational numbers and simple algebrai
Lesson 1 Lesson 2
Benchmark 4: --The student models, per
irrational number pi, and first degree algeb
Indicator A1a: --Generates and/or s
computational procedures and mathematical concepts addition, subtraction, multiplication, and division of rational numbers with a special emphasis on fractions and expressing answers in simplest form.
Locating a Lesson
1. Select the standard that you are interested in by clicking the appropriate tab at the top of the page.
2. Then, locate the lesson by identifying the benchmark and indicator number (ex. Indicator 1.1 A1a).
3. Once you have located the indicator that you are interested in, you can view a lesson by clicking on either Lesson 1 or Lesson 2.
http://elearndesign.org/baip/_LESSONS/_FINDER/lessons/baip_lessonmat_7_1_1_A1a_1_norm1/10/100.html


Navigating the Lessons
There are two basic navigation paths within the lesson. The navigation panel and the linear navigation.
KansasBAIP Math > 7th Grade > Standard 1 > Benchmark 1 > A1a
Equivalent Representations of Rational Numbers and Algebraic Expressions
Tanya Gray and Mary Frazier - Goodland School District, USD #352 -- S1.B1.A1a: Lesson 1
Frameworks
I. Contextual
II. Teaching
III. Lesson
IV. Application
V. Extension
Resources
Glossary
Download / Tools
References
Credits
Help
Print version of this page
Contextual Framework: View Explanation
Standard: Number and Computation -- The student uses numerical and computational concepts and procedures in a variety of situations.
Navigation Panel
The navigation panel is located on the left side of all pages. Its includes paths to all of the frameworks as well as the resources associated with each lesson.
Linear Navigation
The linear navigation is located at the end of each page. The arrows allow you to navigate forward to the next page or return to the previous page on the list indicated in the navigation panel associated with each lesson.
Tanya Gray and Mary Frazier - Goodland School District, USD #352


Printing a Lesson:
You have two options for printing a lesson.
1. The first option allows you to print the frameworks individually. For example, if you would like to print only the Lesson Framework, you navigate to that framework. Then, click on Print Version of this page to print this framework alone. You may print any framework individually via these steps.
2. Another option for printing the lesson is to click on the "Download/Tools" button under Resources. You will find a link here for downloading a lesson in pdf format that you can print all pages in a lesson.
Print version of this page
Instructional Translation:
(A. Indicator:) During this lesson, students will solve real-world problems using rational numbers that are represented in different ways. Students will also solve real-world problems using algebraic expression in one variable.
(B. Prior Knowledge:) Prior to starting this lesson, students have been introduced to the concept of rational numbers. Students have also been introduced to the concept of scientific notation and exponents. Students should understand that symbols and letters can represent missing numbers. Students should have an understanding of basic math facts and all four operations.
Viewing Definitions of Vocabulary Words:
Vocabulary words or terms that appear in the text body are underlined. Click the underlined glossary item to see the definition. While viewing the glossary definition, click "Full Glossary" at the top left of the definition window to view the entire glossary.


S1.B1.A1a: Lesson 1, Lesson Framework - Mozilla Firefox
http://elearndesign.org/baip/_LESSONS/_FINDER/lessons/baip_lessonmat_7_1_1_A1a_1_norm1/10/300.html
KansasBAIP Math > 7th Grade > Standard 1 > Benchmark 1 > A1a
Equivalent Representations of Rational Numbers and Algebraic Expressions
Tanya Gray and Mary Frazier - Goodland School District, USD #352 -- S1.B1.A1a: Lesson 1
Frameworks
I. Contextual
II. Teaching
III. Lesson
IV. Application
V. Extension
Resources
Glossary
Download / Tools
References
Credits
Help
Print version of this page
Lesson Framework: View Explanation
Prior Knowledge
Teaching Concepts: 1 | 2 | 3 | 4 | 5 | 6 | 7 | Application | Modeling New Concept | Step by Step Demonstration
Download PowerPoint Slides
Prior Knowledge:
Teaching Concept 1: Understanding Rational Numbers, Including Decimals, Fractions, Percents, and Ratios (PowerPoint 1)
Decimals: 1.25, 0.34, -6.9, 4.678
Fractions: ¾, 4 17/18, -2⅓, 125 12/100;
Percents: 75%, 7%, 12½%, 33 1/3%
Ratios: 4:8, 100:125, -7:42, 12:1
Downloading the PowerPoint
You can download the PowerPoint slides to use in your classroom via a computer or projector. To download these slides click on the underlined Download PowerPoint Slides link, which is located in the Lesson Framework above the first slide.


S1.B1.A1a: Lesson 1, Application Framework - Mozilla Firefox
http://elearndesign.org/baip/_LESSONS/_FINDER/lessons/baip_lessonmat_7_1_1_A1a_1_norm1/10/400.html
KansasBAIP Math > 7th Grade > Standard 1 > Benchmark 1 > A1a
Equivalent Representations of Rational Numbers and Algebraic Expressions
Tanya Gray and Mary Frazier - Goodland School District, USD #352 -- S1.B1.A1a: Lesson 1
Frameworks
I. Contextual
II. Teaching
III. Lesson
IV. Application
V. Extension
Resources
Glossary
Download / Tools
References
Credits
Help
Print version of this page
Application Framework: View Explanation
Download Handout
Practice:
Guided Practice: (Preview Handout 1)
Teacher prompt: What is the first step in solving the problem?
Downloading a handout
You can download and print the entire handout for any lesson. To print the handout, click Download Handout located under the right hand corner of the Application Framework. Save the handout to your computer, and then open the handout in Microsoft Word to print.



Welcome, this section of the training is designed to teach you how students use the online tutorials. The tutorials contain instruction, practice problems, and immediate feedback directly aligned with the assessed mathematics indicators for the state of Kansas. The tutorials area also aligned with the lessons you just learned about. They allow students an opportunity to independently practice applying the concepts of the lessons. As a classroom teacher you can assign tutorials to students based on when you would like to implement them into the curriculum. The following slides demonstrate how a student will progress through a tutorial. Click on the next button below to begin.

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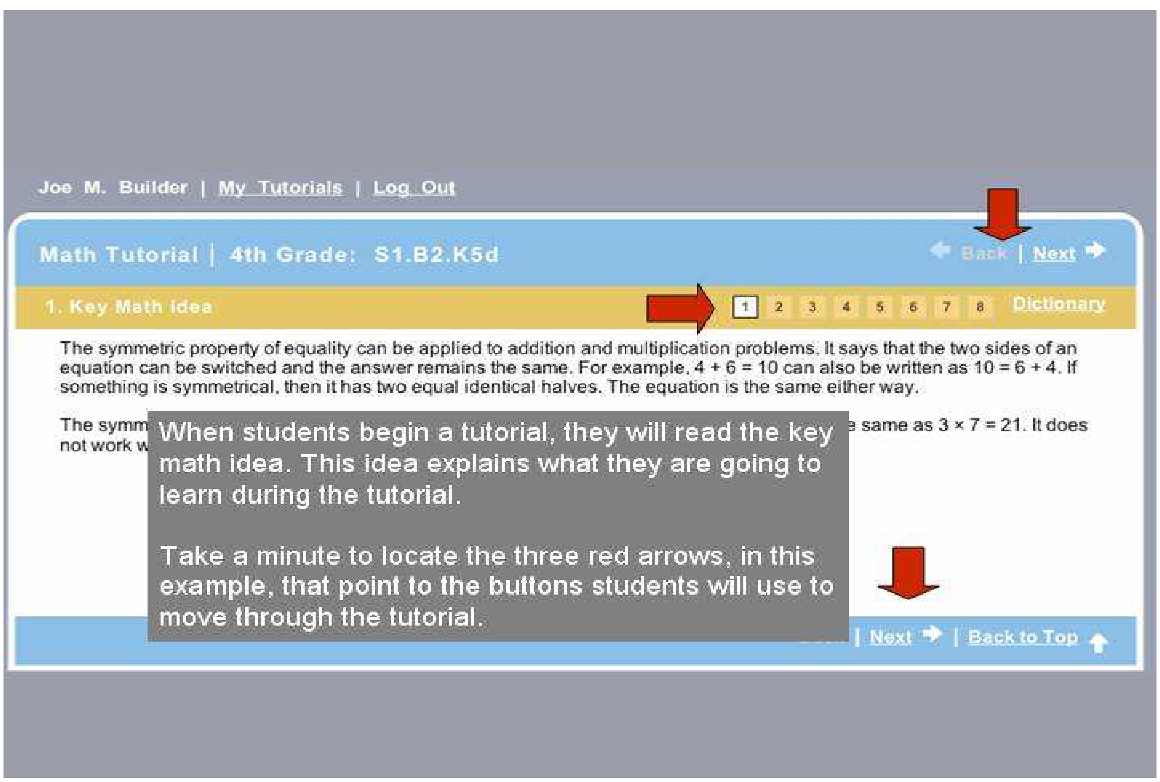
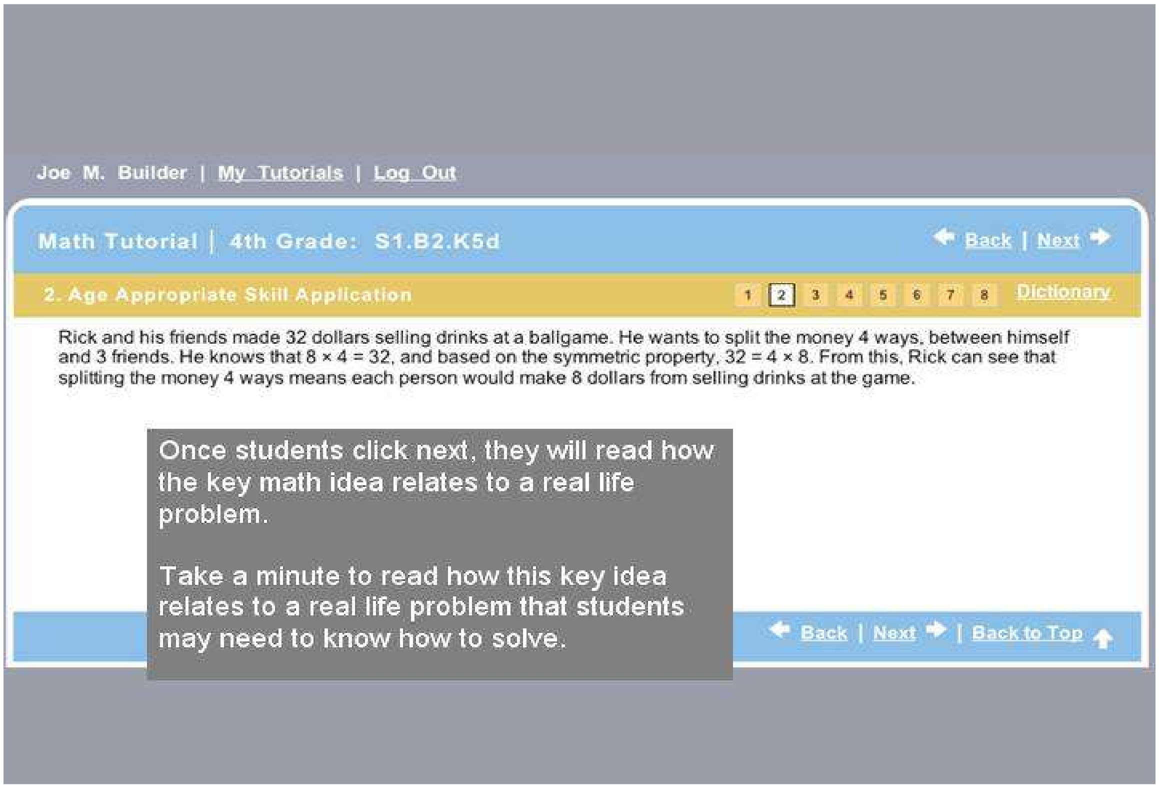
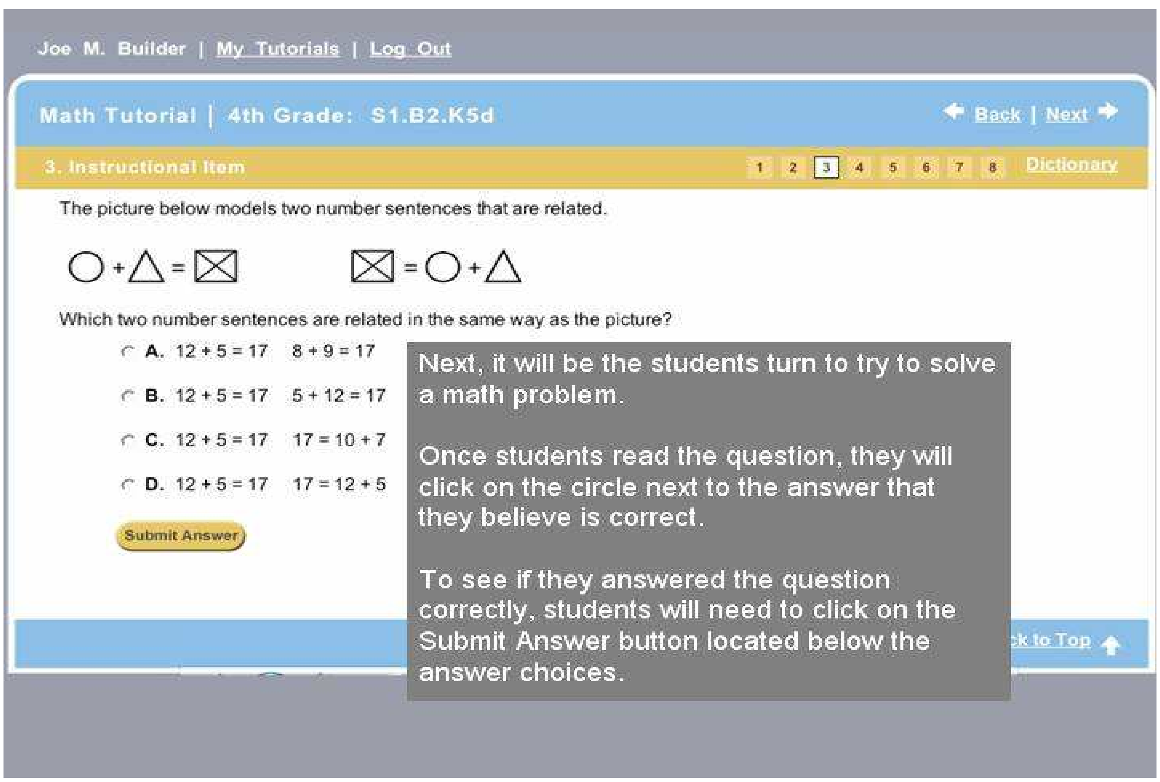
Navigating the Student Tutorials

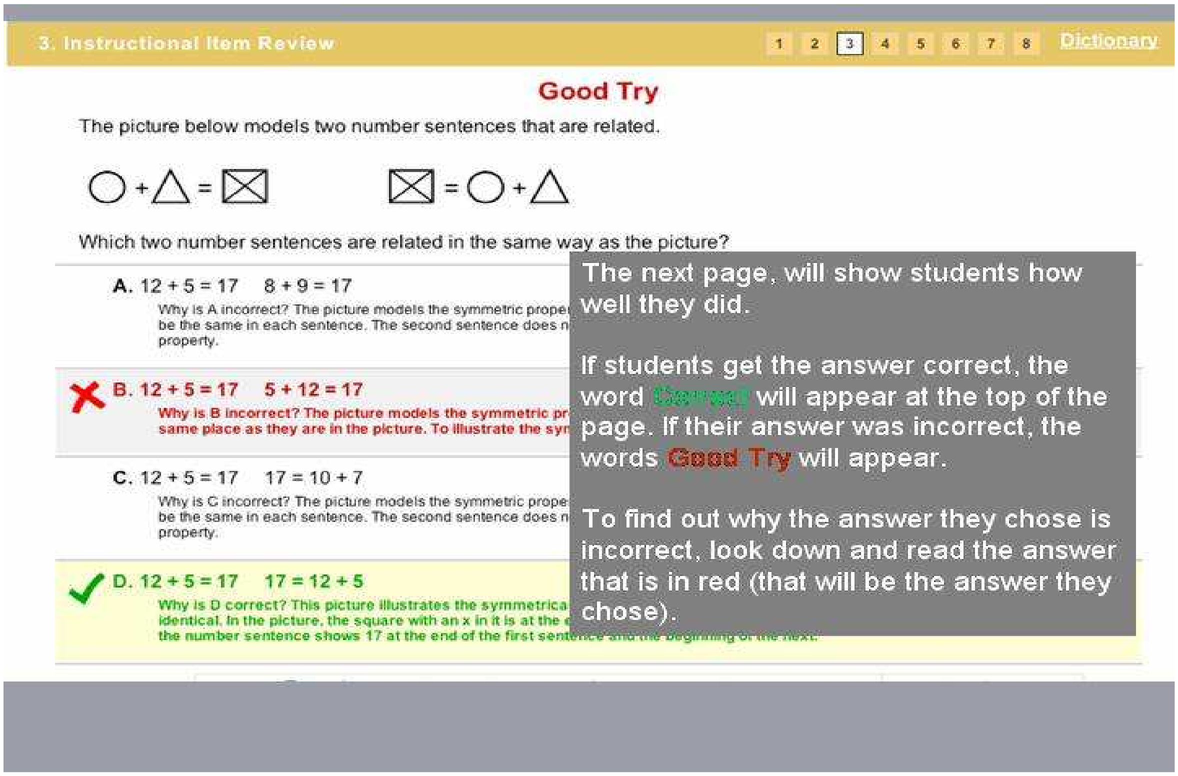
Before beginning, it is important to understand that there are three ways students can move through the tutorials:

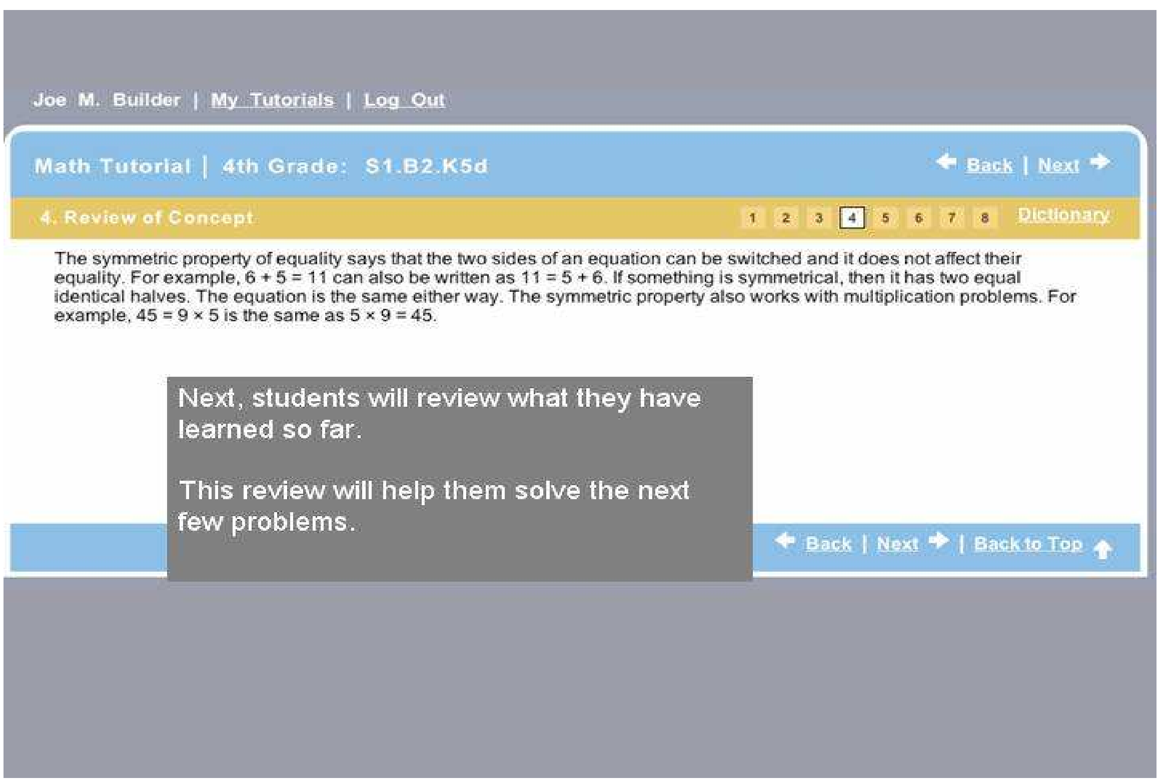
1. Students can click the words next and back, located at the right top and bottom of the screen, to move both forwards and backwards through the tutorial.
2. However, when students are asked to answer a question, they have to click the submit answer button to move forward in the tutorials.
3. Finally, students can use the numbered buttons located on the top right hand side of the tutorial to move one step ahead or view material they have already read.

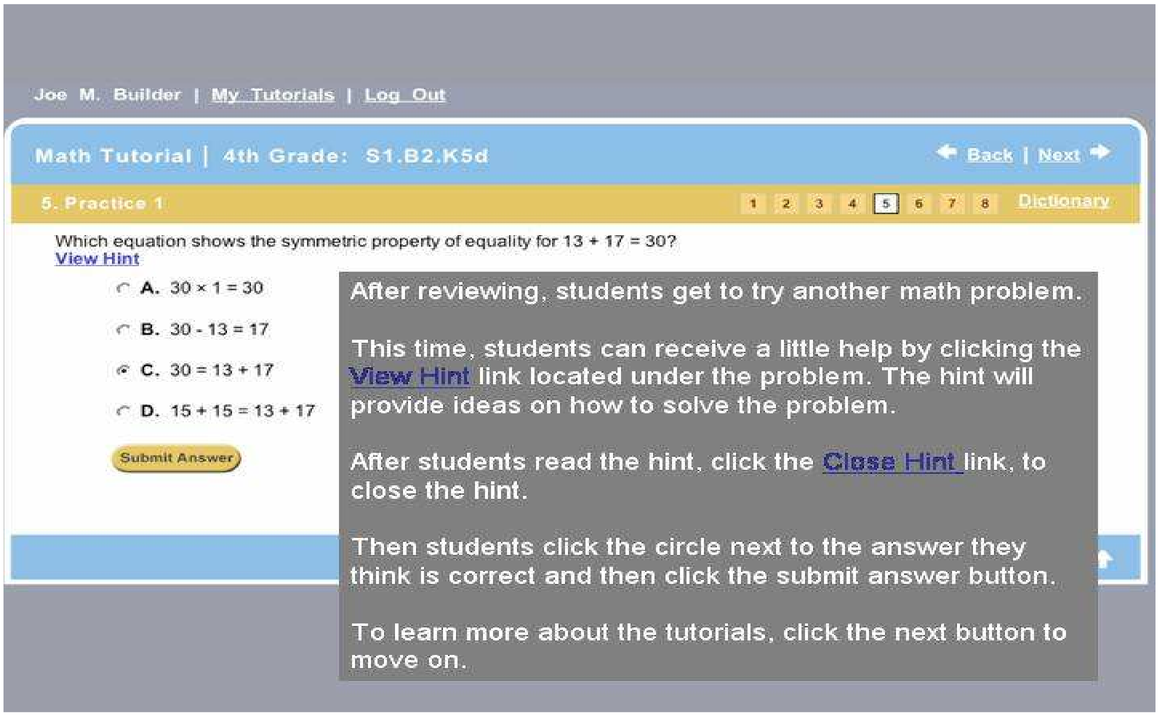


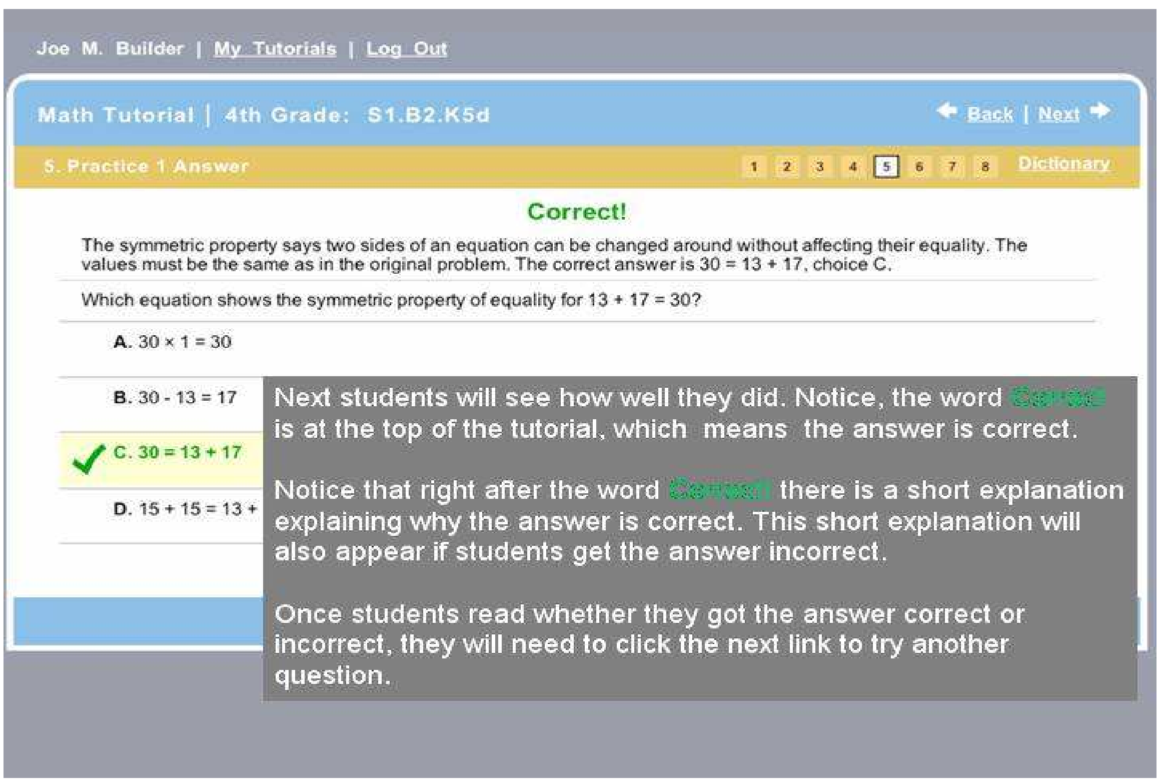

Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
2. Age Appropriate Skill Application
1 2 3 4 5 6 7 8 Dictionary
Rick and his friends made 32 dollars selling drinks at a ballgame. He wants to split the money 4 ways, between himself and 3 friends. He knows that 8 × 4 = 32, and based on the symmetric property, 32 = 4 × 8. From this, Rick can see that splitting the money 4 ways means each person would make 8 dollars from selling drinks at the game.
Once students click next, they will read how the key math idea relates to a real life problem.
Take a minute to read how this key idea relates to a real life problem that students may need to know how to solve.
Back | Next | Back to Top

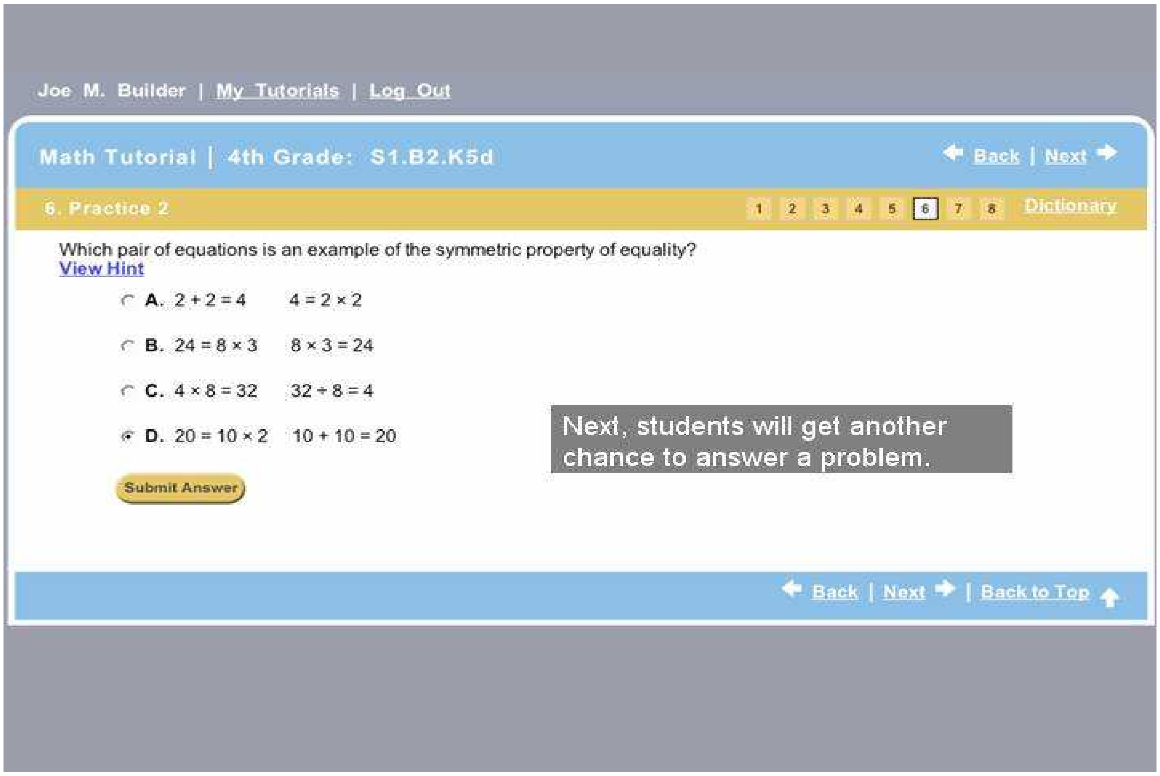

Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
3. Instructional Item
1 2 3 4 5 6 7 8 Dictionary
The picture below models two number sentences that are related.
Which two number sentences are related in the same way as the picture?
A. 12 + 5 = 17 8 + 9 = 17
B. 12 + 5 = 17 5 + 12 = 17
C. 12 + 5 = 17 17 = 10 + 7
D. 12 + 5 = 17 17 = 12 + 5
Submit Answer
Next, it will be the students turn to try to solve a math problem.
Once students read the question, they will click on the circle next to the answer that they believe is correct.
To see if they answered the question correctly, students will need to click on the Submit Answer button located below the answer choices.

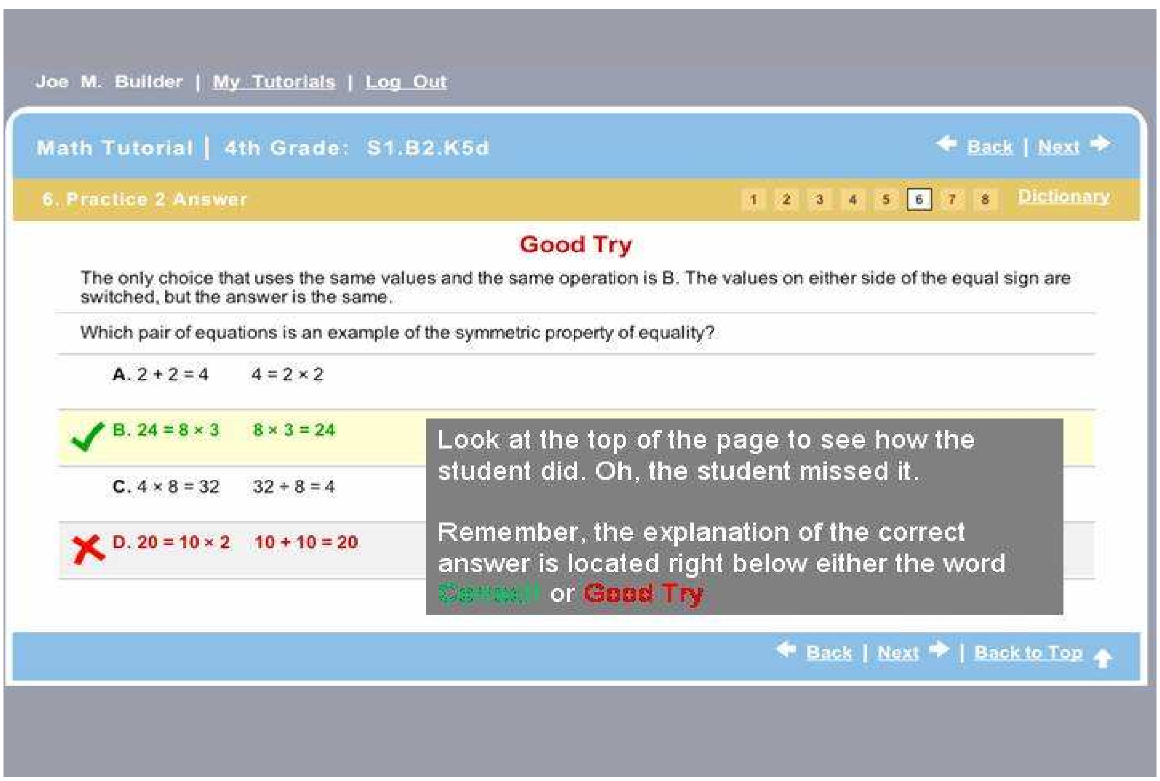

3. Instructional Item Review
1 2 3 4 5 6 7 8 Dictionary
Good Try
The picture below models two number sentences that are related.
Which two number sentences are related in the same way as the picture?
A. 12 + 5 = 17 8 + 9 = 17
B. 12 + 5 = 17 5 + 12 = 17
C. 12 + 5 = 17 17 = 10 + 7
D. 12 + 5 = 17 17 = 12 + 5
The next page, will show students how well they did.
If students get the answer correct, the word Correct will appear at the top of the page. If their answer was incorrect, the words Good Try will appear.
To find out why the answer they chose is incorrect, look down and read the answer that is in red (that will be the answer they chose).


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
4. Review of Concept
1 2 3 4 5 6 7 8 Dictionary
The symmetric property of equality says that the two sides of an equation can be switched and it does not affect their equality. For example, 6 + 5 = 11 can also be written as 11 = 5 + 6. If something is symmetrical, then it has two equal identical halves. The equation is the same either way. The symmetric property also works with multiplication problems. For example, 45 = 9 × 5 is the same as 5 × 9 = 45.
Next, students will review what they have learned so far.
This review will help them solve the next few problems.
Back | Next | Back to Top


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
5. Practice 1
1 2 3 4 5 6 7 8
Dictionary
Which equation shows the symmetric property of equality for 13 + 17 = 30?
View Hint
A. 30 × 1 = 30
B. 30 - 13 = 17
C. 30 = 13 + 17
D. 15 + 15 = 13 + 17
Submit Answer
After reviewing, students get to try another math problem.
This time, students can receive a little help by clicking the View Hint link located under the problem. The hint will provide ideas on how to solve the problem.
After students read the hint, click the Close Hint link, to close the hint.
Then students click the circle next to the answer they think is correct and then click the submit answer button.
To learn more about the tutorials, click the next button to move on.


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
5. Practice 1 Answer
1 2 3 4 5 6 7 8
Dictionary
Correct!
The symmetric property says two sides of an equation can be changed around without affecting their equality. The values must be the same as in the original problem. The correct answer is 30 = 13 + 17, choice C.
Which equation shows the symmetric property of equality for 13 + 17 = 30?
A. 30 × 1 = 30
B. 30 - 13 = 17
C. 30 = 13 + 17
D. 15 + 15 = 13 +
Next students will see how well they did. Notice, the word Correct! is at the top of the tutorial, which means the answer is correct.
Notice that right after the word Correct! there is a short explanation explaining why the answer is correct. This short explanation will also appear if students get the answer incorrect.
Once students read whether they got the answer correct or incorrect, they will need to click the next link to try another question.


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
6. Practice 2
1 2 3 4 5 6 7 8 Dictionary
Which pair of equations is an example of the symmetric property of equality?
View Hint
A. 2 + 2 = 4 4 = 2 × 2
B. 24 = 8 × 3 8 × 3 = 24
C. 4 × 8 = 32 32 ÷ 8 = 4
D. 20 = 10 × 2 10 + 10 = 20
Submit Answer
Next, students will get another chance to answer a problem.
Back | Next | Back to Top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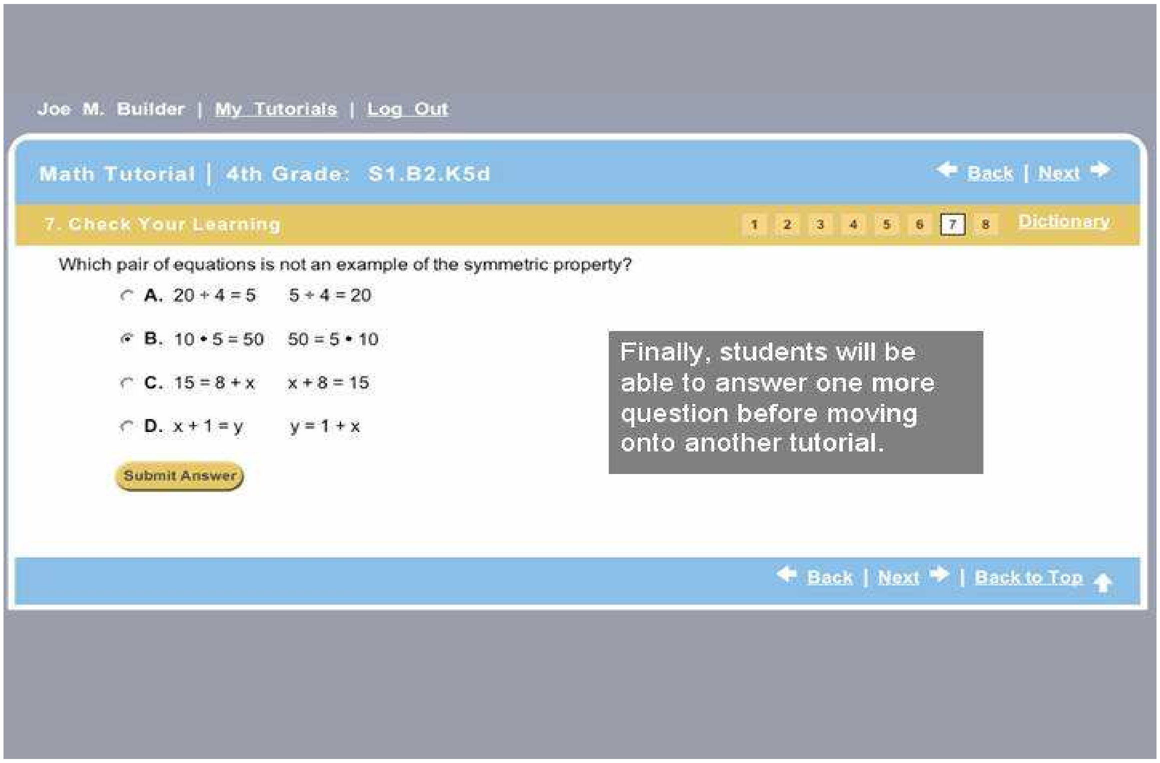
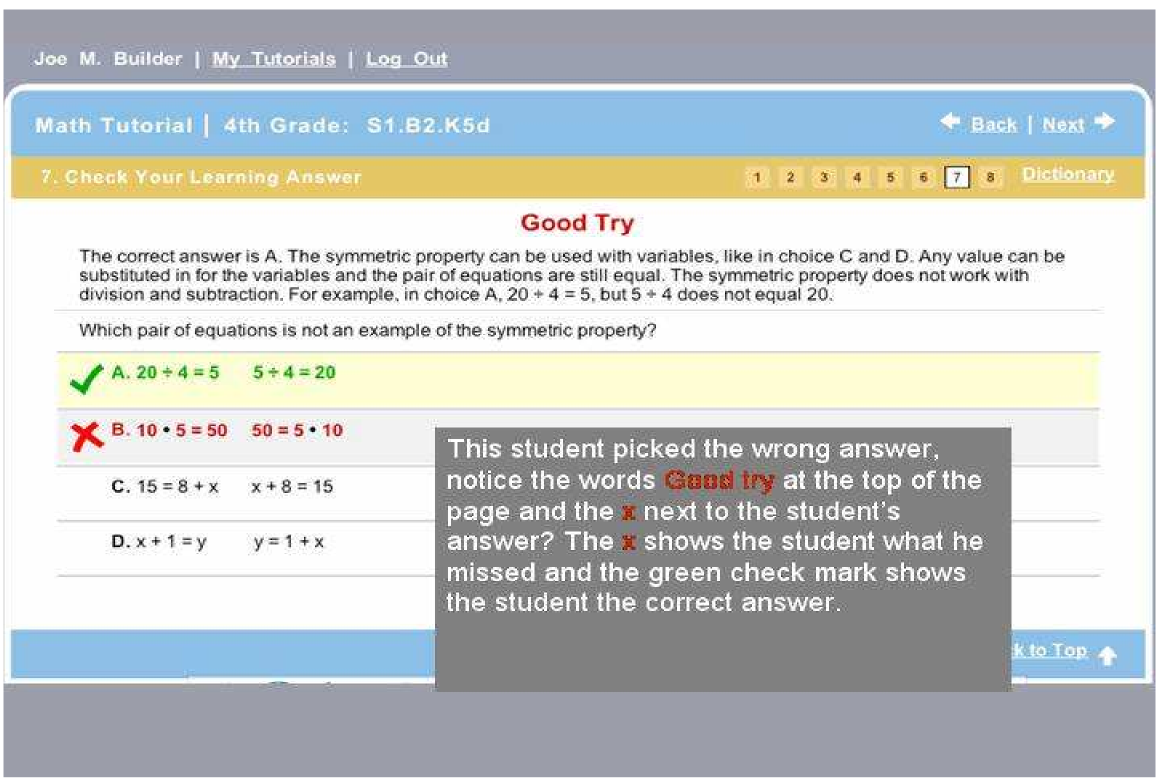
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
6. Practice 2 Answer
1 2 3 4 5 6 7 8 Dictionary
Good Try
The only choice that uses the same values and the same operation is B. The values on either side of the equal sign are switched, but the answer is the same.
Which pair of equations is an example of the symmetric property of equality?
A. 2 + 2 = 4 4 = 2 × 2
B. 24 = 8 × 3 8 × 3 = 24
C. 4 × 8 = 32 32 ÷ 8 = 4
D. 20 = 10 × 2 10 + 10 = 20
Look at the top of the page to see how the student did. Oh, the student missed it.
Remember, the explanation of the correct answer is located right below either the word
or Good Try
Back | Next | Back to Top


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
7. Check Your Learning
1 2 3 4 5 6 7 8 Dictionary
Which pair of equations is not an example of the symmetric property?
A. 20 ÷ 4 = 5 5 ÷ 4 = 20
B. 10 • 5 = 50 50 = 5 • 10
C. 15 = 8 + x x + 8 = 15
D. x + 1 = y y = 1 + x
Submit Answer
Finally, students will be able to answer one more question before moving onto another tutorial.
Back | Next | Back to Top


Joe M. Builder | My Tutorials | Log Out
Math Tutorial | 4th Grade: S1.B2.K5d
Back | Next
7. Check Your Learning Answer
1 2 3 4 5 6 7 8 Dictionary
Good Try
The correct answer is A. The symmetric property can be used with variables, like in choice C and D. Any value can be substituted in for the variables and the pair of equations are still equal. The symmetric property does not work with division and subtraction. For example, in choice A, 20 ÷ 4 = 5, but 5 ÷ 4 does not equal 20.
Which pair of equations is not an example of the symmetric property?
A. 20 ÷ 4 = 5 5 ÷ 4 = 20
B. 10 • 5 = 50 50 = 5 • 10
C. 15 = 8 + x x + 8 = 15
D. x + 1 = y y = 1 + x
This student picked the wrong answer, notice the words Good try at the top of the page and the x next to the student's answer? The x shows the student what he missed and the green check mark shows the student the correct answer.

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Congratulations, you have finished the BAIP training guide and are now ready to utilize the BAIP materials in your classroom. Go to the next slide to learn more about participating in the field test.

Kansas BAIP
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Field Test Responsibilities

As a participant of the field test we ask that you complete the following tasks:

- Allow students to complete a 35-50 item pretest during the first two weeks of January via the CETE computerized assessment system.
- Select and teach lessons in your classroom, paying particular attention to the marker lessons (These are described in the next slide).
- After teaching a lesson, provide feedback in a short, four item survey. (Directions will be provided prior to beginning the field test)
- Allow students to access and complete tutorials, paying particular attention to the marker tutorials.
- Allow students to complete a 35-50 item posttest (We will work with you to schedule on an appropriate time for the posttest)

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Marker Indicators

- For purposes of the pilot test, six priority indicators have been identified as marker indicators in each grade.
- The Marker Indicators were judged by subject matter experts as being among the assessed indicators and central to preparing for the state assessment.
- Five test items, which will be used in the pretest, have been developed for each Marker Indicator across grades 4, 5, 6, 7, and 8.
- You may view the Marker Indicators by grade level on the next slide.

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Marker Indicators

4th grade	5th grade	6th grade	7th grade	8th grade
1.4.a1a	1.3.a4	1.3.a2	1.1.a1	1.2.a1a
1.4.a1d	1.4.k4	2.1.k4	1.4.k5	2.2.k3a
1.4.a1e	3.1.a1a	3.2.a1a	2.2.k7	2.2.a1a
2.2.k2a	3.3.k3	3.1.k7b	3.3.a3	3.4.k1ab
2.2.k2b	3.2.a1cf	3.4.k3ab	4.2.a3ab	4.1.k3
3.2.a2	4.2.k3de	4.1.k2	4.2.k1abcd	4.1.a4a

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Upcoming Information

- Prior to beginning the field test in January you will be provided with:
  - Login information for both you and your students.
  - Information on accessing the pretest.
  - Directions for providing feedback on the lessons via the four item survey.

Kansas BAIP
Blending Assessment with Instruction Program

Congratulations, you have finished the BAIP training guide and are now ready to utilize the BAIP materials in your classroom. If you have any questions about the BAIP resources or field test responsibilities feel free to contact the BAIP representative below assigned to your school.

Kylie Stewart,
kbscott@ku.edu

- St. Peters Catholic School
- Neodesha
- Fort Scott
- Ell-Saline
- Arkansas City

Diana Greer,
dgreer@ku.edu

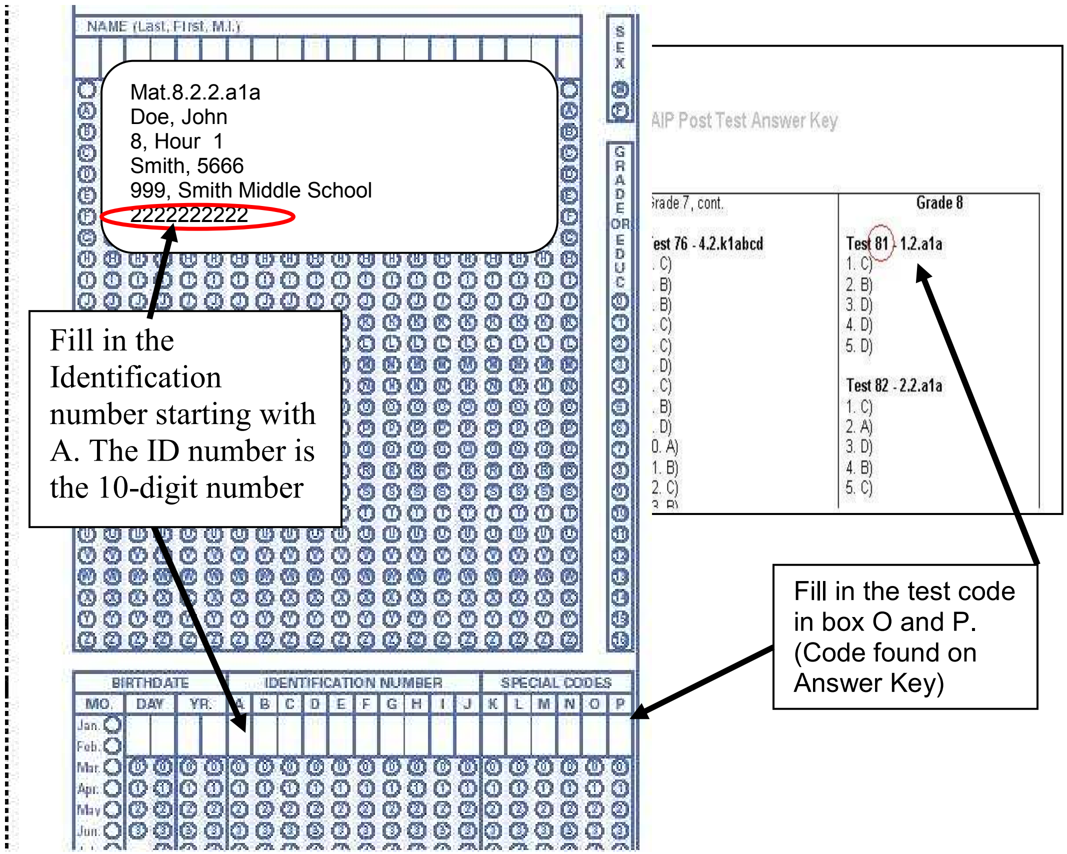
- Mulvane
- Diocese of Wichita
- Chapman
- Oxford
- Christ the King Catholic

Appendix J

Posttest Teacher Instructions

Due to computer difficulties experienced in many of the field test sites on the pre-test we are now conducting post tests in a paper-pencil format. In your teacher packet you will find a class list, scantrons, and tests for each of the selected indicators in your grade level. Each selected indicator test should be given as close to the end of the lesson and tutorial activities as possible. If you have already taught a particular selected indicator we ask that you have your students complete that post-test first. We ask that you follow the following directions in giving the post-tests.

1. Locate the selected indicator test and corresponding scantrons for the selected indicator and class you are ready to assess from your teacher packet.
2. Verify that your student list is accurate.
3. If you are missing students using one of the blank scantrons and fill in the label with the necessary information. (Selected Indicator, Student Name, Grade, Hour, Teacher Name, State ID Number)
4. Handout the scantrons to students and a copy of the test.
5. Have students bubble in the necessary information below on the scantron (State ID Number and Test Code).
6. Ask students to complete the test and fill in their answer in the bubble sheet on Side 1.
7. Collect the scantrons.
8. Return all scantrons to your field test contact person by March 16, 2007.


NAME (Last, First, M.I.)
Mat.8.2.2.a1a
Doe, John
8, Hour 1
Smith, 5666
999, Smith Middle School
2222222222
Fill in the Identification number starting with A. The ID number is the 10-digit number
AIP Post Test Answer Key
Grade 7, cont.
Grade 8
Test 76 - 4.2.k1abcd
Test 81 - 1.2.a1a
1. C)
2. B)
3. D)
4. D)
5. D)
Test 82 - 2.2.a1a
1. C)
2. A)
3. D)
4. B)
5. C)
Fill in the test code in box O and P. (Code found on Answer Key)
BIRTHDATE
IDENTIFICATION NUMBER
SPECIAL CODES
MO.
DAY
YR.