A Validation Study of an Alternate State Science Assessment: Alignment of the Pennsylvania Alternate System of Assessment (*PASA*) Science Assessment

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Submitted to the Graduate Faculty of

School of Education in partial fulfillment

of the requirements for the degree of

Ed.D in Special Education

University of Pittsburgh

[2009]

UNIVERSITY OF PITTSBURGH

SCHOOL OF EDUCATION

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The current study examined the validation and alignment of the PASA-Science by determining whether the alternate science assessment anchors linked to the regular education science anchors; whether the PASA-Science assessment items are science; whether the PASA-Science assessment items linked to the alternate science eligible content, and what PASA-Science assessment content was considered important by parents and teachers. Special education and science education university faculty determined all but one alternate science assessment anchor linked to the regular science assessment anchors. Special education and science education teachers determined that the PASA-Science assessment items are indeed science and linked to the alternate science eligible content. Finally, parents and teachers indicated the most important science content assessed in the PASA-Science involved safety and independence.

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1.0 INTRODUCTION

Over the past 10 years, legislation has been enacted requiring states to measure academic progress for all students including students with severe disabilities. With the passage of the Individuals with Disabilities Education Act (IDEA) in 1997, school districts were mandated to include students with severe disabilities in accountability systems such as large scale assessments (Browder, Spooner, Wakeman, Trela, & Baker, 2006; Byrnes, 2004; Flowers, Browder, & Ahlgrim-Delzell, 2006). IDEA also required states to provide an alternate version of any large scale, or district wide, assessment for students with significant disabilities such as: severe cognitive disabilities, multiple disabilities, severe autism, deafness, or blindness by the year 2000 (Browder, Spooner, Algozzine, Ahlgrim-Delzell, Flowers, & Karvonen, 2003; Browder, Flowers, Ahlgrim-Delzell, Karronen, Spooner, & Algozzine, 2004).

In 2001, further legislation, known as No Child Left Behind (NCLB), required school districts to develop grade level academic standards and assessments at grades 3 – 8 and 11 for measurement of Adequate Yearly Progress of schools and school districts. In accordance with IDEA and NCLB, the Pennsylvania State Board of Education developed academic standards that all students were expected to achieve in math, reading, and writing. In order to assess a student's understanding of the academic standards within a grade level, the Pennsylvania System of School Assessment (PSSA) was created. Through this assessment, the State Board of Education was able to measure whether school districts were preparing students to demonstrate a basic level of proficiency in math, reading, and writing standards in grades 3, 4, 5, 6, 7, 8, and 11.

With so much emphasis being placed on the measurement of academic progress for all students, including students with severe disabilities, all states were faced with the problem of how to assess students that were unable to complete the regular state assessment, like the PSSA, with the accommodations permitted. As a result, many states began developing alternate state assessments around 1999, with the exception of Kentucky where an alternate assessment had been in place since 1990 (Browder et al., 2004; Kentucky Alternate Assessment Program, n.d.). At that time, the Pennsylvania State Board of Education commissioned the development of an alternate state assessment so that students with severe disabilities were included in large scale assessments in accordance with IDEA and NCLB. The alternate state assessment that was designed became known as the Pennsylvania Alternate System of Assessment (PASA).

Since *Title I Guidance on Standards, Assessment, and Accountability* emphasized that any alternate state assessment should relate to the state standards used to measure the Adequate Yearly Progress (Flowers et al., 2006), many states were using the state regular academic standards to design their alternate assessments. Through an interpretation of the regular academic standards, states like Pennsylvania were developing alternate state assessments to measure math and reading performance, while some other states attempted to link functional skills to the state academic standards (Browder et al., 2004; Kentucky Alternate Assessment Program, n.d.). To date, all 50 states and the District of Columbia have developed some form of alternate state assessment, whether it be through a portfolio assessment (23 states), rating scale or checklist (15 states), performance based or event recording assessment (9 states), or an Individualized Education Program (IEP) analysis (4 states) (Roach, Elliott, & Webb, 2005).

Regardless of the assessment design, the goal of each assessment was to accurately assess basic achievement of the grade level academic standards. From the onset, the PASA consisted of

approximately 20 performance-based questions in math and approximately 20 performance-based questions in reading in which student performance may be documented through a videotaped recording or through the use of detailed narrative notes. The performance on the PASA is scored to determine the proficiency level in math and reading during the PASA scoring conference. At the scoring conference, teams are trained to use a 6-point scoring rubric to rate the level of independence and the level of cognitive awareness the student showed during the assessment. After scoring has taken place, math scores and reading scores are separately averaged and compared to established cut scores to determine the level of performance. Students who take the PASA may be classified as emerging, novice, proficient, or advanced based on their overall performance. Each student's performance level from the PASA is then combined with the performance of other students who took the PASA and PSSA within their school district to report overall annual performance for the state.

In an effort to further design an alternate assessment that provided meaningful measures of performance on the alternate math and reading standards, the PASA leadership team also developed various cognitive demand levels of the assessment known as level A, level B, and level C. Although each level assesses math or reading skills linked to the alternate math or reading content standards, the level of complexity within the skills varies by level with level A being the least complex and level C being the most complex. In reading, the complexity of the cognitive demand at level A may include matching objects, the level B may include selecting a picture with a feature named, while the level C cognitive demand may include reading words. In math, the complexity of the cognitive demand at level A may include matching a set that has the most, the level B may count items within a group, and the level C cognitive demand may include addition.

In 1999 the PASA was administered for the first time as the alternate assessment to the PSSA. Since the initial PASA was administered, the alternate assessment has gone through a few revisions in how the assessment is packaged, but the test has remained a performance-based assessment to measure math and reading performance of students with severe disabilities.

In addition to requiring the development of academic standards for math and reading at the state level and a state assessment for measuring performance in these areas, NCLB also set the expectation of statewide science standards and statewide science assessment by the 2007-2008 school year. In Pennsylvania the PSSA version of science was administered for grades 4, 8, and 11 in the spring of the 2007-2008 school year. At the same time, the PASA version of science was also administered for grade 4, 8, and 11 in the spring of 2007-2008 school year. In an attempt to maintain consistency, the PASA-Science was designed in the same fashion as the PASA-Math and PASA-Reading. The PASA-Science consisted of approximately 20 performance-based questions, similar to math and reading, and was also designed to have three different cognitive complexity levels (level A, level B, and level C) like the math and reading. Since both the PSSA and PASA-Science were administered for the first time in the spring of 2008, many of the reviews and evaluations that were conducted in math and reading have yet to be completed for the science assessments.

2.0 STATEMENT OF THE PROBLEM

During the initial development of the PASA-Science, the link to the regular assessment anchors had been of upmost importance. The PASA leadership team reviewed the Pennsylvania Science Anchors and attempted to reinterpret the anchors to reduce the depth and breadth of the content without straying from the regular education science anchors. In an effort to ensure that the PASA-Science measured science-related content, two separate PASA-Science pilots were conducted, the first in the spring of 2007 and the second in the fall of 2007. To ensure that the assessment items were indeed science-related content, a survey that yielded approximately 450 teacher respondents was conducted. Survey questions for test administrators and scorers asked participants to rate their agreement with questions related to validity, test item design, and biases. Related to the question of test validity, test administrators and scorers were asked to rate their agreement with the statement, "This item assesses a science-based skill" for each item of the assessment level that they administered or scored. Teachers and scorers were also asked to rate their agreement with the statement, "This item assesses a skill that is important for the student to know/be able to do" for each item of the assessment level that they administered or scored. Survey data were used to make decisions about the design of items, the validity of items, and how to reduce biases within the items prior to the administration of the PASA-Science to all the students in grade 4, 8, and 11 in the spring of 2008.

Since the alignment and validity of the PASA-Science assessment have not been evaluated, the purpose of this study is to serve as a follow up to the pilot study of validity and to evaluate the technical adequacy of the PASA-Science. This study is designed to measure the alignment of the PASA-Science to Pennsylvania regular education science assessment anchors and to measure the social validity of the science skills within the assessment. In order to measure the research questions 1-4, this study will use the similar criteria to those used by Flowers, Wakeman, Browder, and Karvonen (2007) to examine the alignment of the PASA-Math and PASA-Reading alignment review.

2.1 RESEARCH QUESTIONS

1. Are the Pennsylvania Alternate Science Anchors linked to the Pennsylvania Science Anchors?
2. Are the PASA-Science assessment items science?
3. Are the PASA-Science assessment items linked with the Pennsylvania Alternate Science Eligible Content?
4. Do the PASA-Science assessment items demonstrate content centrality?
5. Is the science content assessed in the PASA-Science educationally valid for students with significant cognitive disabilities in grades 4, 8, and 11?

2.2 DEFINITIONS

Alternate Assessment – "assessments administered to students who could not participate in general education testing programs, even with accommodations" (Flowers, C., Wakeman, S., Browder, D., & Karvonen, M., 2007 p. 8).

Student with Severe Disabilities – "an individual who currently participates in school accountability systems through alternate assessments based on alternate achievement standards" (Spooner, F., Ahlgrim-Delzell, L., Kohprasert, K., Baker, J., & Courtade, G., 2008 p. 350).

Academic Content Standards – "must specify what all students are expected to know and be able to do; contain coherent and rigorous content; and encourage the teaching of advanced skills. A State's academic content standards may either be grade-specific or may cover more than one grade if grade-level content expectations are provided for each of grades 3 through 8. At the high school level, the academic content standards must define the knowledge and skills that all high school students are expected to have in at least reading/language arts, mathematics, and, beginning in the 2005-06 school year, science, irrespective of course titles or years completed" (U.S. Department of Education, Office of Elementary and Secondary Education, 2007 p. 2).

Academic Content Standard – "a description of student performance that "includes at least two levels of achievement (proficient and advanced) that reflect mastery of the material in the State's academic content standards, and a third level of achievement (basic) to provide information about the progress of lower-achieving students toward mastering the

proficient and advanced levels of achievement" (U.S. Department of Education, Office of Elementary and Secondary Education, 2007 p. 2-3).

Alternate Academic Content Standard – "achievement standards that are aligned with the State's academic content standards; promote access to the general education curriculum; and reflect professional judgment of the highest achievement standards possible" (U.S. Department of Education, Office of Elementary and Secondary Education, 2007 p. 3).

Alignment – "the extent to which expectations and assessments are in agreement and serve in conjunction with one another to guide the system toward students learning what they are expected to know and do" (Roach et al., 2005 p. 220).

Educational Validity – can be defined as the question "is the resultant behavior change meaningful, i.e., beneficial for the child now and in the future, and considered valuable by those in the natural environment of that person?" (Voeltz, L.M., Evans, I.M., 2004, p. 65).

3.0 REVIEW OF LITERATURE

3.1 SCIENCE EDUCATION

As mentioned previously, the academic content standards for reading and mathematics were developed in an effort to set some expected level of achievement. Science standards, and subsequently a statewide science assessment or alternate state assessment, were not required to be in place until 2008. Even though NCLB set the expectation of statewide academic science standards by 2008, previous documents had been encouraging the reform of science education well before NCLB.

In 1983, the published report *A Nation at Risk* called for reform in science education because the United States was falling behind other industrialized countries in academic performance (National Commission on Excellence in Education, 1983). As a follow up to this publication, the American Association for the Advancement of Science (AAAS) founded *Project 2061: Science for all Americans* in 1985. Project 2061 was written in an effort to develop national science standards and achievement of these standards by the year 2061 (American Association for the Advancement of Science, 1989). Finally in 1996, The National Research Council (NRC) published the National Science Education Standards (NSES).

The NSES were created with the hope that local school districts and state boards of education would use these standards to help guide the development of science curriculums for

students. Eight different standards areas were developed and they are summarized in Table 1 (National Research Council, 1996). Table 1 also includes a description of some general areas covered under each of the eight standards.

Although these guidelines provided recommendations as to what should be taught, each individual state also created their own science standards as a reference for curriculum development for each school district. In 2002, the Pennsylvania Department of Education published the Academic Standards for Science and Technology and Environment and Ecology (Pennsylvania Department of Education, 2002a). The Pennsylvania academic standards for science and technology, along with a description of categories within the standards (Pennsylvania Department of Education, 2002a), are summarized in Table 2. The Pennsylvania academic standards for environment and ecology, along with a description of categories within the standards (Pennsylvania Department of Education, 2002a), are summarized in Table 3.

Upon further inspection of the Pennsylvania science standards, it is evident that many of the recommended NSES standards are included in the Pennsylvania science standards, but additional areas such as specific standards dedicated to agriculture and environmental law have also been included. With the development of the Pennsylvania science standards in 2002, school districts throughout the state were able to determine whether or not their science curriculums ensure the standards were being addressed.

Table 1 Science and Content Standards and Examples

Content standards	Examples
unifying concepts and processes in science	systems, order, organization, evidence, models, explanation, change, constancy, and measurement
science as inquiry	ask questions about events, plan and conduct simple investigations, and use data to construct an explanation
physical science	properties of objects and materials, position and motion of objects, light, heat, electricity, and magnetism
life science	characteristics of an organism, life cycles, and organisms and their environment
earth and space science	properties of earth materials, objects in the sky, and changes in the earth and sky
science and technology	identify a simple problem, propose a solution, evaluate a product or design, understanding about science and technology, and abilities to distinguish between natural objects and objects made by humans
science in personal and social perspectives	personal health, characteristics and changes in populations, types of resources, changes in environments, and science and technology in local challenges
history of nature of science	science as a human endeavor

Adapted from "National Science Education Standards," by National Research Council, 2005, National Academy Press, p. 103-119.

Table 2 Pennsylvania Academic Standards for Science and Technology

Content standards	Categories within standards
unifying themes	systems, models, patterns, scale, change
inquiry and design	nature of scientific knowledge, process knowledge, scientific method, problem solving in technology
biological sciences	living forms, structure and function, inheritance, evolution
physical science, chemistry and physics	matter, energy, forces and motion, astronomy
earth sciences	land forms and processes, resources, meteorology, hydrology and oceanography
technology education	biotechnology, information and technology, physical technology
technological devices	tools, instruments, computer operations, computer software, computer communication systems
science, technology and human endeavors	constraints, meeting human needs, consequences and impacts

Adapted from "Academic Standards for Science and Technology," by Pennsylvania Department of Education, 2002, 22 Pa. Code, Ch. 4, Appendix B

Table 3 Pennsylvania Academic Standards for Environment and Ecology

Content standards	Categories within standards
watersheds and wetlands	cycles, role of watersheds, physical factors, characteristics and functions of wetlands, impacts of watersheds and wetlands
renewable and nonrenewable resources	uses, availability, management, influential factors
environmental health	environmental health issues, human actions, biological diversity
agriculture and society	society's needs, agricultural science, agricultural systems, technology
integrated pest management	effects, benefits and impacts, health risks, management practices
ecosystems and their interactions	living and nonliving components, cycles, change over time
threatened, endangered and extinct species	diversity, adaptation, management strategies
humans and the environment	societal needs, sustainability, human impacts, supply and demand
environmental laws and regulations	environmental laws and their impact

Adapted from "Academic Standards for Environment and Ecology," by Pennsylvania Department of Education, 2002, 22 Pa. Code, Ch. 4, Appendix B

3.2 SCIENCE CURRICULA

When attempting to determine the effectiveness of science curricula and science instruction of students with mild disabilities, researchers typically reported on two different forms of science curricula used within the regular education classroom: a content approach or a hands-on approach. In the content approach, students are expected to listen to lectures from a teacher, memorize information from text books, and complete study guides to demonstrate an understanding of the knowledge (Lynch, Taymans, Watson, Ochsendorf, Pyke, & Szesze, 2007; Mastropieri & Scruggs, 1992; McCarthy, 2005). In the hands-on approach, or inquiry-based approach, however, students are expected to manipulate materials and conduct trials thus providing a more real experience. Through the concrete experiments and the manipulation of variables within the lesson, students are expected to gain a better understanding of the science material. In addition to the experiential learning that takes place, the hands-on approach reduces the expectation that students will learn specific definitions and facts from text as in the content approach (Mastropieri & Scruggs, 1992; Norman, Caseau, & Stafanich 1997; Scruggs & Mastropieri, 1995, Scruggs & Mastropieri, 2007). The hands-on approach includes curriculum lessons from science programs such as the Full Option Science System (FOSS) and Chemistry that Applies (CTA) (Lynch et al., 2007; Mastropieri & Scruggs, 1992).

3.3 DIFFICULTIES FOR STUDENTS WITH MILD DISABILITIES WITHIN SCIENCE CURRICULA

In recent history some researchers have begun to address the issue of teaching science to children with disabilities through either one of these two curriculum designs. According to the available research, a large portion of the science research explored instructional techniques for children with various disabilities within the regular education environment. Scruggs and Mastropieri (1995) identified individuals receiving this instruction as diagnosed with: mild mental retardation, learning disabilities, visually impaired, emotional disabilities, vision impairments, and physical impairments.

According to Lynch et al. (2007) children with mild disabilities may have difficulty with the science content as a result of their poor reading and math skills. Poor reading skills such as word recognition and comprehension may result in an inability to understand the content covered in the texts. In addition to this difficulty with reading and mathematics, researchers have identified several other areas that may affect science understanding. Attention is certainly an area where students with mild disabilities show difficulty. Whether this attention deficit emerges as difficulty attending to key components of lessons or short attention spans resulting in a student being easily distracted, the end result may be that a student misses critical parts of the lesson (Scruggs & Mastropieri, 1995; Steele, 2004). Difficulty with the retrieval of information may lead to a student demonstrating difficulty with communicating his/her knowledge about the lesson. Difficulties with memory may then result in the inability to practice common study techniques like rehearsal and the elaboration of concepts (Scruggs & Matropieri, 1995; Steele,

2004). Additional possible deficits commonly found in students with mild disabilities are the ability to make predictions, solve problems, and make inferences about the material being covered. Scruggs and Mastropieri (1995) referred to this as logical reasoning while Steele (2004) identified such deficits as organizational problems. Regardless of how these deficits are labeled, Scruggs and Mastropieri (1995) noted that teachers found them to be fundamental skills necessary for accessing and learning in an inquiry-based science curriculum. An additional area identified by Scruggs and Mastropieri (1995) is "outerdirectedness." "Outerdirectedness refers to an observed tendency in individuals with mental retardation to rely on situational or external cues for guidance" (Scruggs & Mastropieri, 1995, p. 265). Other skill deficits that have been identified include a difficulty generalizing information from one lesson to another and visual processing (Steele, 2004).

3.4 PERFORMANCE OF STUDENTS WITH MILD DISABILITIES WITHIN INCLUSIVE SCIENCE LESSONS

As a possible result of the deficits listed above, and quite possibly the curriculum structure overall, students with mild disabilities have earned lower grades in science and scored one standard deviation below students without disabilities on science achievement tests. Furthermore, the data suggested that as the students with mild disabilities progress through school, they fall further behind in their overall performance within science (Lynch et al., 2007; Mastropieri, Scruggs, Norland, Berkeley, McDuffie, & Connors, 2006). Considering the difficulties with reading identified by Lynch et al. (2007), and the fact that many science texts are believed to be 2-3 years above the listed grade level (Steele, 2004), poorer performance may

be expected as the students progress to more specialized science areas and text in high school. As a possible result of their lack of their outerdirectedness (Scruggs & Masteropieri, 1995) during inquiry-based science lessons, students with mild disabilities may not independently form conclusions or ideas related to the lesson. Instead, the student may simply repeat what others have said or follow the lead of another student or the teacher. In an inquiry-based or hands-on lesson, learning is expected to occur when the student actively engages in the materials and forms his/her own conclusions. If the student is only following the lead of the teacher or another student, he/she may not be making the discoveries necessary to fully understand the information from the lesson.

Even though the performances of students with mild disabilities have varied, results have shown that students with mild disabilities who have participated in hands-on programming such as FOSS and CTA have demonstrated a better understanding of the science concepts taught within the lesson and have demonstrated improvement in their observational, recording, and predicting skills. For instance, McCarthy (2005) reported students with mild disabilities who participated in a hands-on lesson performed better on two of the three posttests when compared to students who only participated in a content approach to the lesson. It should be noted, however, that with results like those reported by McCarthy (2005), Scruggs, Mastropieri, and Boon (1998) cautioned that there is no clear indication of exactly why the overall improvements were seen within the hands-on lesson when compared to the content lesson. Speculation as to why positive results like those found in McCarthy (2005) may occur have ranged from: fewer topics being covered during the lesson; shorter, step by step lessons; lesson may be sequenced from simple content to more complex content or concrete ideas to more abstract ideas; more teacher direction during the lesson; or peer assistance and interactions during the activity (Lynch

et al., 2007; Mastropieri & Scruggs, 1992; Mastropieri, Scruggs, Mantzicopoulos, Sturgeon, Goodwin, & Chung, 1998; Mastropieri et al., 2006).

3.5 RECOMMENDATIONS FOR STUDENTS WITH DISABILITIES WITHIN INLCUSIVE SCIENCE LESSONS

Even though students with mild disabilities demonstrated various difficulties within the science curriculum, teachers have continued to report that science is the content area most suited for the inclusion of students with mild disabilities into the mainstream setting. Through the participation in the regular education classroom, students with disabilities are given the opportunity to cooperate and collaborate with peers as they develop and refine their problem solving and reasoning skills. Science lessons within the regular education classroom also provide the student with the opportunity to engage in practical experiences and expand background knowledge, which may serve some direct benefit to successful functioning in adulthood (Mastropieri & Scruggs, 1992; Mastropieri & Scruggs, 1997; Norman et al. 1997).

In order for students with mild disabilities to demonstrate positive academic progress during hands-on science lessons within the regular education classroom, Mastropieri, et al. (1998), identified several factors that may play a role after their review of qualitative data (review of videotapes, transcripts, teacher notes, and interviews with teachers and students). Administrative support for the inclusive setting and individual teacher affect that created a setting where students felt comfortable were just a few of the factors identified within the study.

Additionally, Scruggs and Mastropieri (1995), Mastropieri and Scruggs (1992), and Steele (2004) identified other factors like collaborative teams, teaching specific study skills, and

curriculum design have been reported to potentially play a role in the performance of students with mild disabilities in the inclusive science lessons. By having both a special education teacher and regular education teacher present, the student is taught by someone who has experience within the science field while the special education teacher provides suggestions on how to accommodate the lesson for specific disabilities, as well as provide support for the students with mild disabilities during the lesson.

Study skills, such as mnemonic devices, peg words, key words, and note taking strategies have also proven to be beneficial to students with mild disabilities. Study skill strategies such as those mentioned above appear to assist in retention of science vocabulary, comprehension of information, and content knowledge (Scruggs & Mastropieri, 1995; Mastropieri et al., 1998; Steele 2004). For example, Mastropieri et al. (1998) and Scruggs and Mastropieri (1995) reported increases in grades and a more successful inclusion experience when study skills such as mnemonics were part of the science lesson. Students using mnemonics outperformed, and demonstrated a positive academic change in performance on science tests, compared to students who used other types of strategies such as direct rehearsal and visual-spatial displays. In addition to the study skills, basic lesson accommodations such as clear questions, using less vocabulary, and breaking lessons into smaller parts, all serve to assist in the acquisition of the science content (Mastropieri & Scruggs, 1992; Steele 2004).

Though there are many benefits to including students with mild disabilities in the regular education science lessons, many of which were included in the sections above, an additional benefit was the fact that students with mild disabilities were given the opportunity to engage in lessons that introduced and taught many of the content areas recommended by the National Research Council (1996). Some of the content standards taught included: physical science

(properties of matter, mixtures, and electricity); life science (structures of life); earth and space science (rocks and minerals); science as inquiry (measurement, charts, and data analysis); and science in personal and social perspectives (ecosystems) (Lynch et al., 2007; Mastropieri et al., 2006; McCarthy, 2005; Scruggs & Mastropieri, 1995; Scruggs & Mastropieri, 2007).

In addition to participating in a wide variety of science content areas, progress and performance of students with mild disabilities were monitored through means similar to the students from the regular education classes. Evaluations of instructional effectiveness was measured through posttests that consisted of multiple choice tests, hands-on projects, short answer tests, and the end of the year assessment described in NCLB (Lynch et al., 2007; Mastropieri et al., 2006; McCarthy, 2005; Scruggs & Mastropieri, 1995).

3.6 DIRECT INSTRUCTION IN SCIENCE

To this point many of the recommendations for instruction revolved around the use of accommodations to assist the students with mild disabilities to participate in the science lesson. Another possible science curriculum design currently receiving some attention, albeit not specifically for students with disabilities, is a science lesson designed using direct instruction. Direct instruction is a teaching model that provides lessons in which concepts are presented in a specific sequence by teachers who are following a script. As the teacher is presenting the concepts through the script, new information is systematically introduced while previously taught concepts are systematically reviewed. Originally designed as a curriculum to teach basic skills to students at risk, direct instruction has shown improvement in the overall performance of several school districts in various studies (Kim & Axelrod, 2005).

In an effort to determine the effectiveness of direct instruction-like lessons, several researchers have compared a specific direct instruction lesson to a discovery-based lesson of the same topic. In each of the studies (Chen & Klahr, 1999; Dean & Kuhn, 2007; Klahr & Nigam, 2004; Strand-Cary & Klahr, 2008), researchers looked at a specific concept within the nature of science; the control of variable strategies (CVS). In the direct instruction lessons, students were presented with designed teacher-directed lessons on how to determine if there were confounding variables affecting the results of a study and whether or not information from the experiment could be attributed to any one variable. During the direct instruction lesson, the teacher presented comparisons and used scripts to comment on each. The following is an example of a script used on one study:

> *Comparison 1* (confounded – format and color both varied). Is this a good comparison? No. Let me tell you why. This is a bad comparison because Pat changed both features. If you change both features in a comparison you can't tell which one makes a difference (Dean & Kuhn, 2006, p. 389).

In each of the studies, the students in the discovery-based lesson were allowed to try different things with the materials, but received no instruction on how to evaluate whether or not the comparison was good based on confounding variables.

The results of each of the four studies supported the use of direct instruction demonstrating that students within the direct instruction groups showed much better performance when determining whether or not a comparison between two posters was appropriate given the comparisons that were being measured. Chen and Klahr (1999) reported that second, third, and fourth grade students who were in the direct instruction group within their study were able to demonstrate improved CVS after being shown different aspects of an item that they had already seen, and generalized their understanding of CVS with items that were not used in the lessons. Klahr and Nigam (2004) and Strand-Cary and Klahr (2008) demonstrated that third and fourth

grade students who received direct instruction lessons out-performed students from the discovery-based lesson when judging the correctness of posters. Klahr and Nigam (2004) reported that the direct instruction group evaluated the posters more effectively when compared to the responses given by the students in the discovery-based lesson. Strand-Cary and Klahr (2008) also found that more third, fourth, and fifth grade students who participated in the direct instruction lesson were found to be rated as CVS experts (59%) when compared to the students who participated in the discovery learning lesson (10%). Finally, Dean and Kuhn (2007) reported that more of the fourth grade students who participated in the direct instruction lesson made correct comparisons when reviewing a computer-based task.

Although these four studies demonstrated that direct instruction-based lessons may have an immediate impact in the demonstration of CVS, it should be noted that some students from the discovery-based lesson did show similar results at later follow up sessions. In other words, the direct instruction group may do better during the initial posttest, but all of the students display similar responses after a delay in testing (Dean & Kuhn, 2007; Strand-Cary & Klahr, 2008).

As mentioned previously, there was no indication that any students with mild disabilities or students with severe disabilities were included within any of the four previously mentioned studies. However, direct instruction does possess some of the qualities found to bring success for students with mild disabilities participating in science lessons with the regular education classroom. Mastropieri and Scruggs (1992) and Steele (2004) recommended accommodations such as clear questions and breaking lessons into smaller parts, all can be found in a direct instruction lessons (SRA, 2008). Furthermore, research has been conducted demonstrating the positive benefits of direct instruction and students with disabilities (Kim & Axelrod, 2005).

3.7 SCIENCE AND STUDENTS WITH SIGNIFICANT COGNITIVE DISABILITIES

The information available regarding the science instruction for students with severe cognitive disabilities is much less extensive when compared to the work done with students with mild disabilities. In an attempt to determine the extent of research conducted on teaching science to students with severe cognitive disabilities, Courtade, Spooner, and Browder (2007) used the science content standards identified by the NSES (National Research Council, 1996) to conduct a literature review of the PsychINFO database and the ERIC database between 1985 to 2005 and a hand search of the 2004 and 2005 journals recognized for publishing studies involving the education of students with severe disabilities including, but not limited to, *Exceptional Children, Journal of Special Education, Research and Practice for Persons with Severe Disabilities,* and *Focus on Autism and Other Developmental Disabilities*. In an effort to further ensure the studies selected were appropriate, only studies documenting a recognized experimental design which included at least one student between 5 and 21 years old with an IQ equal or lower than 55 were included. In addition to meeting the above criteria, studies also must have reported dependent achievement measures found in the NSES standards.

After conducting the literature review, Courtade et al. (2007) reported only 11 studies included measures of science-related skills for students with severe or profound disabilities. Further inspections of Courtade et al. (2007) revealed only three of the national content standards were represented in the 11 studies (physical science, earth and space science, and science in personal and social perspectives). In an effort to better understand the studies, the following three sections categorize each of the studies based on the national standard identified by Courtade et al. (2007).

3.7.1 Physical science and students with significant cognitive disabilities

In two separate studies students between 11 and 18 years old were taught concepts found in physical science by learning how to use a cell phone to call an adult for help when he/she was lost (Taber, Alberto, Hughes, & Seltzer, 2002; Taber, Alberto, Seltzer, & Hughes, 2003).

In the first study, Taber et al. (2002) used a multiple probe design to determine whether 14 middle school students could recognize when they were lost in a public place and then use a cell phone to alert their teacher they were lost. In a follow up study, Taber et al. (2003) once again used a multiple probe design to measure whether six high school students could either use a one touch dialing function to call their teacher after they recognized they were lost or to answer their cell phone when their teacher attempted to call them after the student and teacher were separated from each other. In both studies, researchers used least to most prompting to teach the student the steps within the task analysis. The dependent measure in both studies was the number of steps completed correctly from the task analysis including the student's ability to describe his/her physical surroundings to indicate where he/she was standing in the public place so that the teacher can find the student.

Although both studies dealt with teaching important life skills such as what it means to be lost and how to use a cell phone (either dialing the phone or answering the phone), the physical science involved in the study came in during one step of the task analysis. In step 11 of the task analysis in Taber et al. (2002) and step 7 in both task analyses in Taber et al. (2003), participants needed to describe the physical surroundings of their location to be found. Since the researchers in both studies included leading questions to teach students how to identify and describe key features of the surroundings and their position to those surroundings in order to successfully complete the task analysis, these two studies were considered science.

3.7.2 Earth and space science and students with significant cognitive disabilities

The second content area, earth and space science, had only one study according to Courtade et al. (2007). Using a multiple probe design, Browder and Shear (1996) determined if three middle school students between 12 and 16 years old were able to read weather-related sight words (e.g., sunny, cloudy, wind) to measure a specific method of teaching sight words. While weather-related words were selected, two of the overall goals of the study were to determine the number of unknown words read correctly in a sight word test and the generalization of reading sight words from a newspaper weather report. The fact that these words were weather-related appeared to be secondary to the sight word tests and generalization being studied. This is evident based on the fact that all lessons were taught in the general language arts class and the participants in the study were asked to read the newspaper during the language arts lessons. Since learning weather-related words may benefit the students in their daily lives, Browder and Shear (1996) selected the weather words as the target for the students with disabilities. Even though earth and space science content was taught and measured by the student's ability to read the weather-related words and make decisions about what to wear according to what was read, considering the study to be science may not be accurate. This thought is further supported by the fact that the lead investigator of the study teaching weather-related words, Diane Browder, conducted a later review of studies that taught students with severe disabilities how to read. In their summary of studies used to teach reading, Browder and Xin (1998) included Browder's early work on teaching weather-related words (Browder & Shear, 1996) as a reading study of how to teach sight words.

3.7.3 Science in personal and social perspectives and students with significant cognitive disabilities

Of the 11 studies identified in the Courtade et al. (2007) research, eight were categorized as science in personal and social perspectives. All eight of these studies included some form of self-preservation whether it was practicing health and safety and first aid, reading product warning labels, responding to strangers, or handling broken items.

A total of 11 students were taught various first aid skills within three of the different studies included in science in personal and social perspectives. Spooner, Stem, and Test (1989) used a multiple baseline design to measure the performance of three teenagers between 15 to 17 years old to determine whether or not they knew how to call emergency response in the event of an emergency, how to take care of minor injuries, how to apply bandages to a minor injury, and how to administer the Heimlich maneuver to someone who is choking. Researchers used a two step procedure to teach the task analysis steps. The first step of the intervention, group discussion, involved the trainer discussing different types of emergencies. The second step of the intervention involved the teacher modeling how to complete the skill and then had the student practice the just reviewed skill. Once the student was able to demonstrate all of the skills on the task analysis, the trainer had the student demonstrate all of the steps one more time. Student overall performance was measured on the basis of how many of the task analysis steps for each first aid skill were completed independently. The second study involved teaching four high school students between 17 to 20 years old how to administer first aid for minor cuts, minor burns, and insect bites (Gast & Winterling, 1992). Using a multiple probe design, Gast and Winterling (1992) measured whether or not a backward chaining intervention with constant time delay, along with an orientation lecture, would increase the students' ability to complete the task

analysis. The success of the intervention was determined by the total number of correct responses completed in the task analysis. The third study also taught first aid skills, but to four younger participants than those found in the above mentioned studies. Marchand-Martella and Martella (1992) taught four students between 6 to 12 years old how to care for abrasions on their arms or legs by simulating injuries. Researchers used a multiple baseline design to determine the effectiveness of the social modeling intervention procedure. During the social modeling procedure, the teacher demonstrated how to care for an abrasion on her elbow or knee, or an abrasion on a puppet. After modeling the steps, the teacher then asked the student to complete a similar task on the puppet. Overall success of the intervention within the study was measured by the number of steps completed correctly on the task analysis by each student.

In order to measure the performance within each of the studies teaching first aid, researchers determined whether or not the participants successfully completed the various tasks analyses that were developed for each individual first aid emergency. All three studies were successful in teaching students of differing ages to care for several first aid scenarios and were likely considered science because of the safety and injury examples included in the science in personal and social perspectives category.

Another area of studies identified as science by Courtade et al. (2007) addressed reading product warning labels. Collins and Stinson (1994) taught four high school students between 16 to 20 years old to read product warning labels and to define what the product label meant in the context of the warning label. The intervention used during the instruction is known as progressive time delay. During the initial trials, a verbal prompt was provided at a 0-second time delay after asking the student to read the word. As the sessions progressed, the time delay moved to 1 second all the way to a maximum for 5 seconds before the verbal prompt was

delivered. Using a multiple probe design across word pairs, researchers determined the success of the intervention by measuring whether or not the student was able to read the product warning label and then describe the underlying meaning of key words within a product label. In the second reported study, Collins and Griffen (1996) taught four elementary school students between 8 to 11 years old to read a product warning label, such as danger and caution, and display the proper motor response, such as notifying the teacher or putting the item on the correct shelf. As with Collins and Stinson (1995), Collins and Griffen (1996) measured whether or not the student was able to correctly read the warning label and whether or not the participants then correctly displayed the appropriate motor response. Although this study also used a multiple probe design and measured success by the number or words read and the actions completed, the intervention selected was slightly different. Collins and Griffen (1996) used a constant time delay when teaching the students the sight words. After the teacher asked the student to read the word, a 0-second time delay was used to tell the student the word during the first session. After that, a constant 5-second time delay was used as the intervention.

Although these two studies were reported as science most likely because of the safety component listed in science in personal and social perspectives, they face the same problem as Browder and Shear (1996). Just as Browder and Xin (1998) classified the Browder and Shear (1996) study are reading, the Collins and Stinson (1995) and Collins and Griffen (1996) studies were also classified as reading studies of sight words.

Two of the remaining studies addressed the topic of recognizing a dangerous situation, such as being approached by a stranger. Watson, Bain, and Houghton (1992) taught seven students between 6 to 8 years old how to respond when approached by a stranger while on the playground. Students were taught to tell the stranger “no,” move away from the stranger, and

then tell a teacher. Using direct instruction-like lessons, students were guided through lessons that first defined what it meant to be a stranger and then had the students observe a modeled response and then practice the response themselves. Watson et al. (1992) described that they used a "modification of a multiple probe interrupted time series format" (p. 188) to measure how the students would respond when approached by a stranger on the playground. This type of design was used since the researchers did not find it ethical to expose the students to repeated scenarios where someone may have been trying to abduct them. Using this design model, the researchers determined whether or not the student engaged in the three steps that were taught during the intervention. Utley, Reddy, Delquadri, Greenwood, Martweet, and Bowman (2001) used a class-wide peer tutoring program in an inclusive fourth grade classroom to teach five students between 7 to 9 years old how to identify dangerous situations by identifying problems depicted on flashcards. It should be noted that the subjects in this study met the minimum requirements to be included by Courtade et al. (2007). Courtade et al. (2007) only included studies in which one of the students involved was below an IQ of 55. In Utley et al. (2001), only one student fell below that IQ of 55 cut off while the other students were slightly above. In addition to recognizing dangerous situations, Utley et al. (2001) also included units teaching about body parts and functions, poisons and non-poisons, and drugs and their effects during peer tutoring lessons. Lessons were led by the teacher instead of measuring the responses participants gave within the lessons or the completion of task analyses. Utley et al. (2001) used a BAB reversal design to compare the peer tutoring phase of instruction to the teacher-led classroom lesson. Pretest and posttest measures of performance were used to determine the success of each treatment phase.

Watson et al. (1992) is classified under science in personal and social perspectives presumably under the safety example while Utley et al. (2001) is presumably included because of the safety example and also the drug example. It should be noted, however, that even though Courtade et al. (2007) identified Utley et al. (2001) as a science study, the curriculum unit was named health and safety curriculum. Furthermore, the curriculum was from a health education text and the review of the concepts within the unit was covered during a health and safety period.

The final study identified as science by Courtade et al. (2007) taught high school students between 17 to 21 years old how to respond when a broken glass or plate was found in the sink, on the counter, or on the floor (Winterling, Gast, Wolery, & Farmer, 1992). During instruction, each task was taught using three levels of teaching. First, a lecture was done to teach students why it is important to handle broken items safely and a demonstration of how to clean up the broken item. Then, students were guided through the completion of the steps by imitating what was modeled to them. Finally, a 5-second time delay was used to instruct the students on the completion of the task analysis. Since the measurement of steps completed in the task analyses for the various locations of the broken glass or dish was the dependent measure, the notion of teaching students safety behavior was more than likely the reason why this study was included as science in personal and social perspectives. By using a multiple probe design, the researchers were able to determine that the interventions were successful in teaching students to remain safe when they come upon a broken item and how to properly clean up the broken item.

Although the studies identified as science in personal and social perspective according to Courtade et al. (2007), in no situation did the researchers cite science as the purpose for teaching the students involved in the studies. Instead, reasons such as: increasing community exposure to outside experiences and workplaces (Gast & Winterling, 1992; Marchand-Martella & Martella,

1992; Spooner et al., 1989); teaching warning labels to prevent accidental poisoning (Collins & Stinson, 1995; Collins & Griffen, 1996); knowing what to do when approached by strangers (Watson et al., 2001); introducing a health and safety curriculum (Utley et al., 2001); or teaching daily living skills (Winterling et al., 1992) were given; not an introduction to science-based curriculums. It should also be noted that even though these items are considered science by the NSES as indicated by Courtade et al. (2007), all but one, Utley et al. (2001), would not be considered science according to the Pennsylvania science standards (Pennsylvania Department of Education, 2002a). Instead, items such as teaching first aid, recognizing dangerous situations, and the affects of drugs on the body would be classified under the Pennsylvania health, safety, and physical education standards (Pennsylvania Department of Education, 2002b).

Even if the above studies didn't reflect science as indicated by the Pennsylvania science standards, they did share some similar qualities in instruction and data collection. Many of the lessons involved interventions using time delay procedures to teach concepts like sight words and cleaning up, and all but one of the studies used some form of a multiple baseline probe. One study though, Watson et al. (2001), did use a direct instruction lesson similar to those used in the CVS lessons used to teach a nature of science concept. In addition, many of the studies determined success by the independent completion of various task analyses ranging from cleaning a wound and identifying where someone is lost to how to respond if approached by a stranger. In addition, many of these studies used 1:1 teaching when presenting the intervention. Some lessons may have begun with a brief small group introduction, but the major components of the intervention were taught through modeling and prompting with only the teacher and the student present.

3.8 COMPARISON OF SCIENCE FOR CHILDREN WITH SIGNIFICANT COGNITIVE DISABILITIES AND STUDENTS WITH MILD DISABILITIES

Although there are similarities in the broad content areas covered for students with mild disabilities and students with severe cognitive disabilities, most of the similarities stop there. As noted previously, the topics covered under the content areas were much broader for students with mild disabilities when compared to students identified with significant cognitive disabilities. In most cases, the lessons for students with significant cognitive disabilities focused on specific aspects of a topic (reading warning labels, how to dress a wound, etc.) instead of introducing themes such as properties of matter and how those properties change.

Two other major differences between the lessons for students within the regular education classroom and the lessons for students with significant disabilities include: where and how instruction was conducted and how the effectiveness of instruction through content understanding was measured. In a majority of the 11 studies found to meet Courtade et al. (2007) criteria for teaching science to students with significant cognitive disabilities, instruction took place in either a self contained classroom or a specialized school. Furthermore, lessons for most students with significant cognitive disabilities included role playing, 1:1 instruction, small group instruction, modeling, rehearsals, total task chaining, and time delay procedures. Interventions such as modeling, rehearsals, total task training, and time delay procedures are best classified as behaviorally based interventions. Instead of presentation in a large group presentation in a regular education classroom, like the instruction for students with mild disabilities, students with significant cognitive disabilities received the uniquely designed behaviorally based lessons. In contrast, the students with mild disabilities participated in inquiry based procedures such as the hands-on method found in the FOSS program. There was one

similarity in instruction found that was used for students with significant disabilities that was also recommended for regular education students (not specifically students with mild disabilities). Direct instruction was found to be successful in teaching a nature of science concept in four separate studies of third through fifth graders and direct instruction was found to be part of an effective intervention for students with significant disabilities. A possible reason for the success of both is the principles of the direct instruction model. Since direct instruction provides a systematic review and introduction of material through teacher directed scripts, and ongoing evaluation of performance, this type of intervention may be considered more behaviorally based than inquiry-based.

In addition to the differences in where and how instruction was done, measurement of performance was also conducted differently for students with significant cognitive disabilities. As mentioned earlier, the performance of students with mild disabilities was conducted using multiple choice tests, short answer tests, and in one case, the high stakes end of year science assessment. Measurement of effectiveness for students with significant cognitive disabilities, however, was completed through the measurement of the number of steps in a task completed correctly, the number of new sight words read, generalization of skills, and in one case, a posttest measure of achievement (Courtade et al., 2007; Lynch et al., 2007; Mastropieri et al., 2006; McCarthy, 2005; Scruggs & Mastropieri, 1995).

3.9 ALIGNMENT OF ALTERNATE STATE ASSESSMENTS AND ALTERNATE ACHIEVEMENT STANDARDS

In addition to NCLB setting the expectations for students with significant disabilities to have access to the general education curriculum, and assessments based on academic standards, it also set the expectation for the development of alternate content standards (Browder, Spooner, Algozzine, Ahlgrim-Delzell, Flowers, & Karvonen, 2003). By developing these alternate content standards, the scope and complexity of the regular education standards was reduced or took the form of introductory skills or prerequisite skills. In order to measure and report the level of a student's performance against the alternate content standards, the aforementioned alternate state assessments were created. Once alternate assessments and alternate content standards were created, states needed to demonstrate a link between the alternate assessment, alternate content standards, and the regular education standards (Browder et al., 2006; Flowers et al., 2006; Kulm, Dager-Wilson, & Kitchen, 2005). According to the U.S. Department of Education Office of Elementary and Secondary Education (2007),

> "Each state must present evidence that its assessment is aligned to its standards. Some alignment evidence is generated in the test development process, and documentation of the steps taken to ensure that items were drafted to reflect the full range of the State standards is appropriate verification of efforts to attain alignment" (p. 51)

In other words, the alternate state assessment and alternate content standards must be aligned to the regular education standards. To determine if indeed an assessment links to the regular standards, the U.S. Department of Education Office of Elementary and Secondary Education (2007) recommends providing documentation of reports of independent alignment studies and how problems identified from studies will be addressed, descriptions of the process

and groups involved in the creation of the assessment, and the specifications of the process used to ensure the assessment reflects the State standards.

In an effort to demonstrate that a state's alternate assessment and alternate content standards do indeed link to the regular education standards, researchers have conducted alignment studies of different states over the past several years. Alignment measures have been classified in three different complexity levels: low complexity, moderate complexity, and high complexity (Bhola, Impara, & Buckendahl, 2003; Flowers, Browder, & Ahlgrim-Delzell, 2006). Of the three different levels of alignment complexity, several studies have been published using either the low complexity or high complexity models. According to Bhola et al. (2003), low complexity models of alignment "represent a logical starting point for conducting studies to align assessments with content standards. This model defines alignment as the extent to which the items on a test match relevant content standards" (p. 22). Bhola et al. (2003) go on to state that the low complex model is the basis for the moderate and complex alignment studies. Since the high complexity level will also be reviewed in the upcoming sections, it is necessary to have an understanding of what characterizes a high complexity alignment model. According to Bhola et al. (2003), a high complexity model "enables users to determine how well content standards are being measured by assessments, using the following five interrelated dimensions: content match, depth match, emphasis, performance match, and accessibility" (p. 22).

3.9.1 Low complexity alignment studies

In the low complexity alignment study content experts are asked to use a Likert scale to rate assessment items and the degree of agreement with the standards used to measure student achievement. As one part of an overall validation study of the performance-based Utah

Alternate Assessment (UAA) Hager and Slocum (2008) used survey data completed by four university faculty members specializing in special education to determine if each assessment item could be found in the language arts and math domains. The faculty participants reported that 85% of the assessment items were found in the identified domain.

In another low complexity alignment study Browder et al. (2004) used surveys and focus groups to measure content validity. Participants such as university faculty specializing in math, language arts, or special education and stakeholders such as special education teachers and administrators, and researchers were involved in the study. Participants received surveys for a particular content area with open ended questions and different state performance indicators. Browder et al. (2004) then asked the participants to review the performance indicators for 31 states and identify the states that had performance indicators related to the national standards. In math 86% of the experts and 70% of the stakeholders reported some states performance indicators were clearly linked to the math standards. South Dakota and Colorado were two states identified as having a clear link to the state math standards. Further analysis revealed that 86% of the experts and 100% of the stakeholders also reported that some of the state performance indicators were not aligned to the national standards at all. Some of the reasons given for why states were not considered to be aligned were because performance indicators were considered to be too broad, too vague, or too limited. In language arts, 86% of the experts and 100% of the stakeholders reported some states' performance indicators were clearly aligned to the language arts standards. One such state identified was Arizona. Of the experts reviewing language arts, 67% reported some states with no link and 78% of the stakeholders also reported no link between some states performance indicators and the language art standards.

In a third low complexity alignment study, Johnson and Arnold (2004) evaluated the Washington Alternate Assessment System (WAAS) by addressing three different questions, with the first asking participants to determine whether or not there was evidence to support the validity of the content in this portfolio-based assessment. All of the portfolios submitted for the 2001-2002 evaluation from grade 4, 7, and 10 were evaluated. While reviewing the portfolios, reviewers were asked to indicate yes or no to a researcher-created rater checklist. Results of the checklists indicated that 81% of the entries showed a relation to the reading standards and 75% of the entries showed a relation to the math standards.

Through the use of low complexity alignment measures, all three studies produced some descriptive data related to the alternate assessment and some academic standard. These three studies indicated the degree to which there was correspondence between the states' performance indicators, alternate assessment items, or alternate standards and the national standards or state standards.

3.9.2 High complexity alignment studies

High complexity alignment studies, such as those using Webb's model (Bhola et al., 2003) and the Link for Academic Learning (LAL) (Flowers et al., 2007) use multiple measures like performance match, content match, and depth match to determine the level of correspondence between the alternate standards, performance indicators, or alternate assessment items and the national standards or state standards. The use of Webb's model (measuring categorical concurrence, range of knowledge, balance of representation, and depth of knowledge) was used by Flowers, Browder, and Ahlgrim-Delzell (2006) to review three states' alternate assessments (1 performance-based assessment and 2 portfolio-based assessments) that researchers agreed had

a good alternate assessment and a strong link to the general education curriculum. The participants (6 content experts in math and reading with knowledge of test development) rated the performance-based assessment as the overall best aligned alternate assessment. Overall though, no state achieved 100% categorical concurrence with the performance-based assessment only having 50% categorical concurrence (general analysis of content match between alternate standards and state standards) in language arts and 66.7% categorical concurrence in math. The range of knowledge (test of understanding or mastery of standards represented in content area) and balance of representation (the distribution of the assessment items) were poor for all three state assessments. Finally, the depth of knowledge (measuring the depth of understanding) was rated as poor, but with a reduction in the breadth and depth of the state academic standards permitted by NCLB (Browder et al., 2006).

In a summary of an alignment study of the Idaho Alternate Assessment using the Webb model, Roach and Elliot (2004) reported the findings on the content standard objectives and assessment items for a measurement of the depth of knowledge. A total of 11 panelists of special education teachers and personnel from the Idaho Department of Special Education looked at reading, language arts, and math standards from grades 1, 4, 8, and 10. Panelists found that the depth of knowledge in the Idaho Alternate Assessment was low.

Using the Webb model, a total of 10 participants including special education teachers, graduate students, and personnel from the Wisconsin Department of Public Instruction rated the agreement between the Wisconsin Alternate Assessment and the Wisconsin academic standards (Roach, Elliot, & Webb, 2005). Participants reviewed several contents areas in the Wisconsin Alternate Assessment including: math, reading, language arts, social studies, and science. Participants reported a content match (categorical concurrence) for math, reading, and social

studies, but not for language arts and science. The balance of representation and the range of knowledge were met for all tests, but the science range of knowledge was weak in physical science, earth and space science, and science in social/personal perspective. Finally, the depth of knowledge didn't meet the overall depth, but this result is similar to the expected results from in Roach et al. (2005) and Browder et al. (2006).

According to Almond, Bechard, Wakeman, and Karvonen (2008), the LAL alignment model is similar to the Webb alignment model, however, the LAL model measures additional criteria. Both the Webb and LAL model measure content match, depth of knowledge, and balance of representation, but Almond et al. (2008) report four additional criteria explored in the LAL model. These four additional criteria measure concepts such as: changes in grade level expectations, the link between grade level content and achievement standards, barriers to performance due to student disability, and curriculum link (Flowers et al., 2007). In a report submitted to the Pennsylvania Department of Education, Almond et al. (2008) used the LAL model to measure the extent that the PASA-Math and PASA-Reading are aligned to national standards and state standards.

A total of 11 participants used the LAL model to examine the eight criteria reported within the LAL model. When reviewing the first criterion in the LAL model, participants found that most of the math and reading extended standards and assessment items were linked to the national standards, but the panelists reported that too large of a reading portion of the level A PASA-Reading were considered foundational skills. According to the second criterion in the LAL model, the PASA-Math and PASA-Reading were evaluated on how well the alternate achievement standards matched to specific grade levels. Both the math and reading alternate standards were found to link at the grade 3 and 4 standards, but varying results were reported for

the grade 5/6, 7/8, and 11 assessments. In math half of the grade 5/6 and almost half of the grade 7/8, and 11 assessments were found to link to the grade 3 and 4 standards and not their corresponding grades. The reading alternate standards, however, showed alignment to the reading independently standard for each of the corresponding grade levels. Unfortunately though, no alternate standards were found related to the other two remaining reading academic standards. When measuring the content centrality and performance centrality, criterion 3 in the LAL model, the PASA-Math and PASA-Reading were much better. All of the reading alternate standards were linked to grade level standards and 78% of the PASA-Reading assessment skills had an identifiable alternate standards link. In math, 96% of the alternate standards were linked to grade level standards and 96.9% of the PASA-Math assessment skills had an identifiable alternate standard link. Criterion 4 of the LAL, which measured the depth of knowledge, and balance of representation, showed the PASA-Math had a balance in representation, but a low level of depth of knowledge. The balance of representation for the PASA-Reading was not as strong since only one of the three major reading domains from the standards was focused with the assessment. The depth of knowledge for the most part was similar to that of math and fell below the depth of knowledge specified in the alternate standards.

Based on the additional criteria reviewed by the LAL model, the PASA-Math and PASA-Reading did not demonstrate a differentiation across grade levels (criterion 5 of the LAL model). The PASA-Math and PASA-Reading also demonstrated some expectation for students to perform skills to show an understanding of the content (criterion 6 of the LAL) through the scoring rubric, but the expectations for improved levels of independence the following year were not explicit. Reviewers noted that there were efforts to develop assessments so disabilities did not create barriers to performance (criterion 7 of the LAL model), but more work needed to be

done for students with hearing impairments, students with vision loss, or students with multiple disabilities. Finally, the PASA-Math and PASA-Reading provided teachers with examples of how to structure learning in the general curriculum (criterion 8 in the LAL), but the reviewers recommended more teaching training related to instruction and how to differentiate questions for different types of students.

Through the use of high complexity alignment measures, researchers are not only able to measure the agreement on content like the low level alignment measures, they are able to determine the level of agreement. As evidenced through the four alignment studies reviewed above, researchers were able to provide alternate assessment developers with information about how balanced the assessment is compared to the standards and determine the level of cognitive understanding that is required in the standards and whether or not the alternate assessment is measuring the same level of knowledge.

3.10 EDUCATIONAL VALIDITY

In addition to the measurement of how closely an alternate assessment and alternate standards align to the national or state academic standards, some researchers have also asked questions related to the importance of the alternate standards and assessment items. In other words, do stakeholders like parents, special education teachers, and special education administrators find the skills to be appropriate and important to day to day functioning for students with severe disabilities (Hamilton & McLone, 1989; Voeltz & Evans, 2004)?

In a measure of educational validity, Kleinert and Kearns (1999) asked 80 content experts to use a 5-point Likert scale to rate 25 of Kentucky's Academic Expectations from the Kentucky

Alternate Assessment. Of those 80 content experts asked to participate, 44 of them returned their ratings of the academic expectations. Only 40% of the academic expectations were rated with an average score of 4.5, which was in turn considered highly important by the researchers. Academics such as: emotional wellness, accessing information, speaking, and interpersonal relationships were rated as highly important. Academic expectations such as quantifying, number concepts, and classifying were not rated as important according to the content experts.

As part of the validation of the UAA, Hager and Slocum (2008) asked six parents, 18 special education teachers, and 14 special education administrators to rate various features of the UAA. When asked to rate the importance of the skills on the UAA, participants rated 78% of the math and language arts skills as important and 17% of the math and language arts skills as somewhat important. Participants were also asked to rate the assessment construct and whether or not the assessment represented important language arts and math tasks. Participants reported only 43% of the math skills and 75% of the language arts skills were considered acceptable. Participants also reported that 38% of the math skills and 19% of the language arts skills needed addition items. The teachers who participated in the study were then asked whether or not the UAA skills would adequately measure math and language arts skills. Only 69% of the teachers responded that the assessment items would adequately measure the math and language arts skills.

Although fewer educational validity studies have been conducted to date, the need for this type of information is clearly warranted. If stakeholders do not feel the information is important in the day to day functioning of the student's life, there may be less focus on those skills that are not considered to be important. In both educational validity studies of alternate assessments, participants did not determine that all of the areas were important, or as important as others. Though the studies did not ask participants to explain why the information was rated

as more important or less important, the initial information collected may help anticipate areas within the alternate standards that may not be reviewed as thoroughly within the curriculum.

3.11 SUMMARY OF LITERATURE REVIEW

The information available on science instruction and students with mild disabilities has demonstrated that students with mild disabilities have been successful in participating in some science-based curricula in the regular education classroom with some accommodations in place. The information available on science instruction with students with significant disabilities has been more limited. According to Courtade et al. (2007) and Browder and Spooner (2006), there are only 10 or 11 studies classified as teaching students with significant disabilities.

With the expectation of a statewide assessment to measure student performance of science standards beginning in 2008, states had to develop statewide tests and alternate science assessments for those students that couldn't take the regular science assessment with accommodations. In addition to the development of an alternate assessment, states were charged with the task of developing alternate academic standards for those students who would be taking the alternate science assessment. As mentioned previously, these alternate science content standards and alternate assessments must both be aligned to the state science standards. According to the literature presented, only one of the alignment studies, whether it was a low complexity measure or a high complexity measure, attempted to validate alternate science content and the science standards.

Alignment is an important and necessary part of the review of alternate state standards and alternate state assessments to ensure that the material students are being assessed on and the curriculum being developed matches similar aspects of the regular standards. This point is clear when comparing the items Courtade et al. (2007) considered science with the Pennsylvania Science Anchors. Since Pennsylvania has separate standards for Health, Safety, and Physical Education, many of the items classified as science in personal and social perspectives by Courtade et al. (2007) would be classified under the Safety and Injury Prevention domain of the Health, Safety, and Physical Education (Pennsylvania Department of Education, 2002b) standards. If items such as these were included with the alternate science standards and the PASA-Science, these items would most likely be identified as 'not science.' Although skills such as recognizing dangerous situations and how to treat minor cuts and burns are important for all students to learn, these skills are not part of the alternate science anchors or the PASA-Science. By conducting a preliminary alignment measure of the alternate science anchors and the PASA-Science, steps can be taken to ensure that only science-based measures are assessed and students' performance on the PASA-Science is an accurate measure of their science knowledge related to the alternate science anchors.

4.0 RESEARCH METHOD

4.1 PARTICIPANTS

To address each of the research questions, three different groups of participants were selected for participation in the research study. To address research questions 1 – 4, the current study used the guidelines used by Flowers et al. (2007) when selecting panelists to complete their Links for Academic Learning alignment process. When selecting panelists for the alignment study, Flowers et al. (2007) recommend, "at least two academic content experts, two experts in curriculum for students with significant cognitive disabilities, and one alignment leader for each subject area across all the grade levels" (p. 46). Since the research study used independent ratings from all panelists, no alignment leader was selected. Instead, content experts and experts in curriculum for students with significant cognitive disabilities were selected.

For research question #1 (alignment of alternate science anchors to regular science assessment anchors), seven university faculty members with expertise in special education or science education were selected to determine the degree of alignment of the alternate science anchors with the regular science assessment anchors. All seven university faculty members selected are currently teaching in Pennsylvania. A list of potential university faculty with expertise in special education was created with the assistance of Dr. Steven Lyon, Associate Professor at the University of Pittsburgh. From that list, nine special education faculty were

contacted via email to request their participation in the research study. From that initial set of contacts, four faculty members within the field of special education accepted the invitation to participate in the study. The four university faculty selected for this study have expertise within the field of special education, experience in development of university level coursework about students with severe disabilities, and an understanding of curricula design and assessments for students with severe disabilities.

A list of potential university faculty with expertise in science education was generated by identifying university level faculty from Pennsylvania who were presenting at the 2009 National Science Teachers Association (NSTA) in New Orleans. From that list, six science faculty were contacted via email to invite them to participate in the research study. Three faculty members with expertise in science education accepted the invitation to participate in the study. The three university faculty who were selected have expertise in the field of science education, the development of university level coursework about science, and an understanding of science assessment and curricula design.

A closer look at the university faculty selected revealed that a majority of the university faculty currently teach at universities located in western Pennsylvania. Of the seven university faculty selected to participate, five of those teach at a university in western Pennsylvania and four of those five teach at a university in or around the Pittsburgh region. The other two university faculty currently teach in the central region of Pennsylvania. One of the faculty teaches in central Pennsylvania while the other faculty member teaches at a university in south-central Pennsylvania. It should also be noted that although male and female university faculty were contacted about participation in the study, all seven panelists who agreed to participate are female. Finally, when asked to report the number of years working in their identified field, the

panelists listed their years teaching, including their experience previous to their current university position. As a result, it was difficult to determine how many years each of the panelists were at their current placement. From the information provided, it was determined that three of the university faculty reported teaching at their university between 4 – 10 years while the other four university faculty reported teaching at a university over the past 10 years.

For questions #2 - #4 (alignment of PASA-Science assessment items to alternate science assessment anchors and the content centrality of the assessment items considered academic) a total of 18 participants from the field of special education and science education were selected. A total of at least two special education teachers from each grade level (4, 8, 11) were selected for participation in the study. Special educators selected had to meet the following criteria: participated in some form of the PASA-Science pilot (either as a teacher or a scorer), administered the 2008 PASA-Science, and attended the 2008 PASA-Science scoring conference. A total of 10 special education teachers met the above criteria and were contacted via email to request their participation in the study. Eight out of the 10 special education teachers accepted the invitation to participate in the study. An initial list of prospective science educators was generated with the assistance of Gabriela Rose and Ruth Martin of the Math and Science Collaborative at the Allegheny Intermediate Unit #3. Science educators who currently possess teacher's certification and have attended a science workshop through the math and science collaborative in the past year were included on the prospective science educator list. A total of 25 prospective science teachers were contacted via email to request their participation in the research study. From these initial emails, a total of 10 science educators accepted the invitation to participate. The original intent of the study was to include at least two science educators at the elementary and middle school levels and eight high school science educators (two high school

teachers each from general sciences, physical sciences, biological sciences, and earth and space sciences). Unfortunately, only half of the desired high school teacher amount accepted an invitation to participate in the study.

Just as a closer look revealed a majority of the university level faculty were from the western region of Pennsylvania, similar results were found when looking at where the school districts were located that the special education and the science education teachers currently teach. Of the 18 special education and science education teachers selected as panelists, nine of those teachers taught in school districts located in southwestern Pennsylvania and four of the teachers selected taught at school districts located in northwestern Pennsylvania. Three other teacher panelists taught in school districts located in either central Pennsylvania or south-central Pennsylvania. The two final teacher panelists were currently teaching in school districts in the southeastern region of Pennsylvania. It should also be noted that some of the panelists selected taught within the same school district. Two the of the high school teachers selected from southwestern Pennsylvania taught in the same high school while three of the northwestern Pennsylvania teachers taught in the same school district. Male and female special education teachers and science education teachers were invited to participate as panelists, but only two of the 18 teachers are male. Both male panelists are special education teachers who met the criteria above for identification as a possible special education panelist. No male science education teachers responded to the initial request to participate. When asked to report the number of years working in their identified field, whether it be working with students with significant cognitive disabilities or teaching science, the teacher panelists reported a range of work experience. Five of the teachers reported that have worked in their chosen field for 3 to 5 years. Nine of the teachers reported working in their field for between 10 to 15 years. Two teachers reported they

have been teaching for over 20 years, while one teacher reported teaching for over 30 years, and the final teacher reported she has been teaching for the past 41 years.

For research question #5 (rating of educational validity) all individuals who would be administering the PASA-Science to students in grades 4, 8, and 11 during the 2009 school year were asked to participate in the study. In addition, all of the parents of students with severe disabilities enrolled to participate in the PASA-Science were asked to participate in the research. Using the PASA database, individuals were identified by determining who would be administering the 2009 PASA-Science. Once the test administrators were identified, information about the survey was included in the administrator's packet each test administrator receives prior to administering the assessment. Using the PASA database, the selection of participants was based on their students' grade level (4, 8, 11) and test level (level A, level B, level C). According to the PASA database, a total of 2,724 individuals were registered to administer the PASA-Science to one or more students. As a result 2,724 test administrators at the various grades and test levels received a questionnaire about the test items included in the test level(s) administered. In addition to the test administrators being sent surveys for completion, the parents/guardians of the students taking the PASA-Science were also sent questionnaires. Parents/guardians also received a questionnaire about the test items included in their son/daughter's PASA-Science Assessment. According to the PASA database, a total of 5,891 students were slated to participate in the 2009 PASA-Science.

4.2 SETTING

Participants for questions #1 - #4 were required to attend a half-day training at the PaTTAN office in Harrisburg. After completion of the initial training and explanation of the research study, participants completed the remaining activities at either their home or work before returning their assignments via email.

Participants selected for research question #5 were not required to attend an initial training. Instead, the surveys and instructions to complete the surveys were mailed to them. Participants then completed the surveys and returned their materials using the self-addressed envelope provided.

4.3 PROCEDURE

The procedures for questions #1 - #4 were similar in nature. In each case, participants attended a three-hour training to review the purpose of the alignment study and to receive training on how to complete the activities. Since the researcher was not sure of the panelists' overall understanding of alternate state assessments, students with significant cognitive disabilities, or teaching science, each training began with a review of legislation driving the need for alternate state assessments and how the PASA system of assessment was designed to meet that legislation. In addition, the training provided information on how the PASA system of assessment was designed and the conceptual levels of the PASA assessments. Following that, the training focused on some of the research findings reported on teaching science to students with mild disabilities and the findings reported on teaching science to students with significant cognitive

disabilities. The next section of the training was used to give the panelists an understanding of the PASA-Science and how the items were designed. In order to this, the panelists were shown individual test items from the previous year's PASA-Science assessment. Assessment items from each of the four domains were reviewed at this time. The final portion of the training involved alignment. Panelists were given step by step directions on how to complete their portion of the alignment study by using PASA-Science items that were not selected as assessment items or alternate science assessment anchors that were not approved by the PASA leadership team. During this part of the training, the panelists were divided by groups and practiced using the rating scales and Likert scales they would be expected to use during their homework. At that time, the presenter walked around to address any questions the panelists had while they were participating in these practice exercises. Following the practice exercises, participants for questions #1 - #4 were given their materials, a CD with the assessment rating scales, and directions for completing their assignments. The training concluded with a review of the documents they received, how to complete the assessment ratings using their CD, and instructions on how to email the items back to the primary researcher. A final timeline was provided to the participants for the completion of the alignment review and instructions for when all of the ratings and materials needed to be returned to the PASA team. The PowerPoint® training for the university level faculty can be found in Appendix A. The PowerPoint® training for the special education and science education teachers can be found in Appendix B.

Since the PASA team did not have access to students' home addresses, all correspondence for research question #5 was done through the teachers. The test administrators were mailed a letter explaining the survey, how to complete the survey themselves, and how to disseminate the surveys to the parents of specific students from his/her classroom. All of the

materials needed for each parent were enclosed in an envelope with the parent's name on the outside. Each envelope included a letter explaining the enclosed survey, why the information is needed, instructions on how to complete the survey, and an expected return date for the survey. The test administrators and parents were then asked to complete a survey which included the description of each assessment item from a specific grade (4, 8, 11) and test level (A, B, C). Test administrators and parents were asked to rate the importance of each item using a 4-point rating scale ranging from very important to not really important. After completion of the surveys, participants were instructed to use the self addressed envelope to mail all of the surveys back to the PASA leadership team. In order to accurately identify and separate parent surveys from test administrator surveys, different colored ink was used on the self-addressed stamped envelopes. Parent surveys were returned in envelopes with black ink while test administrator surveys were returned in envelopes with blue ink.

4.4 DATA COLLECTION

The data collection procedures used to address research questions #1, #2, and #3 were adapted from the Links for Academic Learning (LAL) created and reviewed by Flowers et al. (2007). Participants completing research question #1 completed an Excel™-based file to enter their data. A sample 4th grade Excel™ file can be found in Appendix C. All data files for research question #1 included the grade and the corresponding alternate assessment anchors. Participants were asked to rate whether or not a link was found between the alternate assessment anchor and a regular assessment anchor. If the participant responded that there was a link between the alternate science assessment anchor and the regular assessment anchor, he/she then identified the

major area category of the corresponding regular assessment anchor, the anchor domain, and the domain strand. Participants in research question #1 continued this process until all of the alternate science assessment anchors have been reviewed for grades 4, 8, and 11.

Participants completing research questions #2 - #4 also completed an Excel™-based file to enter their data. A sample 4th grade level A Excel™ file can be found in Appendix D. All data files for research questions #2 - #4 included the grades 4, 8, and 11, assessment levels A, B, and C, a description of the individual assessment items, and the alternate eligible content link. Participants were asked to review the assessment items and determine whether each item is considered science using the definitions provided at training. If the participant determined that the skill is not science, the participant then determined whether or not the assessment item is considered a foundational skill using the definition provided at training. For all of the items rated as science, participants then determined if there was a link between the individual assessment items and the alternate science eligible content. He/she determined the level of content centrality by using the 3-point Likert scale rating (near link, far link, no link) reviewed in the training. Flowers et al. (2007) defined the near link as, "the standard is specific and the item clearly measures the content" (p. 57); far link as, "the item measures has some of the original content standard" (p. 57); and no link as, "the item does not measure the standard" (p. 57). If the participant determined there was no link between the assessment item and the alternate eligible science content, he/she included the reason why there was no link by using the 3-point Likert scale rating (mismatched, overstretched, or backmapping) reviewed in the training. Flowers et al. (2007) defined mismatched as, "an error in identifying the correct standards" (p. 57); defined overstretched as, "the item has lost the intention meaning of the standard" (p. 57); and backmapping as, "fitting a functional activity to academic standards" (p. 57). Participants

continued this process for each assessment item for the grade and level they received until all items for that grade and level were completed.

The data collection for research question #5 involved completion of a hard copy survey by parents and teachers. A sample of a hard copy survey can be found in Appendix E. All participants for research question #5 were asked to read the assessment item and the description of the assessment item and rate the level of importance for students with significant disabilities using a 4-point Likert scale rating (very important, important, not important, really not important) introduced in the introduction letter. Participants were expected to review each assessment item for the grade and level assigned until all the items were rated.

4.5 DATA ANALYSIS

Since the design of research questions #1 - #4 are a modification of the design used in the Links for Academic Learning (Flowers et al., 2007), the data analysis used reflected their design. For a better understanding of which criteria from the Links for Academic Learning was used to design the research questions related to determining the alignment of the PASA-Science, Table 4 lists all eight criteria that is included in the Links of Academic Learning and the PASA-Science alignment research questions. For each of the above research questions, Flowers et al. (2007) used descriptive statistics to measure achievement of the eight criteria within their model. All summary data will be presented in table form.

Table 4: Comparison of Links for Academic Learning Criteria and PASA-Science Research Questions

LINKS FOR ACADEMIC LEARNING	PASA-SCIENCE ALIGNMENT STUDY RESEARCH QUESTIONS
CRITERION 1: The content is academic and includes the major domains/strands of the content area as reflected in state and national standards.	Research Question 1: Are the Pennsylvania Alternate Science Anchors linked to the Pennsylvania Science Anchors? Research Question 2: Are the PASA-Science assessment items science?
Criterion 2: The content is referenced to the student's assigned grade level (based on chronological age).	
Criterion 3: The focus of achievement maintains fidelity with the content of the original grade level standards (content centrality) and when possible, the specified performance.	Research Question 3: Are the PASA-Science assessment items linked with the Pennsylvania Alternate Science Eligible Content? Research Question 4: Do the PASA-Science assessment items demonstrate content centrality?
Criterion 4: The content differs from grade level in range, balance, and depth of knowledge, but matches high expectations set for students with significant disabilities.	
Criterion 5: there is some differentiation in content across grade levels or grade bands.	
Criterion 6: The expected achievement for students is for the students to show learning of grade referenced academic content.	
Criterion 7: The potential barriers to demonstrating what students know and can do are minimized in the assessment.	
Criterion 8: The instruction program promotes learning in the general curriculum.	

Research Question 1: Are the Pennsylvania Alternate Science Anchors linked to the Pennsylvania Regular Education Science Anchors?

Data analysis involved the use of descriptive statistics to determine the number and percentage of alternate assessment anchors linked to the regular education science assessment anchors by domain. The compiled data was used to answer the question about how closely the alternate science assessment anchors link to the regular education science assessment anchors for each category identified within the anchors. Although not a specific research question, the surveys also provided information regarding the identified link between the alternate science assessment anchors and the regular education science assessment anchors. This information was used to determine if there was agreement between the identified regular education science assessment anchor by the PASA team and the seven content experts.

Research Question 2: Are the PASA-Science assessment items science?

Descriptive statistics provided a summary of the number and percentage of the PASA-Science assessment items rated as science or foundational skills. The descriptive data collected in these tables were used to determine the extent to which the *PASA*-Science assessment items are measuring academic science content.

Research Question 3: Are the PASA-Science assessment items linked with the Pennsylvania Alternate Science Eligible Content?

Descriptive statistics were also used to present the link between individual PASA-Science items and the corresponding alternate science eligible content. These data were used to determine the percentage of items rated as 'linked' by grade and by level. The information collected about whether an item is linked to the alternate science eligible content was used to evaluate how closely the PASA-Science assessment items can be identified in the alternate

science eligible content. By included this data, the PASA team was able to determine whether assessment items are measuring performance on specific alternate science eligible content.

Research Question 4: Do the PASA-Science assessment items demonstrate content centrality?

Descriptive statistics were used to provide a summary of the content centrality of the individual PASA-Science items to the corresponding alternate science eligible content. These statistics were used to determine the percentage of items rated in content centrality by grade and by level. The information collected about content centrality was used to evaluate how closely the PASA-Science assessment items are actually measuring the alternate science eligible content. By determining this, the PASA team was able to evaluate whether assessment items are measuring performance on specific alternate science eligible content and are a true representation of student understanding of the science concepts.

An additional summary of the possible reasons why science assessment items at different grade levels and test levels did not meet content centrality has also been included. The information collected about reasons why assessment items did not meet content centrality may be used to evaluate how items may need to be revised for future assessments.

Research Question 5: Is the science content assessed in the PASA-Science educationally valid for students with significant cognitive disabilities in grades 4, 8, and 11?

Data analysis included the use of descriptive statistics similar to those used during the 2008 fall pilot PASA-Science study. The rating of importance for each PASA-Science assessment item was summarized as the percentage of participants and the level of importance by assessment item domain, grade level, and assessment level. This information may assist the PASA team in determining what content may be most likely taught within the classroom and what content may not be covered. By having parents and teachers rate their preferences, the

PASA team may use this information to determine which of the alternate science assessment anchors and alternate science eligible content, if any, may need additional support to ensure skills addressing these anchors are being taught in classrooms across the state.

5.0 RESULTS

5.1 ANALYSIS OF DATA REGARDING RESEARCH QUESTION 1: COMPARISON OF ALTERNATE SCIENCE ASSESSMENT ANCHORS TO REGULAR EDUCATION SCIENCE ASSESSMENT ANCHORS

Research Question 1: Are the Pennsylvania Alternate Science Anchors linked to the Pennsylvania Science Anchors?

The following results reflect the ratings of the seven university faculty and their decisions on whether or not the alternate science assessment anchors are linked to the regular education science assessment anchors, and show the number of panelists who matched the category (i.e. Nature of Science, Biological Science, Physical Science, and Earth and Space Sciences) and anchor domain (e.g. Reason and Analysis, Procedures and Tools for Science Investigation, etc.) the PASA team classified the alternate science anchors.

Of the 11 grade 4 alternate science assessment anchors, eight of the alternate anchors were identified by all seven faculty as being linked to the grade 4 regular education science assessment anchors. All three alternate science assessment anchors that did not have complete agreement were within the Biological Sciences. Even though there was not agreement between all seven faculty, the majority of the faculty classified the alternate science anchors as linked to the regular education science anchors. The alternate assessment anchor identified the most as

not possessing a link was ‘identifying/describing edible and non-edible things in the environment.’ When comparing the agreement between the faculty placement in the science category and anchor domain and the PASA team, 100% agreement was found on eight of the 11 alternate anchors. In one instance, no faculty member matched the PASA team on the categorization of the alternate anchor related to change in natural or human-made systems. It should be noted that five of the seven faculty did identify the same science category as the PASA team. All information related to the grade 4 alternate science assessment anchors is presented in Table 5.

All seven reviewers agreed that eight out of the 11 alternate science assessment anchors in grade 8 were linked to the regular education science anchors. Alternate anchors that were not identified by all faculty as possessing a link to the regular education standards were within the Biological Sciences category. However, two of those alternate science anchors were identified as linked to the regular assessment science anchors by the majority of the faculty. The only alternate anchor with less than half of the faculty identifying a link to the regular education anchors was ‘identifying/describing the effects of improper food handling, preparation, and food storage on the safety of foods.’ For this alternate anchor, only three faculty determined there was a link to the regular education anchors. When comparing the agreement between the faculty placement in the science category and anchor domain and the PASA team, 100% agreement was found on eight of the 11 alternate anchors. Although an exact match was not identified in all of the alternate assessment science anchors, there were still agreements in some of the science categories. For example, the one faculty member that did not match the PASA team on the alternate anchor related to relationships among and between organisms did at least identify the alternate anchor as Biological Sciences. A similar pattern was found for the alternate anchor

Table 5 Grade 4 Alternate Science Assessment Anchors Linked to Regular Science Assessment Anchors and Agreement of Anchor Domain between Reviewers and PASA Team

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Nature of Science				
Identify appropriate instruments for a specific task.	7	100	7	100
Describe change in natural or human-made system.	7	100	0	0
Biological Sciences				
Identify characteristics and needs of living things.	6	86	6	100
Identify living and nonliving things in the environment.	7	100	7	100
Identify routines related to different seasonal time periods.	5	71	5	80
Identify/Describe the source/effects of pollution in the community.	7	100	7	100
Identify/Describe edible and non-edible things in the environment.	4	57	2	50

Table 5 (continued)

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
		Physical Sciences		
Describe observable physical properties of matter.	7	100	7	100
Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.	7	100	7	100
		Earth and Space Sciences		
Identify the types and uses of Earth's resources.	7	100	7	100
Identify basic weather conditions.	7	100	7	100

Note. The number and percentage of reviewers with an exact match of alternate assessment anchor domain to the PASA team was based on the number of reviewers who identified a link to the regular education science assessment anchors.

related to food safety. One of the faculty that did not match identified the alternate anchor to be within Biological Science. All information related to the grade 8 alternate science assessment anchors is presented in Table 6.

All of the faculty identified nine of the 11 alternate science assessment anchors as possessing a link to the regular education science standards at grade 11. Of the two remaining alternate anchors, it should be noted that six out of seven faculty identified a link for the alternate anchor related to how human-made systems impact the ecosystem. Just as was found in grade 4 and grade 8, the alternate assessment anchor related to food safety had the most faculty determining that there was no link to the regular education anchors. In this case, only one faculty member determined that the food safety anchor at grade 11 possessed a link to the regular education anchors. When comparing the agreement between the faculty placement in the science category and anchor domain and the PASA team, 100% agreement was found on eight of the 11 alternate anchors. Although no match was identified for the alternate assessment science anchor involving structural or functional similarities and differences among living things, all seven faculty did identify the same general category, Biological Sciences, as the PASA team. Albeit a small number of instances, the two remaining alternate anchors that did not match the anchor domain identified by the PASA team also did not match the general science category identified by the PASA team. All information related to the grade 11 alternate science assessment anchors is presented in Table 7.

Table 6 Grade 8 Alternate Science Assessment Anchors Linked to Regular Science Assessment Anchors and Agreement of Anchor Domain between Reviewers and PASA Team

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Nature of Science				
Identify appropriate instruments for a specific purpose and describe how technology extends human abilities.	7	100	7	100
Describe the parts of a simple system, their roles, and their relationships to the system as a whole.	7	100	7	100
Biological Sciences				
Identify and describe structural characteristics of living things and their diverse needs for survival.	7	100	7	100
Identify the relationships among and between organisms in different groups.	7	100	6	86
Identify/Describe characteristics of different seasonal time periods.	4	57	2	50

Table 6 (continued)

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Describe the effects of pollution on humans and wildlife within an ecosystem.	6	86	6	100
Identify/Describe the effects of improper food handling, preparation, and food storage on the safety of foods.	3	43	1	33.3
Physical Sciences				
Describe the observable physical properties and the structure of matter.	7	100	7	100
Describe the effect of multiple forces on the movement, speed, or direction of an object.	7	100	7	100
Earth and Space Sciences				
Describe the potential impact of human made processes on changes to Earth's resources.	7	100	7	100
Describe how atmospheric conditions affect regional weather or climate.	7	100	7	100

Note. The number and percentage of reviewers with an exact match of alternate assessment anchor domain to the PASA team was based on the number of reviewers who identified a link to the regular education science assessment anchors.

Table 7 Grade 11 Alternate Science Assessment Anchors Linked to Regular Science Assessment Anchors and Agreement of Anchor Domain between Reviewers and PASA Team

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Nature of Science				
Apply knowledge of scientific investigation to critique aspects of the experimental or design process.	7	100	7	100
Evaluate appropriate technologies for a specific purpose, or describe the information that an instrument can provide.	7	100	7	100
Identify the parts of a simple system, their roles and relationships to the system as a whole.	7	100	7	100
Biological Sciences				
Identify structural or functional similarities and differences among living things and compares their diverse needs for survival.	7	100	6	86

Table 7 (continued)

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Identify structural or functional similarities and differences among living things.	7	100	0	0
Describe how human-made systems impact an ecosystem.	6	86	6	100
Identify/Describe the safety of various foods based on handling, preparation, storage, and appearance.	1	14	1	100
Physical Sciences				
Describe the relationship between the structure and properties of matter.	7	100	7	100
Use the principles of motion and force to solve real world challenges.	7	100	7	100
Earth and Space Sciences				
Describe factors affecting availability, location, extraction, and use of natural resources.	7	100	6	86

Table 7 (continued)

Alternate science assessment anchors	Number of reviewers who linked alternate assessment anchors to regular education science anchors	Percentage of reviewers who rated link to regular education science anchors	Number of reviewers with exact match of alternate assessment anchor domain to PASA team	Percentage of reviewers with exact match of alternate assessment anchor domain to PASA team
Predict how the transfer of energy and substances between Earth's atmosphere and its surface influences regional weather.	7	100	7	100

Note. The number and percentage of reviewers with an exact match of alternate assessment anchor domain to the PASA team was based on the number of reviewers who identified a link to the regular education science assessment anchors.

5.2 ANALYSIS OF DATA REGARDING RESEARCH QUESTION 2: DETERMINING IF PASA-SCIENCE ASSESSMENT ITEMS ARE CONSIDERED SCIENCE

Research Question 2: Are the PASA-Science assessment items science?

Even though data tables for each grade level (4, 8, 11) and test level (A, B, C) have been created, all information will be summarized by grade level. The results reflect the ratings of the special education teachers and science education teachers and their decisions on whether or not the assessment items are considered science. The special education teachers and science education teachers rated an item as science if he/she determined the item can be defined by an alternate assessment anchor. (e.g., can the item 'selecting a part of a man-made system' be found in the alternate anchor 'describe change in natural or human-made systems'). If the special education teacher and/or science teacher determined the item was not defined by the alternate assessment anchor, he/she needed to determine whether or not the skill was considered a foundational skill. Almond et al. (2008) classified foundational skills as "important and appropriate to capture early academic achievement for some students with significant cognitive disabilities but are not considered aligned because they are outside the academic domain" (p.14). Skills such as turning a page would typically be considered a foundational skill.

A total of 63 unique assessment items from grade 4 were evaluated by a total of seven elementary special education teachers and science education teachers. Of those 63 assessment items, all but two assessment items were considered science by all seven of the teachers reviewing grade 4. One skill that was not considered science by the majority of the teachers was

orienting to materials. Orienting to materials was rated by 29% of the teachers as science while the remaining 71% rated the item as not science. The 71% of teachers who rated the item as not science also rated orients to materials as a foundational skill. It should be noted that orients to materials is only listed as an assessment item at all of the level A PASA-Science assessments. The other item not classified as science by all of the elementary teachers was related to selecting an ingredient in a food item. One teacher out of the seven classified this item as not science and a foundational item. Individual assessment items for grade 4 PASA-Science level A, level B, and level C are included in Tables 8, 9, and 10.

A total of 62 unique assessment items from grade 8 were evaluated by a total of five middle school special education teachers and science education teachers. Of those 62 assessment items, all but two assessment items were considered science by all five of the teachers reviewing grade 8. Just as was reported in grade 4, the majority of teachers reviewing grade 8 did not consider orienting to materials as science. Orienting to materials was rated by 20% of the teachers as science; however, only 20% of teachers that rated the item as not science also rated orients to materials as a foundational skill. The other item not classified as science by all of the middle school teachers was related to sorting objects into groups based on attributes. One teacher out of the five classified this item as not science and as a foundational item. Individual assessment items for the grade 8 PASA-Science level A, level B, and level C are included in Tables 11, 12, and 13.

Table 8 Percentage of Grade 4 Level A Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Orients			
Orients to materials	29	71	71
Nature of Science			
Selects tool used to complete a task	100	0	0
Selects object named that is part of a man-made system	100	0	0
Biological Sciences			
Selects food eaten by animals or people	100	0	0
Selects plant/animal with structure named	100	0	0
Selects picture of living/non-living thing	100	0	0
Selects object that is safe/unsafe to eat	100	0	0
Physical Sciences			
Matches 2 objects based on physical property	100	0	0
Selects object that is a solid or a liquid after hearing a sentence	100	0	0
Earth and Space Sciences			
Selects object that represents food	100	0	0
Selects object that can be recycled after listening to a sentence	100	0	0
Selects clothing/accessory worn when it is hot/cold	100	0	0
Selects picture of weather condition named	100	0	0
Selects weather symbol named on weather map	100	0	0
Matches weather symbols	100	0	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items.

Table 9 Percentage of Grade 4 Level B Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Selects most efficient/least efficient tool to complete a task	100	0	0
Selects picture of a part of a man-made system	100	0	0
Biological Sciences			
Selects picture of food required for the survival of an animal named	100	0	0
Selects picture of animal that requires a particular food for survival	100	0	0
Matches 4 pictures of food required for the survival of 4 animals	100	0	0
Selects structure used for a particular function	100	0	0
Selects picture of youngest/oldest plant, animal, or person	100	0	0
Select 1 living/non-living thing from a complex picture	100	0	0
Selects picture of activity commonly associated with the season named	100	0	0
Selects 2 examples of litter in a complex picture	100	0	0
Sorts 5 pictures of items that are safe/unsafe to eat	100	0	0
Physical Sciences			
Creates 1 group based on 1 attribute named from an initial set of 6 items	100	0	0
Selects picture of an object that is in a state of matter named	100	0	0
Selects photograph of ingredient in a food item presented in a photograph when ingredients maintain their appearance	86	14	14
Select picture of person exerting the most/least force to move an item	100	0	0
Selects fastest/slowest moving object/person from an 8-item display	100	0	0

Table 9 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Earth and Space Sciences			
Selects picture of unprocessed food that comes from a source named	100	0	0
Select 2 objects that are recycled together based on similar composition	100	0	0
Selects recyclable item from a complex picture	100	0	0
Selects picture of item that does not use electricity	100	0	0
Selects picture of person wearing clothing/accessories when it is warm/cold	100	0	0
Names weather condition described	100	0	0
Names meaning of weather symbol	100	0	0
Selects weather symbol missing from a map based on weather description	100	0	0
Selects picture of item worn under weather condition named	100	0	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items.

Table 10 Percentage of Grade 4 Level C Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Describes 1 difference between how 2 tools are used	100	0	0
Names 2 parts required to make a man-made system function	100	0	0
Biological Sciences			
Selects picture of an animal that can survive by satisfying basic need in an environment named	100	0	0
Describes 2 function of a structure	100	0	0
Sequences 4 stages in the life cycle of a plant, animal, or person	100	0	0
Selects 2 living/non-living things from a complex picture	100	0	0
Selects person dressed inappropriately for the season from a complex picture	100	0	0
Names 1 activity associated with a season named	100	0	0
Names 2 possible sources of pollution	100	0	0
Names 2 items that are safe/unsafe to eat	100	0	0
Physical Sciences			
Sorts 8 objects into 2 groups based on 1 attribute named	100	0	0
Names 2 examples of objects in a state of matter named	100	0	0
Names 2 ingredients used to make item pictured when ingredients maintain their appearance	100	0	0
Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	100	0	0
Selects picture of the mass, surface, or slope of an object that will make it the hardest/easiest to move an object	100	0	0

Table 10 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Selects the fastest/slowest moving object or person from a 10-item display	100	0	0
Earth and Space Sciences			
Selects unprocessed food in a photograph that comes from a source named	100	0	0
Creates 2 sets of photographs of objects that are recycled together based on similar composition	100	0	0
Describes 2 ways to conserve resources based on a particular scenario described and shown in a picture	100	0	0
Selects picture of item that does not use electricity	100	0	0
Names 2 pieces of clothing/accessories worn when it is hot/cold	100	0	0
Completes a description of weather condition be supplying a missing word in a sentence	100	0	0
Describes weather in two locations	100	0	0
Selects picture of location that is safest/most dangerous under weather condition named	100	0	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items.

Table 11 Percentage of Grade 8 Level A Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Orients			
Orients to materials	20	80	20
Nature of Science			
Selects picture of tool based on advantage named	100	0	0
Select object used to make a simple man-made system function	100	0	0
Biological Sciences			
Select picture of living organism that lives on land or in water	100	0	0
Selects picture of environment in which an organism lives	100	0	0
Selects picture of structure based on function	100	0	0
Selects picture of a member of a kingdom named	100	0	0
Select picture of food that requires refrigeration	100	0	0
Physical Sciences			
Matches 2 objects based on physical property	100	0	0
Selects picture of item that is frozen or has melted	100	0	0
Earth and Space Sciences			
Selects picture of source of food	100	0	0
Selects object that can be recycled based on composition named	100	0	0
Selects category of picture of recyclable object based on similar composition	100	0	0
Selects picture of clothing/accessory worn when it is warm/cool	100	0	0
Select weather symbol named	100	0	0
Selects weather symbol named on weather map	100	0	0

Note. A total of five teachers reviewed and rated the alternate science assessment items.

Table 12 Percentage of Grade 8 Level B Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Describes 1 advantage/disadvantage a new technology has over other tools that perform the same function	100	0	0
Selects picture of a part from a simple man-made system based on function named	100	0	0
Biological Sciences			
Selects picture of an environment required for the survival of an animal named	100	0	0
Names 2 structures used to accomplish a task	100	0	0
Selects picture of next stage of life cycle	100	0	0
Completes a graphic organizer of two kingdoms	100	0	0
Selects picture of season-neutral activity	100	0	0
Describes 1 effect of pollution on the environment	100	0	0
Describes 1 consequence of unsafe food handling practices	100	0	0
Physical Sciences			
Creates 1 group based on 2 attributes named	100	0	0
Select item from a complex photograph based on the possibility of change in physical matter described	100	0	0
Describes 1 reason for maintaining a constant temperature to preserve a state of matter	100	0	0
Selects photograph of ingredients in a food item presented in a photograph when ingredient don't maintain their appearance	100	0	0
Describes 1 reason for a problem in a scenario involving weight and force	100	0	0
Selects moving object/person that will arrive first/last from a 10-item display	100	0	0

Table 12 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Earth and Space Sciences			
Selects picture of source of processed food/product named	100	0	0
Matches 4 pictures of processed food/product with each of its source	100	0	0
Selects 2 items that can be recycled from a photograph	100	0	0
Describes 1 way to conserve	100	0	0
Selects picture of person wearing clothing/accessories for a temperature named and shown	100	0	0
Names extreme weather condition described	100	0	0
Selects weather symbol by making prediction based on current weather and trend	100	0	0
Selects picture of location that is the safest/most dangerous under weather condition named	100	0	0

Note. A total of five teachers reviewed and rated the alternate science assessment items.

Table 13 Percentage of Grade 8 Level C Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Names 1 advantage/disadvantage of a new technology	100	0	0
Describes function of a part from a simple man-made system	100	0	0
Biological Sciences			
Describe 1 effect that habitat destruction has on the acquisition of basic needs	100	0	0
Names 2 structures required to accomplish a task	100	0	0
Sequences 4 stages in the life cycle	100	0	0
Completes a graphic organizer of 5 classes	100	0	0
Describes 2 characteristics of a season that permits activity named	100	0	0
Describes 1 effect of pollution on wildlife	100	0	0
Describes 1 unsafe food handling/preparation practice in scenario described	100	0	0
Physical Sciences			
Sorts 6 objects into 3 groups based on 2 attributes named	80	20	20
Describes 1 reason an item remains in the same state of matter	100	0	0
Names 2 ingredients used to make item pictured when ingredients don't maintain their appearance	100	0	0
Names item that can be prepared with the ingredients in the photographs	100	0	0
Describes 1 reason for the difference in the force exerted to move an object	100	0	0
Selects moving object/person that traveled the longest/shortest distance from a 15-item display	100	0	0

Table 13 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Selects the fastest/slowest moving object/person from a 15-item display	100	0	0
Earth and Space Sciences			
Names primary ingredient in processed food	100	0	0
Sorts 9 photographs of recyclable and non-recyclable objects into 4 disposable categories	100	0	0
Select picture of person using the most/least amount of a resource	100	0	0
Names 1 clothing/accessory that should be worn in temperature named and shown	100	0	0
Selects word that describes weather condition	100	0	0
Selects area on a weather map based on information within the map legend	100	0	0
Names 2 precautions to take under weather condition named	100	0	0

Note. A total of five teachers reviewed and rated the alternate science assessment items.

A total of 63 unique assessment items from grade 11 were evaluated by a total of six high school special education teachers and science education teachers. Of those 63 assessment items, all but two assessment items were considered 'science' by all six of the teachers reviewing grade 11. Just as was reported in grade 4 and grade 8, orienting to materials was not considered science. Unlike grade 4 and grade 8 though, none of the teachers evaluating the grade 11 assessment items considered orienting to materials science. Instead, all of the teachers rated orienting as not science and as a foundational skill. The other item not to be classified as science by all of the high school teachers was related to identifying foods based on dietary restrictions. One teacher out of the six classified this item as not science and did not classify the item as a foundational item. Individual assessment items for the grade 11 PASA-Science level A, level B, and level C are included in Tables 14, 15, and 16.

5.3 ANALYSIS OF DATA REGARDING RESEARCH QUESTION 3: DETERMINING IF PASA-SCIENCE ASSESSMENT ITEMS ARE LINKED TO ALTERNATE SCIENCE ELIGBILE CONTENT

Research Question 3: Are the PASA-Science assessment items linked with the Pennsylvania Alternate Science Eligible Content?

Data tables for each grade level (4, 8, 11) and test level (A, B, C) have been created to summarize whether or not the special education teachers and science education teachers determined each assessment item linked with the alternate science eligible content. The same special education teachers and science education teachers who determined whether or not the assessment items for grades 4, 8, and 11 were science also determined whether or not the

Table 14 Percentage of Grade 11 Level A Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Orients			
Orients to materials	0	100	100
Nature of Science			
Selects tallest/shortest bar described on bar graph	100	0	0
Matches trendlines	100	0	0
Selects most recent innovation in technology from choices that all perform same basic function	100	0	0
Selects picture of a part of a man-made system that will solve a problem described	100	0	0
Biological Sciences			
Select picture of shelter for an animal named	100	0	0
Selects picture of an animal that lives in a place named	100	0	0
Selects picture of a structure used for a similar function in another animal or person	100	0	0
Selects member of a class named	100	0	0
Select picture of food that is safe/unsafe to eat	100	0	0
Physical Sciences			
Selects object based on 2 attributes named	100	0	0
Selects picture of item that will/will not melt	100	0	0
Earth and Space Sciences			
Selects picture of source of product named	100	0	0
Selects picture of clothing/accessory that should be worn in temperature named	100	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items.

Table 15 Percentage of Grade 11 Level B Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Selects value described on the y-axis of a bar graph	100	0	0
Selects the category on the x-axis based on data from the y-axis of a bar graph	100	0	0
Selects biggest/smallest value on a line graph with numbers	100	0	0
Selects value described on the y-axis of a line graph	100	0	0
Selects the category on the x-axis based on data from the y-axis of a line graph	100	0	0
Selects 2 values described on a line graph	100	0	0
Names 1 consequence of a new technology	100	0	0
Describes 1 solution to a problem with a simple man-made system	100	0	0
Biological Sciences			
Describes 2 advantages/disadvantages of one environment over another for survival of a specific species	100	0	0
Names structure and its function in the accomplishment of a task named	100	0	0
Completes a graphic organizer of 4 classes when pictures of species are shown	100	0	0
Describes 1 effect of pollution on living things in the scenario described	100	0	0
Selects picture of food that is safe to eat based on expiration date	100	0	0
Describes 1 reason for using safe food handling practices	100	0	0
Describes 1 way to determine whether food is unsafe to eat	100	0	0
Physical Sciences			
Selects object based on 3 attributes named	100	0	0

Table 15 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Sequences changes in states of matter as a function of temperature	100	0	0
Selects photograph of item that can be prepared with 3 ingredients	100	0	0
Describes 1 solution to a problem in a scenario involving weight and force after one attempt to move the item failed	100	0	0
Selects the fastest/slowest moving object /person from a 15-item display	100	0	0
Earth and Space Sciences			
Selects picture of source of processed food/product named	100	0	0
Describes 1 effect of conservation effort on the environment	100	0	0
Complete a table showing people wearing different clothing/accessories by matching temperatures	100	0	0
Locates day in which the described activity is most/least appropriate given a 5-day weather forecast	100	0	0
Selects picture of person engaged in action that is safest/most dangerous under weather condition described	100	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items.

Table 16 Percentage of Grade 11 Level C Alternate Science Assessment Items Classified as Science, Foundational, or Not Science

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Nature of Science			
Selects data point described on a bar graph	100	0	0
Selects interval in which change in data described occurred	100	0	0
Identifies trend on a line graph	100	0	0
Calculates the difference in 2 values on a line graph	100	0	0
Makes prediction using a line graph	100	0	0
Selects missing value based on interpretation/extrapolation on a line graph	100	0	0
Names 1 consequence of a new technology	100	0	0
Describes 2 possible problems with a simple man-made system when 1 problem has been eliminated	100	0	0
Biological Sciences			
Sorts pictures of animals in 4 habitats	100	0	0
Describes 1 similarity in the function of different structures between 2 species	100	0	0
Completes a graphic organizer of kingdom, class, and species	100	0	0
Describes 2 effects of human activity on the environment	100	0	0
Describes function of expiration date	100	0	0
Physical Sciences			
Sorts 7 objects into 2 groups based on new attribute after items are presorted	100	0	0
Select picture of item heated/cooled the longest/shortest amount of time	100	0	0
Describe the change in state of matter in a scenario described involving changes in temperature	100	0	0
Selects food based on dietary restrictions	83	0	0

Table 16 (continued)

	Percentage who rated item as science	Percentage who rated item as not science	Percentage who rated item as foundational
Describes 1 solution to a problem in a scenario involving weight and force after two attempts to move the item failed	100	0	0
Calculates missing value of the distance traveled based on a 20-item display	100	0	0
Earth and Space Sciences			
Orders 5 pictures based on the manufacturing process	100	0	0
Describes 1 environmental reason for using one of the 2 pictured options	100	0	0
Names 1 clothing/accessory that should be worn at 1 temperature named and shown but not at another temperature named and shown	100	0	0
Locates day in which the weather condition described is most/least likely to occur given a 5-day forecast with percent probability shown on display	100	0	0
Selects word for a weather condition under which described precautions are most appropriate	100	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items.

assessment items were linked to the alternate eligible content. The results presented reflect the ratings of the special education teachers and science education teachers and their decisions on whether or not the assessment items are linked to the alternate science eligible content. The only assessment items that were measured were those items each individual classified as science. Summary data provided in the tables includes the number of teachers who classified the item as science and the percentages of raters who rated the item as being linked or not linked to the alternate science eligible content.

Although there were two items some individual scorers did not classify as science, all grade 4 assessment items were included in the tables since at least one teacher classified every grade 4 assessment item as science. A total of 63 assessment items from grade 4 were evaluated. Of those 63 assessment items, all but five assessment items were considered to be linked to the alternate science eligible content by those teachers who considered the item science. One assessment item that was not considered linked by a teacher involved selecting food eaten by animals or people. For that particular item six people originally classified that skill as science, but one teacher determined there was no link for that assessment item. Another item that was determined not to be linked by all of the teachers involved selecting a picture of an item that doesn't use electricity. All seven teachers classified this item as science, but only five of the seven teachers classified the item as linked. The third assessment item not considered linked involved selecting the person dressed inappropriately for the season. Only six out of seven teachers considered this assessment item linked to the alternate science eligible content. The fourth assessment item not considered linked by all of the teachers involved naming two ingredients used to make an item pictured. Five out of the seven teachers determined there was a link to the alternate science eligible content. The final assessment item not considered linked

also involved ingredients. Of the seven teachers that classified this item as science, only six out of seven teachers felt the item was linked. The summary of assessment items linked for grade 4 PASA-Science level A, level B, and level C are included in Tables 17, 18, and 19.

Although there were two items some individual scorers did not classify as science, all grade 8 assessment items were included since at least one teacher classified every grade 8 assessment item as science. A total of 62 assessment items from grade 8 were classified as science. Of those 62 assessment items, all but one assessment item was considered to be linked to the alternate science eligible content by those teachers that considered the item science. The only assessment item that was not considered linked was orients to materials. Although the teacher rated the item as science, the teacher didn't rate the item as linked to the alternate science eligible content. However, the teacher did not rate the item as not linked either, so it was treated as a non-response for that item. All other assessment items in grade 8 were considered linked to the alternate science eligible content. The summary of assessment items linked for grade 8 PASA-Science level A, level B, and level C are included in Tables 20, 21, and 22.

Not all of the grade 11 assessment items were included in the linked or not linked rating since no teachers classified orienting to materials at grade 11 as science. As a result, a total of 62 assessment items from grade 11 were evaluated. Of those 62 assessment items, only one item was not rated as linked to the alternate science eligible content by all of the high school teachers. The only assessment item not considered linked by all of teachers involved selecting food based on dietary restrictions. For that particular item five people originally classified that skill as science, and two of the teachers determined there was no link for that assessment item. The summary of assessment items linked for grade 11 PASA-Science level A, level B, and level C are included in Tables 23, 24, and 25.

Table 17 Percentage of Grade 4 Level A Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Orients			
Orients to materials	2	100	0
Nature of Science			
Selects tool used to complete a task	7	100	0
Selects object named that is part of a man-made system	7	100	0
Biological Sciences			
Selects food eaten by animals or people	6	83	17
Selects plant/animal with structure named	7	100	0
Selects picture of living/non-living thing	7	100	0
Selects object that is safe/unsafe to eat	7	100	0
Physical Sciences			
Matches 2 objects based on physical property	7	100	0
Selects object that is a solid or a liquid after hearing a sentence	7	100	0
Earth and Space Sciences			
Selects object that represents food	7	100	0
Selects object that can be recycled after listening to a sentence	7	100	0
Selects clothing/accessory worn when it is hot/cold	7	100	0
Selects picture of weather condition named	7	100	0
Selects weather symbol named on weather map	7	100	0
Matches weather symbols	7	100	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 18 Percentage of Grade 4 Level B Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Selects most efficient/least efficient tool to complete a task	7	100	0
Selects picture of a part of a man-made system	7	100	0
Biological Sciences			
Selects picture of food required for the survival of an animal named	7	100	0
Selects picture of animal that requires a particular food for survival	7	100	0
Matches 4 pictures of food required for the survival of 4 animals	7	100	0
Selects structure used for a particular function	7	100	0
Selects picture of youngest/oldest plant, animal, or person	7	100	0
Select 1 living/non-living thing from a complex picture	7	100	0
Selects picture of activity commonly associated with the season named	7	100	0
Selects 2 examples of litter in a complex picture	7	100	0
Sorts 5 pictures of items that are safe/unsafe to eat	7	100	0
Physical Sciences			
Creates 1 group based on 1 attribute named from an initial set of 6 items	7	100	0
Selects picture of an object that is in a state of matter named	7	100	0
Selects photograph of ingredient in a food item presented in a photograph when ingredients maintain their appearance	6	100	0
Select picture of person exerting the most/least force to move an item	7	100	0

Table 18 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Selects fastest/slowest moving object/person from an 8-item display	7	100	0
Earth and Space Sciences			
Selects picture of unprocessed food that comes from a source named	7	100	0
Select 2 objects that are recycled together based on similar composition	7	100	0
Selects recyclable item from a complex picture	7	100	0
Selects picture of item that does not use electricity	7	71	29
Selects picture of person wearing clothing/accessories when it is warm/cold	7	100	0
Names weather condition described	7	100	0
Names meaning of weather symbol	7	100	0
Selects weather symbol missing from a map based on weather description	7	100	0
Selects picture of item worn under weather condition named	7	100	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 19 Percentage of Grade 4 Level C Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Describes 1 difference between how 2 tools are used	7	100	0
Names 2 parts required to make a man-made system function	7	100	0
Biological Sciences			
Selects picture of an animal that can survive by satisfying basic need in an environment named	7	100	0
Describes 2 function of a structure	7	100	0
Sequences 4 stages in the life cycle of a plant, animal, or person	7	100	0
Selects 2 living/non-living things from a complex picture	7	100	0
Selects person dressed inappropriately for the season from a complex picture	7	86	14
Names 1 activity associated with a season named	7	100	0
Names 2 possible sources of pollution	7	100	0
Names 2 items that are safe/unsafe to eat	7	100	0
Physical Sciences			
Sorts 8 objects into 2 groups based on 1 attribute named	7	100	0
Names 2 examples of objects in a state of matter named	7	100	0
Names 2 ingredients used to make item pictured when ingredients maintain their appearance	7	71	29
Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	7	86	14
Selects picture of the mass, surface, or slope of an object that will make it the hardest/easiest to move an object	7	100	0

Table 19 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Selects the fastest/slowest moving object or person from a 10-item display	7	100	0
Earth and Space Sciences			
Selects unprocessed food in a photograph that comes from a source named	7	100	0
Creates 2 sets of photographs of objects that are recycled together based on similar composition	7	100	0
Describes 2 ways to conserve resources based on a particular scenario described and shown in a picture	7	100	0
Names 2 pieces of clothing/accessories worn when it is hot/cold	7	100	0
Completes a description of weather condition be supplying a missing word in a sentence	7	100	0
Describes weather in two locations	7	100	0
Selects picture of location that is safest/most dangerous under weather condition named	7	100	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 20 Percentage of Grade 8 Level A Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Orients			
Orients to materials	1	0	0
Nature of Science			
Selects picture of tool based on advantage named	5	100	0
Select object used to make a simple man-made system function	5	100	0
Biological Sciences			
Select picture of living organism that lives on land or in water	5	100	0
Selects picture of environment in which an organism lives	5	100	0
Selects picture of structure based on function	5	100	0
Selects picture of a member of a kingdom named	5	100	0
Select picture of food that requires refrigeration	5	100	0
Physical Sciences			
Matches 2 objects based on physical property	5	100	0
Selects picture of item that is frozen or has melted	5	100	0
Earth and Space Sciences			
Selects picture of source of food	5	100	0
Selects object that can be recycled based on composition named	5	100	0
Selects category of picture of recyclable object based on similar composition	5	100	0
Selects picture of clothing/accessory worn when it is warm/cool	5	100	0
Select weather symbol named	5	100	0

Table 20 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Selects weather symbol named on weather map	5	100	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 21 Percentage of Grade 8 Level B Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Describes 1 advantage/disadvantage a new technology has over other tools that perform the same function	5	100	0
Selects picture of a part from a simple man-made system based on function named	5	100	0
Biological Sciences			
Selects picture of an environment required for the survival of an animal named	5	100	0
Names 2 structures used to accomplish a task	5	100	0
Selects picture of next stage of life cycle	5	100	0
Completes a graphic organizer of two kingdoms	5	100	0
Selects picture of season-neutral activity	5	100	0
Describes 1 effect of pollution on the environment	5	100	0
Describes 1 consequence of unsafe food handling practices	5	100	0
Physical Sciences			
Creates 1 group based on 2 attributes named	5	100	0
Select item from a complex photograph based on the possibility of change in physical matter described	5	100	0
Describes 1 reason for maintaining a constant temperature to preserve a state of matter	5	100	0
Selects photograph of ingredients in a food item presented in a photograph when ingredient don’t maintain their appearance	5	100	0
Describes 1 reason for a problem in a scenario involving weight and force	5	100	0
Selects moving object/person that will arrive first/last from a 10-item display	5	100	0

Table 21 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Earth and Space Sciences			
Selects picture of source of processed food/product named	5	100	0
Matches 4 pictures of processed food/product with each of its source	5	100	0
Selects 2 items that can be recycled from a photograph	5	100	0
Describes 1 way to conserve	5	100	0
Selects picture of person wearing clothing/accessories for a temperature named and shown	5	100	0
Names extreme weather condition described	5	100	0
Selects weather symbol by making prediction based on current weather and trend	5	100	0
Selects picture of location that is the safest/most dangerous under weather condition named	5	100	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 22 Percentage of Grade 8 Level C Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Names 1 advantage/disadvantage of a new technology	5	100	0
Describes function of a part from a simple man-made system	5	100	0
Biological Sciences			
Describe 1 effect that habitat destruction has on the acquisition of basic needs	5	100	0
Names 2 structures required to accomplish a task	5	100	0
Sequences 4 stages in the life cycle	5	100	0
Completes a graphic organizer of 5 classes	5	100	0
Describes 2 characteristics of a season that permits activity named	5	100	0
Describes 1 effect of pollution on wildlife	5	100	0
Describes 1 unsafe food handling/preparation practice in scenario described	5	100	0
Physical Sciences			
Sorts 6 objects into 3 groups based on 2 attributes named	4	100	0
Describes 1 reason an item remains in the same state of matter	5	100	0
Names 2 ingredients used to make item pictured when ingredients don’t maintain their appearance	5	100	0
Names item that can be prepared with the ingredients in the photographs	5	100	0
Describes 1 reason for the difference in the force exerted to move an object	5	100	0

Table 22 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Selects moving object/person that traveled the longest/shortest distance from a 15-item display	5	100	0
Selects the fastest/slowest moving object/person from a 15-item display	5	100	0
Earth and Space Sciences			
Names primary ingredient in processed food	5	100	0
Sorts 9 photographs of recyclable and non-recyclable objects into 4 disposable categories	5	100	0
Select picture of person using the most/least amount of a resource	5	100	0
Names 1 clothing/accessory that should be worn in temperature named and shown	5	100	0
Selects word that describes weather condition	5	100	0
Selects area on a weather map based on information within the map legend	5	100	0
Names 2 precautions to take under weather condition named	5	100	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 23 Percentage of Grade 11 Level A Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Orients			
Orients to materials	0	0	0
Nature of Science			
Selects tallest/shortest bar described on bar graph	6	100	0
Matches trendlines	6	100	0
Selects most recent innovation in technology from choices that all perform same basic function	6	100	0
Selects picture of a part of a man-made system that will solve a problem described	6	100	0
Biological Sciences			
Select picture of shelter for an animal named	6	100	0
Selects picture of an animal that lives in a place named	6	100	0
Selects picture of a structure used for a similar function in another animal or person	6	100	0
Selects member of a class named	6	100	0
Select picture of food that is safe/unsafe to eat	6	100	0
Physical Sciences			
Selects object based on 2 attributes named	6	100	0
Selects picture of item that will/will not melt	6	100	0
Earth and Space Sciences			
Selects picture of source of product named	6	100	0
Selects picture of clothing/accessory that should be worn in temperature named	6	100	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 24 Percentage of Grade 11 Level B Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Selects value described on the y-axis of a bar graph	6	100	0
Selects the category on the x-axis based on data from the y-axis of a bar graph	6	100	0
Selects biggest/smallest value on a line graph with numbers	6	100	0
Selects value described on the y-axis of a line graph	6	100	0
Selects the category on the x-axis based on data from the y-axis of a line graph	6	100	0
Selects 2 values described on a line graph	6	100	0
Names 1 consequence of a new technology	6	100	0
Describes 1 solution to a problem with a simple man-made system	6	100	0
Biological Sciences			
Describes 2 advantages/disadvantages of one environment over another for survival of a specific species	6	100	0
Names structure and its function in the accomplishment of a task named	6	100	0
Completes a graphic organizer of 4 classes when pictures of species are shown	6	100	0
Describes 1 effect of pollution on living things in the scenario described	6	100	0
Selects picture of food that is safe to eat based on expiration date	6	100	0
Describes 1 reason for using safe food handling practices	6	100	0
Describes 1 way to determine whether food is unsafe to eat	6	100	0

Table 24 (continued)

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Physical Sciences			
Selects object based on 3 attributes named	6	100	0
Sequences changes in states of matter as a function of temperature	6	100	0
Selects photograph of item that can be prepared with 3 ingredients	6	100	0
Describes 1 solution to a problem in a scenario involving weight and force after one attempt to move the item failed	6	100	0
Selects the fastest/slowest moving object /person from a 15-item display	6	100	0
Earth and Space Sciences			
Selects picture of source of processed food/product named	6	100	0
Describes 1 effect of conservation effort on the environment	6	100	0
Complete a table showing people wearing different clothing/accessories by matching temperatures	6	100	0
Locates day in which the described activity is most/least appropriate given a 5-day weather forecast	6	100	0
Selects picture of person engaged in action that is safest/most dangerous under weather condition described	6	100	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

Table 25 Percentage of Grade 11 Level C Alternate Science Assessment Items Classified as Linked or Not Linked

	Number who rated item as science	Percentage who classified item as linked	Percentage who classified item as not linked
Nature of Science			
Selects data point described on a bar graph	6	100	0
Selects interval in which change in data described occurred	6	100	0
Identifies trend on a line graph	6	100	0
Calculates the difference in 2 values on a line graph	6	100	0
Makes prediction using a line graph	6	100	0
Selects missing value based on interpretation/extrapolation on a line graph	6	100	0
Names 1 consequence of a new technology	6	100	0
Describes 2 possible problems with a simple man-made system when 1 problem has been eliminated	6	100	0
Biological Sciences			
Sorts pictures of animals in 4 habitats	6	100	0
Describes 1 similarity in the function of different structures between 2 species	6	100	0
Completes a graphic organizer of kingdom, class, and species	6	100	0
Describes 2 effects of human activity on the environment	6	100	0
Describes function of expiration date	6	100	0
Physical Sciences			
Sorts 7 objects into 2 groups based on new attribute after items are presorted	6	100	0
Select picture of item heated/cooled the longest/shortest amount of time	6	100	0
Describe the change in state of matter in a scenario described involving changes in temperature	6	100	0

Table 25 (continued)

	Number of raters who rated item as science	Percentage of raters who classified item as linked	Percentage of raters who classified item as not linked
Selects food based on dietary restrictions	5	60	40
Describes 1 solution to a problem in a scenario involving weight and force after two attempts to move the item failed	6	100	0
Calculates missing value of the distance traveled based on a 20-item display	6	100	0
Earth and Space Sciences			
Orders 5 pictures based on the manufacturing process	6	100	0
Describes 1 environmental reason for using one of the 2 pictured options	6	100	0
Names 1 clothing/accessory that should be worn at 1 temperature named and shown but not at another temperature named and shown	6	100	0
Locates day in which the weather condition described is most/least likely to occur given a 5-day forecast with percent probability shown on display	6	100	0
Selects word for a weather condition under which described precautions are most appropriate	6	100	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of linked or not linked are based on the number of raters who scored assessment item as science.

5.4 ANALYSIS OF DATA REGARDING RESEARCH QUESTION 4: DETERMINING THE CONTENT CENTRALITY OF THE PASA-SCIENCE ASSESSMENT ITEMS

Research Question 4: Do the PASA-Science assessment items demonstrate content centrality?

Measurements of content centrality are used to determine how closely assessment items are measuring the alternate eligible content. In this case, content centrality was used to measure how closely assessment items from each grade level and test level of the PASA-Science are measuring the alternate science eligible content. Each assessment item was rated as possessing a near link, far link, or no link according to the descriptions provided by Flowers et al. (2007). The special education teachers and science education teachers who determined whether or not items possessed a link to the alternate eligible science content also determined to what extent the items linked to the alternate science eligible content. If a teacher determined there was no link present, as was found in a few of the items in the various grades above, he/she then determined why there was no link using the content centrality codes defined by Flowers et al. (2007). The results presented reflect the ratings of the special education teachers and science education teachers and their decisions on how well the assessment items linked to the alternate science eligible content. Summary data provided in the tables includes the number of teachers who classified the item as science and the number of raters who classified the item as far-linked, near-linked, or no link. Although a near-link is desired, items that were rated as having a far-link still possessed some of the alternate science eligible content and thus still acceptable.

As described earlier, five assessment items from grade 4 were considered by teachers not to possess a link to the alternate science eligible content. Of those assessment items, there were two occasions where more than one teacher determined that there was no link to the alternate science eligible content. One item that two teachers determined not to be linked involved selecting a picture of an item that doesn't use electricity. The second item that two teachers determined not to be linked involved naming two ingredients used to make an item from a picture. Of the 63 items reviewed at grade 4, 42 of the assessment items were rated as having a near-link by all seven of the elementary teachers. Although the next set of assessment items did not have agreement by all seven of the elementary teachers, 18 of the assessment items were rated with a near-link by the majority of the teachers. In other words, more teachers rated the items as a near-link compared to those teachers that rated the item as far-linked or no link. Only three assessment items overall were more often rated as possessing a far-link rather than a near-link to the alternate eligible science content. Interestingly, one of those three assessment items happened to be selecting the picture of an item that does not use electricity. The other two assessment items that had more ratings of a far-link involved matching weather symbols and selecting a photograph of an ingredient in an item from a photograph. The summary of assessment items rated as near-linked, far-linked and no link for grade 4 PASA-Science level A, level B, and level C are included in Tables 26, 27, and 28.

At grade 8, 61 out of the 62 assessment items were considered by teachers to possess some link to the alternate science eligible content. The item that was not rated as linked was the non-response item (orients to materials) identified in the previous grade 8 data table. As a result, that non-response could not be factored into the data summary. Of the 61 items with reviews at grade 8, 41 of the assessment items were rated as having a near-link by all five of the

Table 26 Ratings of Content Centrality for Grade 4 Level A Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Orients				
Orients to materials	2	2	0	0
Nature of Science				
Selects tool used to complete a task	7	7	0	0
Selects object named that is part of a man-made system	7	6	1	0
Biological Sciences				
Selects food eaten by animals or people	7	5	1	1
Selects plant/animal with structure named	7	6	1	0
Selects picture of living/non-living thing	7	7	0	0
Selects object that is safe/unsafe to eat	7	7	0	0
Physical Sciences				
Matches 2 objects based on physical property	7	5	2	0
Selects object that is a solid or a liquid after hearing a sentence	7	6	1	0
Earth and Space Sciences				
Selects object that represents food	7	6	1	0
Selects object that can be recycled after listening to a sentence	7	7	0	0
Selects clothing/accessory worn when it is hot/cold	7	7	0	0
Selects picture of weather condition named	7	7	0	0
Selects weather symbol named on weather map	7	7	0	0

Table 26 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Matches weather symbols	7	2	5	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 27 Ratings of Content Centrality for Grade 4 Level B Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Selects most efficient/least efficient tool to complete a task	7	7	0	0
Selects picture of a part of a man-made system	7	7	0	0
Biological Sciences				
Selects picture of food required for the survival of an animal named	7	7	0	0
Selects picture of animal that requires a particular food for survival	7	7	0	0
Matches 4 pictures of food required for the survival of 4 animals	7	7	0	0
Selects structure used for a particular function	7	7	0	0
Selects picture of youngest/oldest plant, animal, or person	7	7	0	0
Select 1 living/non-living thing from a complex picture	7	7	0	0
Selects picture of activity commonly associated with the season named	7	6	1	0
Selects 2 examples of litter in a complex picture	7	7	0	0
Sorts 5 pictures of items that are safe/unsafe to eat	7	7	0	0
Physical Sciences				
Creates 1 group based on 1 attribute named from an initial set of 6 items	7	7	0	0
Selects picture of an object that is in a state of matter named	7	7	0	0
Selects photograph of ingredient in a food item presented in a photograph when ingredients maintain their appearance	6	2	4	0

Table 27 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Select picture of person exerting the most/least force to move an item	7	7	0	0
Selects fastest/slowest moving object/person from an 8-item display	7	7	0	0
Earth and Space Sciences				
Selects picture of unprocessed food that comes from a source named	7	7	0	0
Select 2 objects that are recycled together based on similar composition	7	6	1	0
Selects recyclable item from a complex picture	7	7	0	0
Selects picture of item that does not use electricity	7	0	5	2
Selects picture of person wearing clothing/accessories when it is warm/cold	7	6	1	0
Names weather condition described	7	7	0	0
Names meaning of weather symbol	7	5	2	0
Selects weather symbol missing from a map based on weather description	7	6	1	0
Selects picture of item worn under weather condition named	7	5	2	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 28 Ratings of Content Centrality for Grade 4 Level C Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Describes 1 difference between how 2 tools are used	7	7	0	0
Names 2 parts required to make a man-made system function	7	7	0	0
Biological Sciences				
Selects picture of an animal that can survive by satisfying basic need in an environment named	7	5	2	0
Describes 2 function of a structure	7	7	0	0
Sequences 4 stages in the life cycle of a plant, animal, or person	7	7	0	0
Selects 2 living/non-living things from a complex picture	7	7	0	0
Selects person dressed inappropriately for the season from a complex picture	7	6	0	1
Names 1 activity associated with a season named	7	6	1	0
Names 2 possible sources of pollution	7	6	1	0
Names 2 items that are safe/unsafe to eat	7	7	0	0
Physical Sciences				
Sorts 8 objects into 2 groups based on 1 attribute named	7	7	0	0
Names 2 examples of objects in a state of matter named	7	7	0	0
Names 2 ingredients used to make item pictured when ingredients maintain their appearance	7	3	2	2
Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	7	5	1	1

Table 28 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Selects picture of the mass, surface, or slope of an object that will make it the hardest/easiest to move an object	7	7	0	0
Selects the fastest/slowest moving object or person from a 10-item display	7	7	0	0
Earth and Space Sciences				
Selects unprocessed food in a photograph that comes from a source named	7	7	0	0
Creates 2 sets of photographs of objects that are recycled together based on similar composition	7	6	1	0
Describes 2 ways to conserve resources based on a particular scenario described and shown in a picture	7	7	0	0
Names 2 pieces of clothing/accessories worn when it is hot/cold	7	7	0	0
Completes a description of weather condition be supplying a missing word in a sentence	7	7	0	0
Describes weather in two locations	7	7	0	0
Selects picture of location that is safest/most dangerous under weather condition named	7	7	0	0

Note. A total of seven teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

middle school teachers. Although the next set of assessment items did not have agreement by all five of the middle school teachers, 19 of the assessment items were rated with a near-link by the majority of the teachers. Only one assessment item overall was more often rated as possessing a far-link rather than a near-link to the alternate eligible science content. The assessment item involving selecting a picture of a source of food was scored as a far-link by the majority of the five middle school teachers. The summary of assessment items rated as near-linked, far-linked and no link for grade 8 PASA-Science level A, level B, and level C are included in Tables 29, 30, and 31.

Since one of the 63 assessment items was not classified as science, only 62 assessment items were considered when rating their link to the alternate eligible content. According to data presented previously for grade 11, two teachers did not consider one assessment item to possess a link to the alternate science eligible content. That one assessment item involved selecting food based on dietary restrictions. Although two of the high school teachers determined that no link was present for that assessment item, the other teachers rated the skill possessed a near-link to the alternate science eligible content. Of the remaining 61 assessment items reviewed at grade 11, 50 of the assessment items were rated as having a near-link by all six of the high school teachers. Although the next set of assessment items did not have agreement by all six of the high school teachers, nine of the assessment items were rated with a near-link by the majority of the teachers. One assessment item was evenly split with three teachers rating a near-link and three teachers rating a far-link. The assessment item with the even split involved completing a graphic organizer of classes and species. Only one assessment item was more often rated as possessing a far-link rather than a near-link to the alternate eligible science content. Selecting the tallest/shortest bar on a bar graph was the only assessment item that the majority of teachers

Table 29 Ratings of Content Centrality for Grade 8 Level A Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
	Orients			
Orients to materials	1	0	0	0
	Nature of Science			
Selects picture of tool based on advantage named	5	5	0	0
Select object used to make a simple man-made system function	5	4	1	0
	Biological Sciences			
Select picture of living organism that lives on land or in water	5	4	1	0
Selects picture of environment in which an organism lives	5	4	1	0
Selects picture of structure based on function	5	5	0	0
Selects picture of a member of a kingdom named	5	5	0	0
Select picture of food that requires refrigeration	5	5	0	0
	Physical Sciences			
Matches 2 objects based on physical property	5	3	2	0
Selects picture of item that is frozen or has melted	5	4	1	0
	Earth and Space Sciences			
Selects picture of source of food	5	2	3	0
Selects object that can be recycled based on composition named	5	5	0	0
Selects category of picture of recyclable object based on similar composition	5	5	0	0

Table 29 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Selects picture of clothing/accessory worn when it is warm/cool	5	5	0	0
Select weather symbol named	5	4	1	0
Selects weather symbol named on weather map	5	4	1	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 30 Ratings of Content Centrality for Grade 8 Level B Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Describes 1 advantage/disadvantage a new technology has over other tools that perform the same function	5	4	1	0
Selects picture of a part from a simple man-made system based on function named	5	5	0	0
Biological Sciences				
Selects picture of an environment required for the survival of an animal named	5	5	0	0
Names 2 structures used to accomplish a task	5	4	1	0
Selects picture of next stage of life cycle	5	5	0	0
Completes a graphic organizer of two kingdoms	5	5	0	0
Selects picture of season-neutral activity	5	4	1	0
Describes 1 effect of pollution on the environment	5	5	0	0
Describes 1 consequence of unsafe food handling practices	5	5	0	0
Physical Sciences				
Creates 1 group based on 2 attributes named	5	5	0	0
Select item from a complex photograph based on the possibility of change in physical matter described	5	5	0	0
Describes 1 reason for maintaining a constant temperature to preserve a state of matter	5	5	0	0

Table 30 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Selects photograph of ingredients in a food item presented in a photograph when ingredient don't maintain their appearance	5	4	1	0
Describes 1 reason for a problem in a scenario involving weight and force	5	4	1	0
Selects moving object/person that will arrive first/last from a 10-item display	5	5	0	0
Earth and Space Sciences				
Selects picture of source of processed food/product named	5	4	1	0
Matches 4 pictures of processed food/product with each of its source	5	5	0	0
Selects 2 items that can be recycled from a photograph	5	5	0	0
Describes 1 way to conserve	5	5	0	0
Selects picture of person wearing clothing/accessories for a temperature named and shown	5	5	0	0
Names extreme weather condition described	5	5	0	0
Selects weather symbol by making prediction based on current weather and trend	5	3	2	0
Selects picture of location that is the safest/most dangerous under weather condition named	5	4	1	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 31 Ratings of Content Centrality for Grade 8 Level C Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Names 1 advantage/disadvantage of a new technology	5	4	1	0
Describes function of a part from a simple man-made system	5	5	0	0
Biological Sciences				
Describe 1 effect that habitat destruction has on the acquisition of basic needs	5	5	0	0
Names 2 structures required to accomplish a task	5	5	0	0
Sequences 4 stages in the life cycle	5	5	0	0
Completes a graphic organizer of 5 classes	5	5	0	0
Describes 2 characteristics of a season that permits activity named	5	5	0	0
Describes 1 effect of pollution on wildlife	5	5	0	0
Describes 1 unsafe food handling/preparation practice in scenario described	5	5	0	0
Physical Sciences				
Sorts 6 objects into 3 groups based on 2 attributes named	4	4	0	0
Describes 1 reason an item remains in the same state of matter	5	5	0	0
Names 2 ingredients used to make item pictured when ingredients don't maintain their appearance	5	4	1	0
Names item that can be prepared with the ingredients in the photographs	5	3	2	0
Describes 1 reason for the difference in the force exerted to move an object	5	5	0	0

Table 31 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Selects moving object/person that traveled the longest/shortest distance from a 15-item display	5	5	0	0
Selects the fastest/slowest moving object/person from a 15-item display	5	5	0	0
Earth and Space Sciences				
Names primary ingredient in processed food	5	5	0	0
Sorts 9 photographs of recyclable and non-recyclable objects into 4 disposable categories	5	5	0	0
Select picture of person using the most/least amount of a resource	5	5	0	0
Names 1 clothing/accessory that should be worn in temperature named and shown	5	5	0	0
Selects word that describes weather condition	5	4	1	0
Selects area on a weather map based on information within the map legend	5	5	0	0
Names 2 precautions to take under weather condition named	5	5	0	0

Note. A total of five teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

rated as a far-link rather than a near-link. The summary of assessment items rated as near-linked, far-linked and no link for grade 11 PASA-Science level A, level B, and level C are included in Tables 32, 33, and 34.

Since there were teachers at different grade levels and test levels that identified assessment items that they felt did not possess a link to the alternate science eligible content, those teachers were asked to supply a reason as to why they considered the item not linked. When teachers determined there was no link for a specific assessment item, they used one of three possible reasons as to why (mismatch, overstretch, and backmapping). As mentioned previously, Flowers et al. (2007) defined mismatched as, "an error in identifying the correct standards" (p. 57); defined overstretched as, "the item has lost the intention meaning of the standard" (p. 57); and backmapping as, "fitting a functional activity to academic standards" (p. 57). Out of a possible 187 assessment items evaluated, only six items were determined not to possess a link. As the result indicated, five out of the six were from grade 4. The only two reasons given for why an assessment item was not considered linked was either a mismatch or an overstretching of the assessment item. Assessment items that were considered a mismatch by teachers must have been done so because they determined the correct alternate science eligible content was not identified. Assessment items that were considered overstretched by teachers must have done so because they determined the assessment item did not possess the intent of the alternate science eligible content. The summary of reasons listed by teachers is listed in Table 35.

Table 32 Ratings of Content Centrality for Grade11 Level A Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
	Orients			
Orients to materials	0	0	0	0
	Nature of Science			
Selects tallest/shortest bar described on bar graph	6	2	4	0
Matches trendlines	6	4	2	0
Selects most recent innovation in technology from choices that all perform same basic function	6	5	1	0
Selects picture of a part of a man-made system that will solve a problem described	6	5	1	0
	Biological Sciences			
Select picture of shelter for an animal named	6	6	0	0
Selects picture of an animal that lives in a place named	6	6	0	0
Selects picture of a structure used for a similar function in another animal or person	6	6	0	0
Selects member of a class named	6	5	1	0
Select picture of food that is safe/unsafe to eat	6	6	0	0
	Physical Sciences			
Selects object based on 2 attributes named	6	6	0	0
Selects picture of item that will/will not melt	6	6	0	0

Table 32 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Earth and Space Sciences				
Selects picture of source of product named	6	6	0	0
Selects picture of clothing/accessory that should be worn in temperature named	6	6	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 33 Ratings of Content Centrality for Grade 11 Level B Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Selects value described on the y-axis of a bar graph	6	6	0	0
Selects the category on the x-axis based on data from the y-axis of a bar graph	6	6	0	0
Selects biggest/smallest value on a line graph with numbers	6	6	0	0
Selects value described on the y-axis of a line graph	6	6	0	0
Selects the category on the x-axis based on data from the y-axis of a line graph	6	6	0	0
Selects 2 values described on a line graph	6	6	0	0
Names 1 consequence of a new technology	6	6	0	0
Describes 1 solution to a problem with a simple man-made system	6	6	0	0
Biological Sciences				
Describes 2 advantages/disadvantages of one environment over another for survival of a specific species	6	6	0	0
Names structure and its function in the accomplishment of a task named	6	6	0	0
Completes a graphic organizer of 4 classes when pictures of species are shown	6	3	3	0
Describes 1 effect of pollution on living things in the scenario described	6	5	1	0
Selects picture of food that is safe to eat based on expiration date	6	6	0	0
Describes 1 reason for using safe food handling practices	6	6	0	0

Table 33 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Describes 1 way to determine whether food is unsafe to eat	6	6	0	0
Physical Sciences				
Selects object based on 3 attributes named	6	6	0	0
Sequences changes in states of matter as a function of temperature	6	6	0	0
Selects photograph of item that can be prepared with 3 ingredients	6	5	1	0
Describes 1 solution to a problem in a scenario involving weight and force after one attempt to move the item failed	6	6	0	0
Selects the fastest/slowest moving object /person from a 15-item display	6	6	0	0
Earth and Space Sciences				
Selects picture of source of processed food/product named	6	5	1	0
Describes 1 effect of conservation effort on the environment	6	6	0	0
Complete a table showing people wearing different clothing/accessories by matching temperatures	6	6	0	0
Locates day in which the described activity is most/least appropriate given a 5-day weather forecast	6	6	0	0
Selects picture of person engaged in action that is safest/most dangerous under weather condition described	6	6	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 34 Ratings of Content Centrality for Grade 11 Level C Alternate Science Assessment Items

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Nature of Science				
Selects data point described on a bar graph	6	6	0	0
Selects interval in which change in data described occurred	6	6	0	0
Identifies trend on a line graph	6	6	0	0
Calculates the difference in 2 values on a line graph	6	6	0	0
Makes prediction using a line graph	6	6	0	0
Selects missing value based on interpretation/extrapolation on a line graph	6	6	0	0
Names 1 consequence of a new technology	6	5	1	0
Describes 2 possible problems with a simple man-made system when 1 problem has been eliminated	6	6	0	0
Biological Sciences				
Sorts pictures of animals in 4 habitats	6	6	0	0
Describes 1 similarity in the function of different structures between 2 species	6	6	0	0
Completes a graphic organizer of kingdom, class, and species	6	5	1	0
Describes 2 effects of human activity on the environment	6	6	0	0
Describes function of expiration date	6	6	0	0
Physical Sciences				
Sorts 7 objects into 2 groups based on new attribute after items are presorted	6	6	0	0
Select picture of item heated/cooled the longest/shortest amount of time	6	6	0	0

Table 34 (continued)

	Number who classified item as science	Number who classified item as near link	Number who classified item as far link	Number who classified item as no link
Describe the change in state of matter in a scenario described involving changes in temperature	6	6	0	0
Selects food based on dietary restrictions	5	3	0	2
Describes 1 solution to a problem in a scenario involving weight and force after two attempts to move the item failed	6	6	0	0
Calculates missing value of the distance traveled based on a 20-item display	6	6	0	0
Earth and Space Sciences				
Orders 5 pictures based on the manufacturing process	6	6	0	0
Describes 1 environmental reason for using one of the 2 pictured options	6	6	0	0
Names 1 clothing/accessory that should be worn at 1 temperature named and shown but not at another temperature named and shown	6	6	0	0
Locates day in which the weather condition described is most/least likely to occur given a 5-day forecast with percent probability shown on display	6	6	0	0
Selects word for a weather condition under which described precautions are most appropriate	6	6	0	0

Note. A total of six teachers reviewed and rated the alternate science assessment items. Ratings of far link, near link, or not link are based on the number of raters who scored assessment item as science.

Table 35 Alternate Science Assessment Items Rated as No Link to the Alternate Science Eligible Content

Grade	Level	Alternate Assessment Item	Alternate Eligible Content	Reason
4	A	Selects food eaten by animals/people	S4.B.1.1.1 – Describes basic needs of plants and animals	mismatch
4	B	Selects picture of item that does not use electricity	S4.D.1.2.3 – Recognizes examples of people wasting natural resources	mismatch
4	C	Selects person dressed inappropriately for the season from a complex picture	S4.B.3.2.1 – Identify common activities related to all four seasons	mismatch
4	C	Names 2 ingredients used to make item pictured when ingredients maintain their appearance	S4.C.1.1.3 – Identify final product when items are combined resulting in only physical change	overstretch
4	C	Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	S4.C.1.1.3 – Identify final product when items are combined resulting in only physical change	overstretch
11	C	Selects food based on dietary restrictions	S11.C.1.1.3 – Identify final product when items are combined resulting in a physical change, change in appearance, and a chemical change	mismatch overstretch

Note. All of the teachers who rated assessment items as no link are summarized in the table.

5.5 ANALYSIS OF DATA REGARDING RESEARCH QUESTION 5: ASSESSING THE EDUCATIONAL VALIDITY OF THE PASA-SCIENCE ASSESSMENT ITEMS

Research Question 5: Is the science content assessed in the PASA-Science educationally valid for students with significant cognitive disabilities in grades 4, 8, and 11?

In order to gauge the importance of certain content, parents and test administrators were asked to complete a survey rating the importance of various assessment items. A total of 5,891 surveys were sent to parents with 1,205 surveys being returned; a return rate of 20.5%. A total of 2,724 individuals were registered to administer the PASA-Science so those test administrators were mailed surveys. A total of 1,709 test administrators returned surveys to the PASA team; a return rate of 62.7%. It should also be noted that since some of the test administrators administered assessments at different grades and levels, test administrators received a survey for each grade and unique assessment level they were administering. The calculation of the return rate, however, was based on the percentage of test administrators who returned surveys and not the number of surveys returned. The following results provide a summary of the parent and the test administrator responses to the grade and assessment level surveys.

The parents of students in grade 4 had similar responses to the level of importance for much of the same assessment content. The majority of parents who responded to the survey at each assessment level considered the following content to be most important: understanding what is safe to eat and not safe to eat and the selection of clothing based on temperature. Of those parents who completed the surveys at the level B and level C PASA-Science also identified additional content as important. Content such as understanding the parts of a man-made system,

how and when tools are used, the conservation of natural resources, and what to do in extreme weather conditions were also rated as important. Although there was variation in the rated importance of specific content at the various assessment levels, only one area of content from the level A assessment was classified as not important by a large percentage of parents who completed the survey. Content related to recycling was considered not important to 40% of the parents who completed the level A survey. Tables 36, 37, and 38 provide a summary of the parent responses for the grade 4 assessment items.

Just as the majority of parents identified specific content at each level as important, test administrators also reported certain content was considered more important than other content. The majority of test administrators who responded to the grade 4 surveys responded that the following content was important at all assessment levels: how and when to use tools, understanding what is safe to eat and not safe to eat, and the selection of clothing based on temperature. Of those test administrators who completed the surveys at the level B and level C PASA-Science also identified additional content as important. Content such as understanding weather symbols and describing weather conditions, activities that are related to specific seasons and what to do in extreme weather conditions were also rated as important. Although the level B and level C content was rated as overall important by those test administrators who responded, there were a few content areas that were not rated as important as other content like: meeting an animal's basic needs, states of matter, and force and motion. On average these content areas were rated 10 – 15% less important when compared to other content areas. At level A, test administrators who responded also rated understanding states of matter, identifying plant/animal structures, and recycling as less important than other content. Tables 39, 40, and 41 provide a summary of responses for test administrators from grade 4.

Table 36 Parent Ratings of the Level of Importance for the Grade 4 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects tool used to complete a task	54.7	30.9	7.2	7.2
Selects object named that is part of a man-made system	37.9	39.6	12.6	9.9
Biological Sciences				
Selects food eaten by animals or people	56.9	33.7	3.3	6.1
Selects plant/animal with structure named	27.6	44.2	16.6	11.6
Selects picture of living/non-living thing	42.0	35.9	13.3	8.8
Selects object that is safe/unsafe to eat	71.8	19.3	2.2	6.6
Physical Sciences				
Matches 2 objects based on physical property	35.7	44.5	11.5	8.2
Selects object that is a solid or a liquid after hearing a sentence	33.5	38.5	17	11
Earth and Space Sciences				
Selects object that represents food	56.7	31.7	5.6	6.1
Selects object that can be recycled after listening to a sentence	27.6	33.1	23.8	15.5
Selects clothing/accessory worn when it is hot/cold	54.4	36.8	3.8	4.9
Selects picture of weather condition named	40.7	44	7.1	8.2
Selects weather symbol named on weather map	35.4	44.2	13.3	7.2
Matches weather symbols	34.4	41.7	16.7	7.2

Table 37 Parent Ratings of the Level of Importance for the Grade 4 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects most efficient/least efficient tool to complete a task	55.0	42.4	0.7	2.0
Selects picture of a part of a man-made system	45.7	46.4	5.3	2.6
Biological Sciences				
Selects picture of food required for the survival of an animal named	33.8	46.4	15.9	4.0
Selects picture of animal that requires a particular food for survival	27.8	45.7	21.2	5.3
Matches 4 pictures of food required for the survival of 4 animals	25.2	51.0	19.2	4.6
Selects structure used for a particular function	30.7	44.7	20.7	4.0
Selects picture of youngest/oldest plant, animal, or person	47.0	45.0	5.3	2.6
Select 1 living/non-living thing from a complex picture	44.0	46.7	7.3	2.0
Selects picture of activity commonly associated with the season named	47.0	39.7	9.3	4.0
Selects 2 examples of litter in a complex picture	42.0	45.3	10.0	2.7
Sorts 5 pictures of items that are safe/unsafe to eat	77.5	18.5	2.0	2.0
Physical Sciences				
Creates 1 group based on 1 attribute named from an initial set of 6 items	46.4	39.1	11.3	3.3
Selects picture of an object that is in a state of matter named	37.1	48.3	10.6	4.0

Table 37 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects photograph of ingredient in a food item presented in a photograph when ingredients maintain their appearance	34.7	43.3	18.7	3.3
Select picture of person exerting the most/least force to move an item	39.1	47.7	9.3	4.0
Selects fastest/slowest moving object/person from an 8-item display	39.7	47.9	8.9	3.4
Earth and Space Sciences				
Selects picture of unprocessed food that comes from a source named	42.4	47.0	6.0	4.6
Select 2 objects that are recycled together based on similar composition	35.1	46.4	15.2	3.3
Selects recyclable item from a complex picture	44.0	46.7	6.7	2.7
Selects picture of item that does not use electricity	52.3	40.3	3.4	4.0
Selects picture of person wearing clothing/accessories when it is warm/cold	63.1	31.5	0.7	4.7
Names weather condition described	56.4	36.9	2.0	4.7
Names meaning of weather symbol	51.0	42.3	3.4	3.4
Selects weather symbol missing from a map based on weather description	47.3	37.8	13.5	1.4
Selects picture of item worn under weather condition named	61.5	32.4	2.7	3.4

Table 38 Parent Ratings of the Level of Importance for the Grade 4 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Describes 1 difference between how 2 tools are used	49.1	44.3	6.6	0.0
Names 2 parts required to make a man-made system function	43.0	54.2	2.8	0.0
Biological Sciences				
Selects picture of an animal that can survive by satisfying basic need in an environment named	32.7	43.0	23.4	0.9
Describes 2 function of a structure	25.2	58.9	15.9	0.0
Sequences 4 stages in the life cycle of a plant, animal, or person	53.3	43.0	2.8	0.9
Selects 2 living/non-living things from a complex picture	36.4	52.3	11.2	0.0
Selects person dressed inappropriately for the season from a complex picture	52.0	41.0	4.0	1.0
Names 1 activity associated with a season named	34.6	56.1	9.3	0.0
Names 2 possible sources of pollution	39.6	44.3	14.2	1.9
Names 2 items that are safe/unsafe to eat	82.4	15.7	1.9	0.0
Physical Sciences				
Sorts 8 objects into 2 groups based on 1 attribute named	41.7	47.2	10.2	0.9
Names 2 examples of objects in a state of matter named	40.2	44.9	14.0	0.9
Names 2 ingredients used to make item pictured when ingredients maintain their appearance	33.3	49.1	15.7	1.9

Table 38 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	32.4	57.4	9.3	0.9
Selects picture of the mass, surface, or slope of an object that will make it the hardest/easiest to move an object	33.3	52.8	12.0	1.9
Selects the fastest/slowest moving object or person from a 10-item display	32.4	50.9	16.7	0.0
Earth and Space Sciences				
Selects unprocessed food in a photograph that comes from a source named	33.0	58.5	6.6	1.9
Creates 2 sets of photographs of objects that are recycled together based on similar composition	38.9	50.0	11.1	0.0
Describes 2 ways to conserve resources based on a particular scenario described and shown in a picture	50.0	42.6	7.4	0.0
Names 2 pieces of clothing/accessories worn when it is hot/cold	49.5	45.8	3.7	0.9
Completes a description of weather condition be supplying a missing word in a sentence	48.6	43.9	7.5	0.0
Describes weather in two locations	39.8	47.2	10.2	2.8
Selects picture of location that is safest/most dangerous under weather condition named	70.4	25.9	3.7	0.0

Table 39 Teacher Ratings of the Level of Importance for the Grade 4 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects tool used to complete a task	56.3	34.7	4.0	5.0
Selects object named that is part of a man-made system	25.8	49.7	16.5	8.1
Biological Sciences				
Selects food eaten by animals or people	58.7	31.1	4.3	5.9
Selects plant/animal with structure named	17.4	46.6	25.8	10.2
Selects picture of living/non-living thing	28.1	46.3	16.3	9.4
Selects object that is safe/unsafe to eat	72.1	19.5	2.8	5.6
Physical Sciences				
Matches 2 objects based on physical property	28.4	52.2	12.7	6.8
Selects object that is a solid or a liquid after hearing a sentence	10.8	41.4	32.1	15.7
Earth and Space Sciences				
Selects object that represents food	51.2	38.8	4.7	5.3
Selects object that can be recycled after listening to a sentence	13.6	46.3	24.4	15.7
Selects clothing/accessory worn when it is hot/cold	58.0	34.6	3.7	3.7
Selects picture of weather condition named	37.0	46.3	9.6	7.1
Selects weather symbol named on weather map	27.3	52.8	10.9	9.0
Matches weather symbols	24.8	54.0	13.7	7.5

Table 40 Teacher Ratings of the Level of Importance for the Grade 4 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects most efficient/least efficient tool to complete a task	45.8	45.5	7.1	1.6
Selects picture of a part of a man-made system	31.8	54.5	12.0	1.6
Biological Sciences				
Selects picture of food required for the survival of an animal named	19.5	58.1	19.8	2.6
Selects picture of animal that requires a particular food for survival	14.1	55.9	25.5	4.6
Matches 4 pictures of food required for the survival of 4 animals	14.8	51.0	29.0	5.2
Selects structure used for a particular function	21.5	55.0	19.2	4.2
Selects picture of youngest/oldest plant, animal, or person	32.0	53.4	11.3	3.2
Select 1 living/non-living thing from a complex picture	36.7	50.5	9.2	3.6
Selects picture of activity commonly associated with the season named	45.5	49.7	3.6	1.3
Selects 2 examples of litter in a complex picture	35.0	53.4	9.4	2.3
Sorts 5 pictures of items that are safe/unsafe to eat	84.4	14.6	1.0	0.0
Physical Sciences				
Creates 1 group based on 1 attribute named from an initial set of 6 items	28.2	56.8	14.0	1.0
Selects picture of an object that is in a state of matter named	14.3	51.9	26.6	7.1

Table 40 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects photograph of ingredient in a food item presented in a photograph when ingredients maintain their appearance	29.2	54.2	14.3	2.3
Select picture of person exerting the most/least force to move an item	19.4	46.9	26.9	6.8
Selects fastest/slowest moving object/person from an 8-item display	23.3	54.7	17.8	4.2
Earth and Space Sciences				
Selects picture of unprocessed food that comes from a source named	27.9	55.8	13.0	3.2
Select 2 objects that are recycled together based on similar composition	25.3	55.5	14.3	4.9
Selects recyclable item from a complex picture	29.2	58.1	8.8	3.9
Selects picture of item that does not use electricity	33.0	49.2	13.6	4.2
Selects picture of person wearing clothing/accessories when it is warm/cold	72.7	26.0	1.3	0.0
Names weather condition described	57.9	39.5	1.6	1.0
Names meaning of weather symbol	57.0	35.3	6.5	1.3
Selects weather symbol missing from a map based on weather description	39.8	48.5	8.1	3.6
Selects picture of item worn under weather condition named	71.2	26.5	1.9	0.3

Table 41 Teacher Ratings of the Level of Importance for the Grade 4 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Describes 1 difference between how 2 tools are used	40.8	51.6	6.8	0.8
Names 2 parts required to make a man-made system function	41.2	51.6	6.0	1.2
Biological Sciences				
Selects picture of an animal that can survive by satisfying basic need in an environment named	22.1	53.0	23.3	1.6
Describes 2 function of a structure	26.5	53.8	18.1	1.6
Sequences 4 stages in the life cycle of a plant, animal, or person	39.2	50.0	10.0	0.8
Selects 2 living/non-living things from a complex picture	38.7	50.0	10.5	0.8
Selects person dressed inappropriately for the season from a complex picture	72.8	25.2	2.0	0.0
Names 1 activity associated with a season named	47.2	48.0	4.8	0.0
Names 2 possible sources of pollution	31.3	51.4	16.5	0.8
Names 2 items that are safe/unsafe to eat	83.1	14.5	2.4	0.0
Physical Sciences				
Sorts 8 objects into 2 groups based on 1 attribute named	35.3	49.0	13.7	2.0
Names 2 examples of objects in a state of matter named	29.3	50.2	18.9	1.6
Names 2 ingredients used to make item pictured when ingredients maintain their appearance	34.9	51.8	13.3	0.0

Table 41 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects photograph of final product that is made after combining 3 ingredients that maintain their appearance when combined	34.8	52.4	12.8	0.0
Selects picture of the mass, surface, or slope of an object that will make it the hardest/easiest to move an object	20.8	58.0	18.8	2.4
Selects the fastest/slowest moving object or person from a 10-item display	21.2	53.6	23.6	1.6
Earth and Space Sciences				
Selects unprocessed food in a photograph that comes from a source named	29.2	58.4	12.4	0.0
Creates 2 sets of photographs of objects that are recycled together based on similar composition	34.9	55.8	7.2	2.0
Describes 2 ways to conserve resources based on a particular scenario described and shown in a picture	49.2	45.6	4.8	0.4
Names 2 pieces of clothing/accessories worn when it is hot/cold	69.4	28.2	2.4	0.0
Completes a description of weather condition be supplying a missing word in a sentence	46.0	46.0	7.6	0.4
Describes weather in two locations	41.6	47.2	10.0	1.2
Selects picture of location that is safest/most dangerous under weather condition named	79.2	19.6	1.2	0.0

Tables 42, 43, and 44 provide a summary of response by parents in grade 8. A few content areas were rated as important by most parents who responded to the different survey levels. Content like food handling/food safety and selecting clothing based on temperature were considered some of the most important content at each survey level. Other content areas like the effects of pollution, conservation of resources, changes in states of matter, the function of parts in a simple man-made machine, and what to do in extreme weather conditions were rated as more important when compared to other content included in the level B and level C surveys. Content related to how different body structures are used to accomplish a task was rated as lower importance by parents who completed the level A and level B surveys. Additional content including understanding the life cycle and environments needed for the survival of animals were rated as less important by parents who responded to the level B survey. Even though the lowest rated content for the level C survey was selecting the fastest/slowest moving object, 73% of the parents who completed the level C survey rated the content as important.

In comparison to the parents of students who completed the grade 8 level A survey, test administrators who completed the level A survey rated all content areas as less important. The test administrators, however, did identify some content areas as more important that other content at all levels. Content involving food handling/food safety and selecting clothing based on temperature were considered some of the most important content at each survey level. Other content areas like the conservation of resources, changes in states of matter, the function of parts in a simple man-made machine, and what to do in extreme weather conditions were rated as more important when compared to other content included in the level B and level C surveys.

Table 42 Parent Ratings of the Level of Importance for the Grade 8 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects picture of tool based on advantage named	32.9	35.7	14.3	17.1
Select object used to make a simple man-made system function	40.7	36.4	10.0	12.9
Biological Sciences				
Select picture of living organism that lives on land or in water	30.0	39.3	17.9	12.9
Selects picture of environment in which an organism lives	34.5	41.7	11.5	12.2
Selects picture of structure based on function	29.7	31.9	25.4	13.0
Selects picture of a member of a kingdom named	29.3	37.1	17.1	16.4
Select picture of food that requires refrigeration	65.0	20.7	5.7	8.6
Physical Sciences				
Matches 2 objects based on physical property	35.3	42.4	10.8	11.5
Selects picture of item that is frozen or has melted	39.3	30.7	18.6	11.4
Earth and Space Sciences				
Selects picture of source of food	39.6	36.0	13.7	10.8
Selects object that can be recycled based on composition named	36.4	30.0	17.1	16.4
Selects category of picture of recyclable object based on similar composition	33.1	36.0	15.8	15.1

Table 42 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects picture of clothing/accessory worn when it is warm/cool	67.6	23.7	0.7	7.9
Select weather symbol named	47.8	40.6	4.3	7.2
Selects weather symbol named on weather map	44.6	34.5	12.2	8.6

Table 43 Parent Ratings of the Level of Importance for the Grade 8 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Describes 1 advantage/disadvantage a new technology has over other tools that perform the same function	48.3	41.4	6.9	3.4
Selects picture of a part from a simple man-made system based on function named	32.8	56.0	7.8	3.4
Biological Sciences				
Selects picture of an environment required for the survival of an animal named	18.3	44.3	29.6	7.8
Names 2 structures used to accomplish a task	19.7	47.9	29.9	2.6
Selects picture of next stage of life cycle	16.5	47.0	24.3	12.2
Completes a graphic organizer of two kingdoms	24.8	45.3	22.2	7.7
Selects picture of season-neutral activity	34.5	49.1	12.1	4.3
Describes 1 effect of pollution on the environment	44.8	46.6	5.2	3.4
Describes 1 consequence of unsafe food handling practices	75.0	22.4	2.6	0.0
Physical Sciences				
Creates 1 group based on 2 attributes named	17.2	50.9	27.6	4.3
Select item from a complex photograph based on the possibility of change in physical matter described	43.0	50.9	6.1	0.0

Table 43 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Describes 1 reason for maintaining a constant temperature to preserve a state of matter	49.6	41.7	8.7	0.0
Selects photograph of ingredients in a food item presented in a photograph when ingredient don't maintain their appearance	24.3	45.2	25.2	5.2
Describes 1 reason for a problem in a scenario involving weight and force	30.4	47.8	20.0	1.7
Selects moving object/person that will arrive first/last from a 10-item display	23.7	46.5	25.4	4.4
Earth and Space Sciences				
Selects picture of source of processed food/product named	15.8	52.6	25.4	6.1
Matches 4 pictures of processed food/product with each of its source	26.8	52.7	17.0	3.6
Selects 2 items that can be recycled from a photograph	31.3	53.9	13.0	1.7
Describes 1 way to conserve	42.6	51.3	5.2	0.9
Selects picture of person wearing clothing/accessories for a temperature named and shown	58.3	38.3	3.5	0.0
Names extreme weather condition described	53.0	40.9	6.1	0.0
Selects weather symbol by making prediction based on current weather and trend	38.8	48.3	12.1	0.9
Selects picture of location that is the safest/most dangerous under weather condition named	64.3	32.2	3.5	0.0

Table 44 Parent Ratings of the Level of Importance for the Grade 8 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Names 1 advantage/disadvantage of a new technology	32.5	55.6	9.5	2.4
Describes function of a part from a simple man-made system	43.8	52.3	3.1	0.8
Biological Sciences				
Describe 1 effect that habitat destruction has on the acquisition of basic needs	41.7	44.1	12.6	1.6
Names 2 structures required to accomplish a task	33.1	52.0	14.2	0.8
Sequences 4 stages in the life cycle	33.1	42.5	21.3	3.1
Completes a graphic organizer of 5 classes	30.4	45.6	18.4	5.6
Describes 2 characteristics of a season that permits activity named	32.8	50.0	15.6	1.6
Describes 1 effect of pollution on wildlife	42.4	44.0	12.0	1.6
Describes 1 unsafe food handling/preparation practice in scenario described	77.2	17.3	3.1	2.4
Physical Sciences				
Sorts 6 objects into 3 groups based on 2 attributes named	24.8	52.8	19.2	3.2
Describes 1 reason an item remains in the same state of matter	32.5	54.8	11.1	1.6
Names 2 ingredients used to make item pictured when ingredients don’t maintain their appearance	33.9	50.0	13.7	2.4

Table 44 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Names item that can be prepared with the ingredients in the photographs	38.1	52.4	7.9	1.6
Describes 1 reason for the difference in the force exerted to move an object	27.8	48.4	19.0	4.8
Selects moving object/person that traveled the longest/shortest distance from a 15-item display	29.4	43.7	22.2	4.8
Selects the fastest/slowest moving object /person from a 15-item display	28.8	44.8	20.8	5.6
Earth and Space Sciences				
Names primary ingredient in processed food	29.4	54.8	12.7	3.2
Sorts 9 photographs of recyclable and non-recyclable objects into 4 disposable categories	39.5	54.0	5.6	0.8
Select picture of person using the most/least amount of a resource	34.1	50.8	11.9	3.2
Names 1 clothing/accessory that should be worn in temperature named and shown	54.8	42.1	3.2	0.0
Selects word that describes weather condition	47.7	47.7	4.7	0.0
Selects area on a weather map based on information within the map legend	27.3	50.8	16.4	5.5
Names 2 precautions to take under weather condition named	62.5	35.9	1.6	0.0

Grade 8 test administrators who completed the level C survey also rated content involving the ingredients used to make food and recycling just as important as some of the content listed above. Each survey level had content that was considered less important than other content, but some of that content was rated much lower. For example, only approximately 50% of test administrators who responded to the level A survey rated content related to where an animal lives or selecting structures based on function as important. Although not as low, level B and level C surveys also had items that had lower percentages of test administrators who reported content as less important. Content related to selecting the fastest/slowest moving object, understanding the life cycle, and classifying organisms by kingdom/class are just an example. Tables 45, 46, and 47 provide a summary of responses by test administrators in grade 8.

Parents who returned the grade 11 level A survey rated all content as less important than the parents who returned the level B and level C surveys. Only two content areas from the level A surveys were rated as important by more than 80% of the parents who returned surveys. Those two content areas, making sure foods are safe to eat and selecting clothing based on temperature, were rated as important at all three survey levels. Content related to fixing problems with man-made machines, solving problems dealing with moving items, conservation of resources, and how to respond to extreme weather scenarios were also rated as more important than other content by parents who returned the level B and level C surveys. Parents who returned the level C surveys also identified an additional content area rated just as important as some of the other content; selecting foods based on dietary restrictions. One content area not considered as important as other content areas at any level had to do with interpreting bar graphs and line graphs. Only 46% of the parents who responded to the level A survey rated some of the graphing content as important. No more than 68% of the parents who responded to the level B

Table 45 Teacher Ratings of the Level of Importance for the Grade 8 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects picture of tool based on advantage named	18.0	37.5	22.8	21.7
Select object used to make a simple man-made system function	20.8	48.9	13.9	16.4
Biological Sciences				
Select picture of living organism that lives on land or in water	9.5	39.6	31.5	19.4
Selects picture of environment in which an organism lives	17.9	48.0	19.0	15.0
Selects picture of structure based on function	12.1	39.7	27.9	20.2
Selects picture of a member of a kingdom named	11.6	47.6	21.6	17.6
Select picture of food that requires refrigeration	53.8	29.3	6.2	10.6
Physical Sciences				
Matches 2 objects based on physical property	23.4	44.2	19.7	12.8
Selects picture of item that is frozen or has melted	29.7	39.9	15.0	15.4
Earth and Space Sciences				
Selects picture of source of food	18.3	39.2	25.6	16.8
Selects object that can be recycled based on composition named	17.5	44.5	19.3	18.6
Selects category of picture of recyclable object based on similar composition	15.0	47.3	19.0	18.7
Selects picture of clothing/accessory worn when it is warm/cool	55.5	32.7	3.3	8.5
Select weather symbol named	35.2	46.9	9.5	8.4

Table 45 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects weather symbol named on weather map	27.1	44.3	15.0	13.6

Table 46 Teacher Ratings of the Level of Importance for the Grade 8 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Describes 1 advantage/disadvantage a new technology has over other tools that perform the same function	33.3	47.8	14.1	4.8
Selects picture of a part from a simple man-made system based on function named	31.5	60.0	6.7	1.9
Biological Sciences				
Selects picture of an environment required for the survival of an animal named	15.9	48.9	28.9	6.3
Names 2 structures used to accomplish a task	16.0	50.0	27.6	6.3
Selects picture of next stage of life cycle	13.3	43.3	34.8	8.5
Completes a graphic organizer of two kingdoms	16.0	53.2	24.5	6.3
Selects picture of season-neutral activity	36.6	49.6	10.8	3.0
Describes 1 effect of pollution on the environment	36.0	50.2	9.7	4.1
Describes 1 consequence of unsafe food handling practices	73.0	23.3	2.6	1.1
Physical Sciences				
Creates 1 group based on 2 attributes named	24.4	55.2	15.6	4.8
Select item from a complex photograph based on the possibility of change in physical matter described	52.2	42.6	4.1	1.1

Table 46 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Describes 1 reason for maintaining a constant temperature to preserve a state of matter	52.2	40.4	5.6	1.9
Selects photograph of ingredients in a food item presented in a photograph when ingredient don't maintain their appearance	26.7	54.4	15.6	3.3
Describes 1 reason for a problem in a scenario involving weight and force	18.5	59.6	16.3	5.6
Selects moving object/person that will arrive first/last from a 10-item display	14.8	51.9	25.6	7.8
Earth and Space Sciences				
Selects picture of source of processed food/product named	16.8	49.3	28.4	5.6
Matches 4 pictures of processed food/product with each of its source	28.6	51.7	16.0	3.7
Selects 2 items that can be recycled from a photograph	34.8	53.0	10.0	2.2
Describes 1 way to conserve	44.1	45.9	7.4	2.6
Selects picture of person wearing clothing/accessories for a temperature named and shown	65.9	30.0	3.0	1.1
Names extreme weather condition described	59.5	36.1	3.7	0.7
Selects weather symbol by making prediction based on current weather and trend	42.6	50.6	5.3	1.5
Selects picture of location that is the safest/most dangerous under weather condition named	73.4	24.0	1.9	0.8

Table 47 Teacher Ratings of the Level of Importance for the Grade 8 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Names 1 advantage/disadvantage of a new technology	29.2	58.8	10.5	1.5
Describes function of a part from a simple man-made system	46.4	48.7	4.2	0.8
Biological Sciences				
Describe 1 effect that habitat destruction has on the acquisition of basic needs	26.7	59.4	13.2	0.8
Names 2 structures required to accomplish a task	18.4	53.8	24.4	3.4
Sequences 4 stages in the life cycle	17.7	52.5	27.5	2.3
Completes a graphic organizer of 5 classes	23.0	51.3	21.9	3.8
Describes 2 characteristics of a season that permits activity named	51.1	42.9	5.6	0.4
Describes 1 effect of pollution on wildlife	36.2	52.8	9.8	1.1
Describes 1 unsafe food handling/preparation practice in scenario described	81.1	17.4	1.1	0.4
Physical Sciences				
Sorts 6 objects into 3 groups based on 2 attributes named	25.1	54.7	16.9	3.4
Describes 1 reason an item remains in the same state of matter	39.8	51.9	6.4	1.9
Names 2 ingredients used to make item pictured when ingredients don’t maintain their appearance	41.5	50.6	6.8	1.1

Table 47 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Names item that can be prepared with the ingredients in the photographs	47.2	46.8	5.3	0.8
Describes 1 reason for the difference in the force exerted to move an object	22.5	60.7	14.2	2.6
Selects moving object/person that traveled the longest/shortest distance from a 15-item display	17.6	50.9	27.0	4.5
Selects the fastest/slowest moving object /person from a 15-item display	18.8	51.1	25.6	4.5
Earth and Space Sciences				
Names primary ingredient in processed food	34.1	52.3	11.4	2.3
Sorts 9 photographs of recyclable and non-recyclable objects into 4 disposable categories	45.3	48.7	5.2	0.7
Select picture of person using the most/least amount of a resource	30.8	57.1	10.5	1.5
Names 1 clothing/accessory that should be worn in temperature named and shown	76.0	22.5	0.7	0.7
Selects word that describes weather condition	59.2	39.6	0.8	0.4
Selects area on a weather map based on information within the map legend	35.3	47.8	13.3	3.5
Names 2 precautions to take under weather condition named	80.0	19.6	0.4	0.0

survey rated some of the graphing content as important. Although slightly higher, only 70% of parents who responded to the level C survey considered content related to graphing as important when compared to other content. Other content such as calculating speed and using organizers to list the kingdom, class, and species of animals were also reported as less important than other skills based on the level C surveys returned by parents. Tables 48, 49, and 50 provide a summary of responses by parents in grade 11.

A similar pattern of responding to the importance of different content areas was seen at between the parents who returned the grade 11 level A survey and the test administrators who returned the grade 11 level A surveys. Overall test administrators who returned the level A survey rated the content as less important when compared to the ratings for test administrators who returned the level B and level C surveys. Content like making sure foods are safe to eat and selecting clothing based on temperature, were reported by test administrators at all three levels to be some of the most important content. Many test administrators who returned the level B and level C surveys also considered content including fixing problems with man-made machines, solving problems dealing with moving items, conservation of resources, and how to respond to extreme weather scenarios were also rated as more important than other content. Level C surveys also had additional content that was considered just as important by many of the test administrators who returned their surveys. Content like the affect of humans on the environment, conservation of resources, and selecting foods based on dietary restrictions were considered just as important as other content areas. Many test administrators who returned the surveys also considered the content area related to interpreting bar graphs and line graphs not to be as important as other content areas at all three levels. The use of organizers to list the

Table 48 Parent Ratings of the Level of Importance for the Grade 11 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects tallest/shortest bar described on bar graph	20.5	39.7	17.9	21.8
Matches trendlines	15.5	31.0	26.5	27.1
Selects most recent innovation in technology from choices that all perform same basic function	26.1	28.0	23.6	22.3
Selects picture of a part of a man-made system that will solve a problem described	35.9	35.3	11.5	17.3
Biological Sciences				
Select picture of shelter for an animal named	28.0	43.9	12.7	15.3
Selects picture of an animal that lives in a place named	24.2	45.9	15.3	14.6
Selects picture of a structure used for a similar function in another animal or person	22.6	38.1	21.9	17.4
Selects member of a class named	28.6	40.9	14.3	16.2
Select picture of food that is safe/unsafe to eat	59.0	23.7	5.8	11.5
Physical Sciences				
Selects object based on 2 attributes named	23.2	38.7	20.6	17.4
Selects picture of item that will/will not melt	29.5	41.0	14.7	14.7
Earth and Space Sciences				
Selects picture of source of product named	26.1	42.0	17.8	14.0

Table 48 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects picture of clothing/accessory that should be worn in temperature named	56.7	26.8	5.7	10.8

Table 49 Parent Ratings of the Level of Importance for the Grade 11 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects value described on the y-axis of a bar graph	14.7	45.0	25.6	14.7
Selects the category on the x-axis based on data from the y-axis of a bar graph	15.5	42.6	25.6	16.3
Selects biggest/smallest value on a line graph with numbers	25.6	42.6	20.9	10.9
Selects value described on the y-axis of a line graph	19.5	46.1	21.1	13.3
Selects the category on the x-axis based on data from the y-axis of a line graph	17.8	41.1	30.2	10.9
Selects 2 values described on a line graph	17.8	36.4	34.9	10.9
Names 1 consequence of a new technology	32.0	46.9	14.1	7.0
Describes 1 solution to a problem with a simple man-made system	41.1	47.3	8.5	3.1
Biological Sciences				
Describes 2 advantages/disadvantages of one environment over another for survival of a specific species	32.8	48.4	12.5	6.3
Names structure and its function in the accomplishment of a task named	23.3	51.9	18.6	6.2
Completes a graphic organizer of 4 classes when pictures of species are shown	30.5	46.9	15.6	7.0
Describes 1 effect of pollution on living things in the scenario described	52.0	33.9	11.0	3.1
Selects picture of food that is safe to eat based on expiration date	67.2	27.3	3.9	1.6

Table 49 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Describes 1 reason for using safe food handling practices	71.1	27.3	0.0	1.6
Describes 1 way to determine whether food is unsafe to eat	72.4	26.0	0.0	1.6
Physical Sciences				
Selects object based on 3 attributes named	28.6	43.7	22.2	5.6
Sequences changes in states of matter as a function of temperature	26.0	50.4	17.3	6.3
Selects photograph of item that can be prepared with 3 ingredients	46.9	40.6	10.9	1.6
Describes 1 solution to a problem in a scenario involving weight and force after one attempt to move the item failed	39.1	47.7	10.9	2.3
Selects the fastest/slowest moving object /person from a 15-item display	20.5	43.3	31.5	4.7
Earth and Space Sciences				
Selects picture of source of processed food/product named	28.1	46.9	21.9	3.1
Describes 1 effect of conservation effort on the environment	44.1	46.5	7.9	1.6
Complete a table showing people wearing different clothing/accessories by matching temperatures	59.1	33.1	5.5	2.4
Locates day in which the described activity is most/least appropriate given a 5-day weather forecast	50.0	46.8	1.6	1.6
Selects picture of person engaged in action that is safest/most dangerous under weather condition described	63.8	29.9	4.7	1.6

Table 50 Parent Ratings of the Level of Importance for the Grade 11 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects data point described on a bar graph	13.5	57.3	22.9	6.3
Selects interval in which change in data described occurred	14.6	55.2	25.0	5.2
Identifies trend on a line graph	11.6	58.9	23.2	6.3
Calculates the difference in 2 values on a line graph	17.9	46.3	24.2	11.6
Makes prediction using a line graph	14.6	43.8	33.3	8.3
Selects missing value based on interpretation/extrapolation on a line graph	11.6	46.3	36.8	5.3
Names 1 consequence of a new technology	30.9	50.0	14.9	4.3
Describes 2 possible problems with a simple man-made system when 1 problem has been eliminated	44.8	43.8	9.4	2.1
Biological Sciences				
Sorts pictures of animals in 4 habitats	27.1	55.2	14.6	3.1
Describes 1 similarity in the function of different structures between 2 species	24.5	50.0	22.3	3.2
Completes a graphic organizer of kingdom, class, and species	22.3	38.3	36.2	3.2
Describes 2 effects of human activity on the environment	42.6	44.7	9.6	3.2
Describes function of expiration date	69.9	26.9	1.1	2.2

Table 50 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Physical Sciences				
Sorts 7 objects into 2 groups based on new attribute after items are presorted	37.2	42.6	18.1	2.1
Select picture of item heated/cooled the longest/shortest amount of time	30.9	36.2	27.7	5.3
Describe the change in state of matter in a scenario described involving changes in temperature	34.0	45.7	18.1	2.1
Selects food based on dietary restrictions	61.7	29.8	7.4	1.1
Describes 1 solution to a problem in a scenario involving weight and force after two attempts to move the item failed	52.7	39.8	5.4	2.2
Calculates missing value of the distance traveled based on a 20-item display	22.9	38.5	31.3	7.3
Earth and Space Sciences				
Orders 5 pictures based on the manufacturing process	36.5	44.8	14.6	4.2
Describes 1 environmental reason for using one of the 2 pictured options	39.6	46.9	11.5	2.1
Names 1 clothing/accessory that should be worn at 1 temperature named and shown but not at another temperature named and shown	58.9	34.7	5.3	1.1
Locates day in which the weather condition described is most/least likely to occur given a 5-day forecast with percent probability shown on display	44.2	40.0	12.6	3.2
Selects word for a weather condition under which described precautions are most appropriate	55.2	40.6	3.1	1.0

kingdom, class, and species of animals was also reported as less important than other skills based on the level C surveys returned by test administrators. Tables 51, 52, and 53 provide a summary of responses by test administrators in grade 11.

Table 51 Teacher Ratings of the Level of Importance for the Grade 11 Level A Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects tallest/shortest bar described on bar graph	10.2	36.5	23.2	30.2
Matches trendlines	4.9	23.7	35.0	36.4
Selects most recent innovation in technology from choices that all perform same basic function	13.4	33.2	31.1	22.3
Selects picture of a part of a man-made system that will solve a problem described	27.0	45.3	11.6	16.1
Biological Sciences				
Select picture of shelter for an animal named	14.8	51.6	20.1	13.4
Selects picture of an animal that lives in a place named	15.5	52.9	18.0	13.7
Selects picture of a structure used for a similar function in another animal or person	9.8	41.1	30.5	18.6
Selects member of a class named	16.3	46.6	21.2	15.9
Select picture of food that is safe/unsafe to eat	61.5	23.0	5.7	9.9
Physical Sciences				
Selects object based on 2 attributes named	16.5	43.9	24.9	14.7
Selects picture of item that will/will not melt	23.2	48.9	14.4	13.4
Earth and Space Sciences				
Selects picture of source of product named	13.4	48.2	24.6	13.7

Table 51 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Selects picture of clothing/accessory that should be worn in temperature named	54.2	31.0	6.0	8.8

Table 52 Teacher Ratings of the Level of Importance for the Grade 11 Level B Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects value described on the y-axis of a bar graph	12.3	48.2	27.2	12.3
Selects the category on the x-axis based on data from the y-axis of a bar graph	11.2	47.1	29.9	11.9
Selects biggest/smallest value on a line graph with numbers	18.3	54.3	19.8	7.6
Selects value described on the y-axis of a line graph	8.3	51.6	29.6	10.5
Selects the category on the x-axis based on data from the y-axis of a line graph	11.1	49.1	28.5	11.2
Selects 2 values described on a line graph	10.4	47.1	31.7	10.8
Names 1 consequence of a new technology	29.0	55.1	14.1	1.8
Describes 1 solution to a problem with a simple man-made system	52.5	43.5	3.6	0.4
Biological Sciences				
Describes 2 advantages/disadvantages of one environment over another for survival of a specific species	24.5	45.8	25.6	4.0
Names structure and its function in the accomplishment of a task named	18.7	46.8	30.6	4.0
Completes a graphic organizer of 4 classes when pictures of species are shown	19.2	56.5	20.3	4.0
Describes 1 effect of pollution on living things in the scenario described	31.7	56.8	9.4	2.2
Selects picture of food that is safe to eat based on expiration date	72.7	25.9	1.1	0.4

Table 52 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Describes 1 reason for using safe food handling practices	73.7	24.5	1.4	0.4
Describes 1 way to determine whether food is unsafe to eat	73.4	25.2	1.1	0.4
Physical Sciences				
Selects object based on 3 attributes named	20.7	60.1	17.0	2.2
Sequences changes in states of matter as a function of temperature	20.3	57.6	19.9	2.2
Selects photograph of item that can be prepared with 3 ingredients	41.5	52.7	5.1	0.7
Describes 1 solution to a problem in a scenario involving weight and force after one attempt to move the item failed	35.7	57.0	5.4	1.8
Selects the fastest/slowest moving object /person from a 15-item display	11.9	47.3	33.6	7.2
Earth and Space Sciences				
Selects picture of source of processed food/product named	20.5	48.6	27.0	4.0
Describes 1 effect of conservation effort on the environment	33.8	54.0	10.8	1.4
Complete a table showing people wearing different clothing/accessories by matching temperatures	53.4	43.0	2.5	1.1
Locates day in which the described activity is most/least appropriate given a 5-day weather forecast	56.7	40.1	2.9	0.4
Selects picture of person engaged in action that is safest/most dangerous under weather condition described	65.3	31.4	2.9	0.4

Table 53 Teacher Ratings of the Level of Importance for the Grade 11 Level C Alternate Science Assessment Items

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Nature of Science				
Selects data point described on a bar graph	24.4	49.8	22.0	3.8
Selects interval in which change in data described occurred	20.1	52.2	22.0	5.7
Identifies trend on a line graph	23.3	54.3	18.6	3.8
Calculates the difference in 2 values on a line graph	21.9	53.8	20.5	3.8
Makes prediction using a line graph	19.1	48.8	27.3	4.8
Selects missing value based on interpretation/extrapolation on a line graph	13.8	54.3	26.2	5.7
Names 1 consequence of a new technology	32.4	51.9	13.8	1.9
Describes 2 possible problems with a simple man-made system when 1 problem has been eliminated	57.1	37.6	4.8	0.5
Biological Sciences				
Sorts pictures of animals in 4 habitats	19.5	56.2	21.0	3.3
Describes 1 similarity in the function of different structures between 2 species	16.7	53.6	23.9	5.7
Completes a graphic organizer of kingdom, class, and species	17.6	54.8	23.8	3.8
Describes 2 effects of human activity on the environment	41.9	48.6	8.6	1.0
Describes function of expiration date	79.5	17.1	3.3	0.0
Physical Sciences				
Sorts 7 objects into 2 groups based on new attribute after items are presorted	27.3	54.1	15.3	3.3

Table 53 (continued)

	Percentage who rated item as very important	Percentage who rated item as important	Percentage who rated item as not important	Percentage who rated item as really not important
Select picture of item heated/cooled the longest/shortest amount of time	25.7	51.9	19.5	2.9
Describe the change in state of matter in a scenario described involving changes in temperature	22.4	61.9	11.9	3.8
Selects food based on dietary restrictions	64.8	31.4	3.3	0.5
Describes 1 solution to a problem in a scenario involving weight and force after two attempts to move the item failed	48.6	43.8	5.2	2.4
Calculates missing value of the distance traveled based on a 20-item display	16.3	49.5	25.0	9.1
Earth and Space Sciences				
Orders 5 pictures based on the manufacturing process	21.2	58.7	18.8	1.4
Describes 1 environmental reason for using one of the 2 pictured options	38.9	52.4	8.2	0.5
Names 1 clothing/accessory that should be worn at 1 temperature named and shown but not at another temperature named and shown	62.5	33.2	4.3	0.0
Locates day in which the weather condition described is most/least likely to occur given a 5-day forecast with percent probability shown on display	48.6	43.3	6.7	1.4
Selects word for a weather condition under which described precautions are most appropriate	57.2	37.5	5.3	0.0

6.0 DISCUSSION

With the expectation of alternate assessment programs to be aligned with standards (U.S. Department of Education Office of Elementary and Secondary Education, 2007), all states have been required to conduct alignment studies to demonstrate alignment with regular education standards. Several authors also encouraged the alignment studies to be conducted to aid the teachers and students with significant cognitive disabilities because if the alternate assessment standards and alternate assessment items are tied to the regular education standards, this may promote instruction and curriculum changes for students with significant cognitive disabilities. With this in mind, there appeared to be support for the conclusion that the alternate science assessment anchors and alternate science assessment items were linked, but there were some possible limitations to results reported.

6.1 LIMITATIONS

Although the alignment study used aspects of the Links for Academic Learning (LAL) (Flowers et al., 2007), not all of the procedures used within the LAL model were used. When used in its entirety, the LAL model would be considered a high complexity alignment model. Since information such as depth of knowledge, balance, and range of items, were not included, the current alignment study would be considered a low complexity alignment model (Bhola et al.,

2003). However, Flowers, Wakeman, Browder, and Karvonen (2009) and Bhola et al. (2003) suggest completing a low complexity alignment study as a good starting point before moving onto a high complexity alignment model. By conducting a low complexity alignment study it was not possible to pinpoint specific misalignments in alternate science assessment anchors and alternate science assessment items in the current study (Flowers et al., 2009).

A second possible limitation is the format in which the panelists completed the alignment study. Each panelist within the study independently rated the alternate science assessment anchors or the alternate science assessment items with final results totaled as the number, or percentage, or panelists who rated an anchor/item a certain way. Within the LAL model, panelists review the items and come to consensus before rating. Without consensus ratings, the data had to be summarized differently than the data summaries used in the LAL model. As a result, data interpretation may be limited since there was no consensus.

Towles-Reeves, Kleinert, and Muhomba (2009) recommended different stakeholders should participate in the alignment review process, which was done in the current study by including university faculty and teachers from special education and science education. However, these stakeholders did not review all of the materials from all of the grade levels like the panelists selected for the LAL model. Instead, the special education teachers and science education teachers were given grade specific items to rate instead of all of the grade level items.

Another possible limitation, albeit a minor point, is that the LAL model uses the National Research Council's science standards to determine whether items are considered academic (Flowers et al., 2009). The current study used the Pennsylvania regular education science assessment anchors as the first measure of alignment. By doing so, some items that may have

been rated as linked to the national standards may not be linked to the state regular education science assessment anchors.

One final possible limitation of the current study involved the return rate of the grade and test level surveys from parent and teachers. With only 20% of the parent surveys returned and just over 60% of the teacher surveys returned, generalization of the results is difficult. As a result, any conclusions drawn from the data can only refer to the individuals who returned the surveys.

6.2 ALIGNMENT OF ALTERNATE SCIENCE ASSESSMENT ANCHORS AND REGULAR EDUCATION SCIENCE ASSESSMENT ANCHORS

The first step in the alignment study conducted was to determine whether not the alternate science assessment anchors were linked to the regular education science assessment anchors. Linking the alternate assessment anchors and the regular education science assessment anchors is necessary because the anchors are the foundation of what content areas are to be taught in the classroom and possibly what may be included on the statewide science assessment. According to the results of this study, almost all of the alternate science assessment anchors were indeed linked to the regular education science assessment anchors. In other words, both sets of anchors were covering similar content areas. It should be noted that the single alternate science assessment anchor panelists rated as not linked was the same content strand at each grade level. Although an important life skill for students with significant cognitive disabilities, the alternate assessment anchor addressing the safety of food and recognizing what is safe and not safe to eat was not considered to be linked to the regular education science assessment anchors. That being said, this content strand may be rated differently if the panelists were asked to rate the items

compared to the science standards developed by the National Research Council (2005). According to the National Research Council (2005) concepts like nutrition, relationships between germs and illness, and recognizing how foods contribute to a person's overall health are all included within the science in personal and social perspectives. With that in mind, an alternate anchor addressing how to determine whether or not food is safe to eat, proper food storage, and how food preparation affects food would more than likely be classified as science under the personal and social perspective under personal health. In Pennsylvania, concepts such as germs and safe foods are addressed within the regular education state standards of health, safety, and physical education within the concepts of health domain (Pennsylvania Department of Education, 2002b).

In addition to rating whether or not an alternate science assessment anchor was linked to the regular education science standards, panelists were asked to determine the anchor domain in which they believed the linked items should be classified. Even though the panelists did not show 100% agreement with the PASA team on their classification, it should be noted that there were a large majority of skills that had an exact match on the anchor domain. This information was not considered critical to the determination of whether or not an alternate anchor was linked, but more of a confirmation that the PASA team identified the correct anchor domain to include the alternate anchor. The information provided by the panelists provided confirmation to the PASA team that they indeed had the correct anchor domain identified. Some disagreement was expected since the regular education anchors may involve several possible science categories. For example, an alternate anchor related to the change in weather conditions may be identified as changes in seasons patterns that occur regularly (nature of science) or identifying basic weather conditions and how they are measured (earth and space science). The panelists' background, and

experience with the regular education science anchors, may have affected how they classified the alternate anchor.

6.3 VALIDATION OF PASA-SCIENCE ASSESSMENT ITEMS

Several steps were taken within this study to validate the alternate assessment items from the PASA-Science. As Flowers et al. (2009) suggested, the first step in validating alternate assessment items it to first determine whether or not the items are considered academic. Instead of just asking whether or not an item is academic, the panelists involved in this part of the study were asked to determine whether or not each alternate assessment item was considered science or a foundational skill. Almost all of the alternate assessment items were unanimously rated as science. The only item that was repeatedly not rated as science was a skill only present at the level A of the PASA-Science; orienting to materials. Since the students with significant disabilities who take the level A of the PASA-Science are considered the students with the most involved disabilities, the first question of each of the PASA-Science assessments requires the student to demonstrate he/she is attending to the materials that have been placed in front of him/her. As a result of the demand of this skill, a large majority of the panelists rated this as a foundational skill instead of science. According to Almond et al. (2008), "Foundational skills are important and appropriate to capture early academic achievement for some students with significant cognitive disabilities but are not considered aligned because they are outside of the academic domain" (p.14). With that in mind, it was not surprising that many of the panelists rated orienting as a foundational skill and not science.

In addition to determining whether or not the items are considered science, Decker and Bolt (2008), Elliot and Roach (2007), and Marion and Pelligrino (2006) recommended validation of the alternate assessment items to determine to what extent they are measuring specific alternate science eligible content and more specifically, to what extent the alternate assessment items represent a student's understanding of the alternate science eligible content. Both recommended validations were completed in this study by asking panelists to determine first whether or not there was a link to the alternate eligible content, then to determine how closely the alternate assessment items link to the alternate science eligible content. Data from both steps of this part of the validation study support the conclusion that not only do the alternate assessment items measure the alternate eligible content, but also serve as an indication of the student's understanding of the science concepts tested in the PASA-Science. For items to be considered linked, Almond et al. (2008) stated that items must "include major domains of the content area as reflected in the state and national standards" (p. 11). Instead of using state and national standards, this study used the Pennsylvania alternate science eligible content for the panelists to determine a link. With that being said, the data indicated that almost all of the items reported as science by all of the panelists were considered science and only seven of the alternate assessment items from grade 4 to grade 11 were rated as not being linked to the alternate eligible content. It should be noted though that there were a few panelists at grade 4 that considered orienting to the materials as linked to alternate eligible content even though there is no alternate eligible content related to that alternate assessment item. In addition, the one panelist who rated orienting to materials on science in grade 8 failed to rate the item as linked or not linked to alternate eligible content. Since consensus scoring was not used in the study, data were reviewed to determine whether or not the majority of individuals rated items as linked. With this in mind, it should be

noted that of the six items that were rated not linked, no more than two of the panelists from any grade level rated the items as not linked.

According to Flowers et al. (2007) items defined as a near link as, “the standard is specific and the item clearly measures the content” (p. 57); and a far link as, “the item measures has some of the original content standard” (p. 57); and no link as, “the item does not measure the standard” (p. 57). There were a total of 133 items considered a near link by all of the panelists at the different grade levels and another 46 alternate items being rated as a near link by most of the panelists at the different grades. Data such as these suggested that the alternate assessment items are indeed measuring a student’s understanding of the science concepts performed within the PASA-Science. For the alternate assessment items that were considered not linked to the alternate eligible content, those panelists provided two possible reasons for the rating; a mismatch or overstretching. Flowers et al. (2007) defined mismatched as, “an error in identifying the correct standards” (p. 57); defined overstretched as, “the item has lost the intention meaning of the standard” (p. 57). One possible reason for the rating of no link may be due the experience those panelists may have had with those specific alternate assessment items and the alternate eligible content. Interestingly enough, seven of the nine panelists who rated an alternate assessment item as not-link were regular education science teachers. This note is only mentioned because Spooner, Ahlgrim-Delzell, Kohprasert, Baker, and Courtade (2008) raised the notion that science experts may have rated items differently than special education experts when reviewing performance indicators using the National Science Education Standards for their study. Considering science education teachers may have no interaction with students with significant cognitive disabilities, alternate assessment items or alternate eligible content may

have been viewed differently with these science education teachers. Regardless, the overall data supports the validation of the alternate science assessment items.

6.4 EDUCATIONAL VALIDITY AND THE PASA-SCIENCE ASSESSMENT ITEMS

When reviewing the data from the test administrator surveys and the parent surveys, two patterns became apparent that support the claims made by Towles-Reeves et al. (2009). In their review of articles investigating alignment studies, Towles-Reeves et al. (2009) reported that teachers' attitudes toward alternate assessments were less positive for older students such as those students in high school. When reviewing the data from the test administrators who returned the item importance rating surveys, the middle school and high school test administrators tended to rate the importance of science content as less important when compared to the ratings for assessment items from elementary school test administrators. Although there were still assessment items that were rated as important, many of the skills one may consider more related to science understanding (e.g., force and motion, classification of species, and basic needs of animals) were not rated as important by test administrators at the high school level. Middle school test administrators and high school test administrators, however, did consistently rate items related to survival such as identifying foods that were safe to eat, selecting clothing based on the weather, and how to use tools and simple man-made machines as important. Towles-Reeves et al. (2009) also reported that parent perceptions of skills became less positive as their child got older. Instead, parents reported the students should be working more towards functional skills. When reviewing the parent rating of the importance of science assessment items, those parents who returned the surveys also rated items related to functional skills as more important. Parents who

returned level A surveys rated items related to functional skill such as selecting clothing depending on the weather and knowing when foods were safe to eat clearly more important than other assessment items. Although parents at every level rated these two assessment items as important, parents of students who took the level B and level C PASA-Science also rated more science knowledge questions as important. A similar pattern was noted as the grade level increased. Functional skills such as how to solve a problem with a man-made machine and what to do during an extreme weather condition at grade 8 and 11 were rated extremely high compared to nature of science assessment items related to interpreting bar graphs and line graphs or physical science assessment items such as calculating the speed of a moving object. One other note, albeit a minor note, parents at different levels rated all of the assessment items as more important when compared to the test administrators that returned the assessment item surveys. A possible result of the low importance of the science content, especially for the students that take the level A PASA-Science, is that science content may not be introduced in those classrooms.

A final note on the parent and test administrator surveys that were returned needs to be made at this time regarding an item both groups rated as important; the content related to the safety of food and recognizing what is safe and not safe to eat. This science content area was rated as highly important as every grade level and test level by parents and test administrators, but this item was determined not to be linked by the faculty who reviewed the alternate assessment anchors. Although this item was not found in the regular education science anchors, it clearly has its importance in the lives of students with significant disabilities as documented by the test administrators and parent surveys. As indicated earlier, content such as the safety of foods may be considered science if the science standards created by the National Research Council (1996)

were used. Since those standards were not used, and the item was not rated as aligned to the regular education science assessment anchors, the question should be raised as to whether or not that strand of content should be removed from the alternate science assessment anchors.

6.5 EXTENSIONS TO CURRENT RESEARCH

In addition to adding to the limited documentation available on the alignment of alternate state assessments, the current study also contributes to several areas that have recently been explored.

Since the development of alternate state assessments, researchers have been documenting their concerns about the technical adequacy of the alternate assessments. Portfolio-based assessments have been criticized for many reasons including: leaving out criteria for the performance of skills and not measuring standards (Johnson & Arnold, 2004); having fewer questions in the assessment thus making it more difficult to obtain categorical concurrence (Flowers et al., 2006); and documented poor reliability and validity problems (Tindal, McDonald, Tedesco, Glasgow, Almond, Crawford, & Hollenbeck, 2003). Instead of the use of portfolio-based assessments for reasons such as those mentioned above, Elliot, Compton, and Roach (2007) recommended the use of performance-based assessments. Performance-based assessments typically have more aligned items, sample more discrete knowledge, and typically produce quantitative validity evidence (Elliot et al., 2007). As shown in the current results, the PASA-Science assessment items were aligned with the alternate eligible science content and sampled all four science content areas. Since the PASA-Science is a performance-based assessment, the current alignment study provides evidence similar to the claims described by Elliot et al. (2007).

A second area in which the current study adds to the existing research is helping to define what science is for students with significant cognitive disabilities. In their Links for Academic Learning alignment procedure, Flowers et al. (2009) suggested asking the question of whether the skills are considered academic. Because of a lack of research in teaching science to students with significant cognitive disabilities and defining science for student with significant cognitive disabilities, individuals may find it difficult to demonstrate a link between what is currently being taught in the classroom and the link back to the regular education standards (Spooner et al., 2008). Such difficulty was noted by Browder et al. (2006) when reviewing studies documenting the teaching of science to students with significant cognitive disabilities. In their findings, many of the studies included activities that taught daily living skills but also had some measure that could be considered as science. By asking panelists to review all of the PASA-Science assessment items to determine if they would be considered science, this study provides information about skills that are considered science-based. Since these skills were also found to be aligned to the alternate eligible content, a clearer definition of what science is for students with significant cognitive disabilities, at least for students in Pennsylvania, is available.

By having a clearer definition of what science may be for students with significant cognitive disabilities, a third extension of the current study to existing research is that it may provide support for the movement of programming toward access to the general education curriculum. In two separate reports, Browder et al. (2003) and Browder et al. (2004) suggested that a transition in the instructional model to include access to the general education curriculum. As a result, students with significant cognitive disabilities may have increased academic expectations with academic skills being closely aligned to the regular education standard. As mentioned previously, panelists considered the PASA-Science assessment items as science and

linked to the alternate eligible science content. Panelists also rated the alternate science assessment anchors as linked to the regular education science assessment anchors. By having an assessment that is linked to the alternate eligible content and alternate assessment anchors that are linked to the regular education assessment anchors, this study helps provide evidence that the PASA-Science assessment items being taught are linked to the general education curriculum. The assessment content may then be used to help determine how general education science content may be interpreted so that students with significant cognitive disabilities are able to participate in regular science education curriculums.

A final extension to current research is that the current study may help provide insight into possible curriculum decisions being made. By asking test administrators and parents to rate the level of importance of the science content, it is possible that what the test administrators and parents rated as important may be likely to appear in the classroom curriculum. Several authors have also suggested that if an assessment demonstrates alignment, assessment results can be used to evaluate student learning. More specifically, teachers may be able to attribute change in assessment performance to their instructional changes (Decker & Bolt, 2008; Elliot & Roach, 2007). Since the current study demonstrated alignment between PASA-Science assessment items and the alternate eligible content, teachers may utilize the assessment results to help guide which content areas may need to be addressed in the curriculum, therefore using the assessment to make curriculum decisions.

6.6 SUMMARY

The current study was designed to determine: how well the alternate science assessment anchors are aligned with regular education science assessment anchors; how closely aligned are the PASA-Science assessment items to the alternate science eligible content; and finally, how much parents and test administrators value the content assessed through the PASA-Science. According to the data provided by panelists, the alternate science anchors, with the exception of one (identify items that are safe to eat and how to determine when foods are safe to eat), were indeed aligned with the regular education science assessment anchors. Furthermore, a different set of panelists concluded that the alternate assessment items were indeed science, with the exception of orienting to materials, and the alternate assessment items were measuring the students' understanding of alternate science eligible content. Finally, parents and test administrators who returned the assessment item surveys indicated that content related to the safety of their children/students were rated as more important than some of the other science content. Content such as knowing what is safe to eat and how to determine if food is safe, knowing how to solve problems with man-made machines, determining what clothing to wear, and what precautions to take in extreme weather was rated as very important.

6.7 FUTURE CONSIDERATIONS IN THE VALIDATION OF THE PASA-SCIENCE

As mentioned earlier, very limited research has been conducted in the field of alignment of alternate assessment. In their most recent publication Towles-Reeves et al. (2009) reported that only 10 documented alignment studies have been conducted and published. Of those 10 studies,

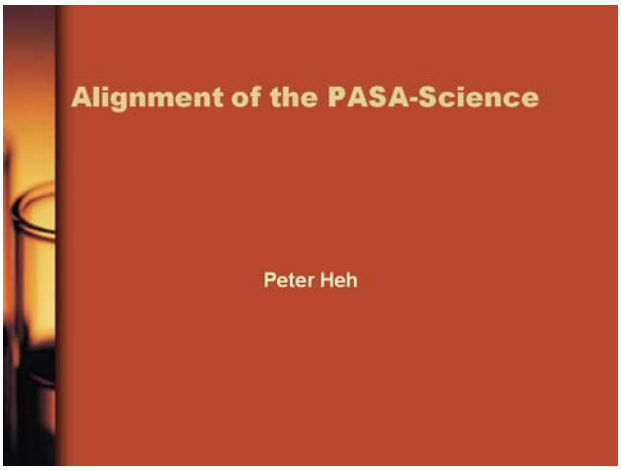
very little was reported on alternate science content. This preliminary study was conducted to measure the alignment of the PASA-Science and the alternate science assessment anchors. Since this study would be considered a low-complexity model of an alignment study, one future consideration is to complete a high-complexity model of alignment such as Webb's model or the Links for Academic Learning model. By doing so, more in depth measures such as the depth of knowledge and measures of the breadth of content coverage may be addressed.

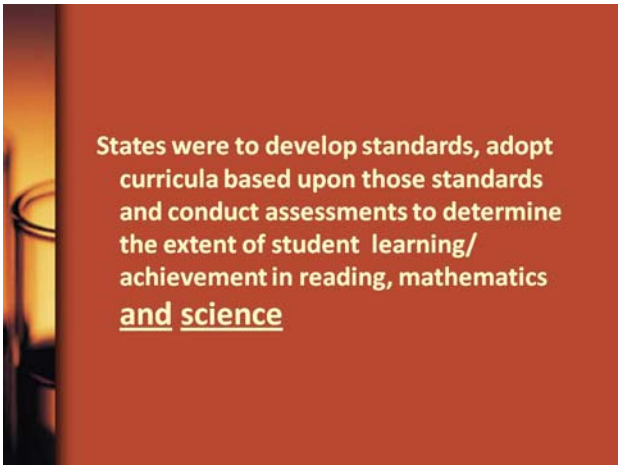
Another future direction of the research with the PASA-Science could be a study on the effect of the PASA-Science on the science instruction for students with significant cognitive disabilities. Preliminary data has been summarized by the PASA team on this very subject; however, no further investigation has been done with the data. Information related to the changes in instruction after several rounds of administering the PASA-Science assessment may lead to a better understanding of how science curriculums are changing in the schools and ultimately the classrooms.

One final future direction that can be done to add to the limited amount of literature on the topic is in the field of teaching science to students with significant cognitive disabilities. Earlier, it was reported that only 11 studies involving teaching science to students with significant cognitive disabilities (Courtade et al., 2007). Now that the alternate assessment anchors have been validated, individual research related to teaching students with significant cognitive disabilities various science content areas. Conducting and documenting successful science instruction will not only add to the limited data available, but may also open more opportunities to students with significant cognitive disabilities to participate in a wide variety of science lessons.

APPENDIX A

POWERPOINT OF ALIGNMENT TRAINING FOR FACULTY





What is PASA?
(The Pennsylvania Alternate System of Assessment)

- A performance assessment of students' knowledge and skills in reading, mathematics and science
- The content is based upon and developed from the PA Academic standards
- Items are developed which assess skills that are meaningful to the students' lives
- Students are assigned to take one of three different conceptual levels of the assessment (A, B or C)
- Students are video-taped performing 20-25 tasks
- Students' tapes are scored using a rubric which measures independence and content knowledge

Differentiation of "Levels" of Performance

- (1) Degree of Independence, and
- (2) Level of Conceptual Understanding

Indicators of Independence:

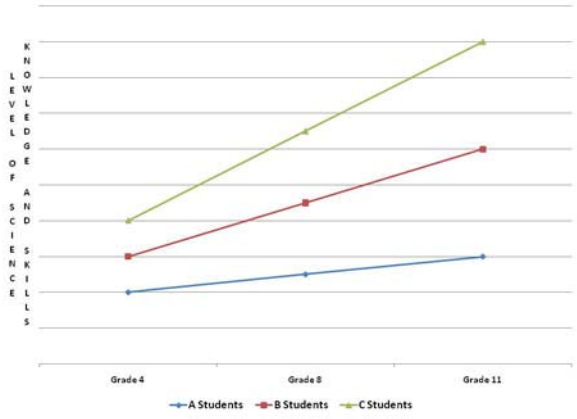
- Engagement with the task,
- Type and amount of prompting,
- Type and amount of assistance,
- Interaction with the test materials,
- Types of modifications needed

Indicators of Conceptual Understanding:

- Matches Items,
- Sorts groups of items,
- Identifies items,
- Identifies/describes functions of items,
- Classifies items,
- Labels items,
- Applies knowledge about items, and
- Produces responses to open-ended questions

Three Different Conceptual Levels of the Assessment:

- A Level – Concrete tasks, related to personal experiences, orienting, matching, sorting, receptive labeling, objects as test materials, extensive prompting and assistance;
- B Level – Representation using pictures, limited test and science vocabulary, related to familiar surroundings and experience, receptive and expressive labeling, sorting, classifying, identifying function, limited assistance; and
- C Level – Symbolic representation using text and complex pictures, extensive test and science vocabulary, related to experiences beyond personal familiarity, labeling, applying knowledge, producing responses to open-ended questions



Research on Science for Students with Disabilities

Mastropieri & Scruggs

- Extensive early work with students with high incidence disabilities
- Most done in general education classes
- Focus on adaptations of the general education curriculum, and
- Students learning much of the same content as general education students

Research on Science for Students with Significant Cognitive Disabilities

Diane Browder and colleagues:

- Substantial contributions to the development of alternate assessments,
- Research on general education curriculum access and validity studies of alternate assessments,
- Recent review of literature on science instruction for students with significant cognitive disabilities

Research on Science for Students with Significant Cognitive Disabilities – (some of) What We Know

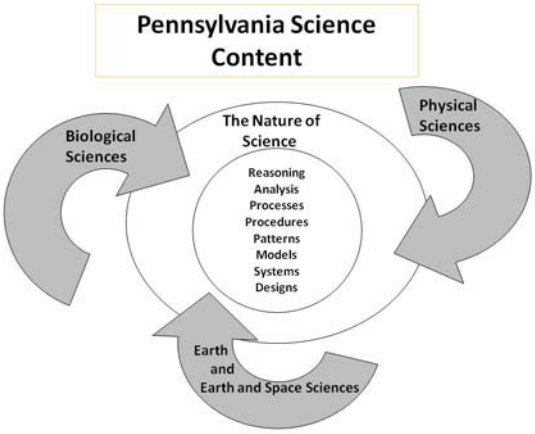
- Few studies have been conducted on teaching "science" to students with significant cognitive disabilities,
- Little consensus exists as to what constitutes "science" for students with significant cognitive disabilities,
- No (published) validation studies have been conducted on alternate science achievement standards or assessments,
- Most (science) alternate assessments are based on portfolios, checklists or IEP reviews

PASA Science: Our Research and Development Efforts

- Reinterpretation of the state science standards anchors and eligible content,
- Consultation with special education teachers,
- Consultation with general education teachers,
- Development of alternate eligible content, tasks and skills with science consultants,
- Two statewide pilot tests of assessment tasks,
- Analysis of data, revisions of tasks and realignment of alternate anchors and eligible content,
- "Final" assessment development and preparation

What we learned:

- Science items can be designed and written in the same format as the reading and math items,
- Teachers were able to administer the science items,
- The students' tapes could be reliably scored,
- Teachers indicated that the majority of the pilot test items were appropriate for the students' level,
- Teachers indicated that the majority of the pilot test items constituted "science,"
- Many teachers indicated that they taught similar content, and
- Logical progressions of the alternate achievement standards, benchmarks, and eligible content could be developed across grade and task levels



PSSA Science Assessment Reporting Categories

A. The Nature of Science
B. Biological Sciences
C. Physical Sciences
D. Earth and Space Sciences

DEVELOPMENT OF THE PASA SCIENCE ASSESSMENT

PSSA	PASA
Standard	
Anchor	Alternate Anchor
Eligible Content	Alternate Eligible Content
Skill Assessed	Skill Assessed
Assessment Item	Assessment Item

PSSA Science

Standard

3.3 Biological Sciences: 3.3.4.A & 3.3.4.B

4.3 Environmental Health: 4.3.4.A & 4.3.4.C

4.6 Ecosystem and their Interactions: 4.6.4.A

Anchor

Biological Sciences: S4.B.1 Structure and Function of Organisms

S4.B.1.1 Identify and describe similarities and differences between living things and their life processes.

Eligible Content

S4.B.1.1.5 Describe the life cycles of different organisms (e.g., moth, grasshopper, frog, seed, producing plant).

Skill Assessed

Use a diagram to answer a question about the life cycle of a grasshopper and a butterfly.

PASA Science

Alternate Anchor

Biological Sciences: S8.B.1 Structure and Function of Organisms

S8.B.1.1 Identify and describe structural characteristics of living things and their diverse needs for survival.

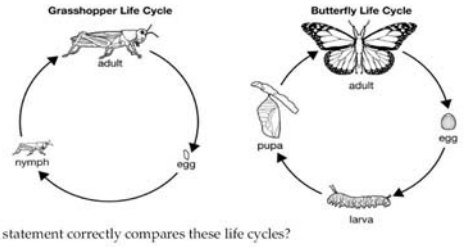
Alternate Eligible Content

S8.B.1.1.3 Describes life cycles of plants and animals including both vertebrates (birds, mammals, reptiles and fish) and invertebrates (complete or incomplete metamorphosis of insects).

Skill Assessed

Sequences 4 stages in the life cycle - stages are substantially different in appearance.

B.1.1.5
Use the diagrams below to answer question 1.



1. Which statement correctly compares these life cycles?

A Butterflies lay eggs and grasshoppers do not lay eggs.
B Butterflies have wings throughout their life cycle and grasshoppers do not.
C Butterflies have more legs as adults than do grasshoppers as adults.
D Butterflies go through more body-shape changes than do grasshoppers.*

A Butterflies and grasshoppers both lay eggs.
B Neither butterflies nor grasshoppers have wings throughout their life cycles.
C Butterflies and grasshoppers both have six legs.
D Key: Butterflies go through one more body-shape change than do grasshoppers.

Skill 12

8 C Science

Skill assessed: Sequences 4 stages in the lifecycle - stages are substantially different in appearance

Materials

- pictures: eggs, butterfly, larva, pupa

1. Present 4 pictures of a butterfly (eggs, butterfly, larva, pupa). *Do not name the pictures.*	
2. Point to each picture as you say: ***These are pictures of a butterfly at different stages of the lifecycle.***	
Beginning prompt	*Response*
3. Say: ***Put the stages in the order that they would occur in the lifecycle.*** Point to the student's far left as you say: ***Start here with the first stage.***	• ***puts cards in order - eggs, larva, pupa, butterfly***
Alternate prompts	*Alternate responses*
Before moving on to the next item: 4. **Remove** all materials on the table.	

Science Areas Represented in the 2008 Assessment

- Nature of Science
- Earth and Space Science
- Physical Science
- Biological Science

Nature of Science-Subcategories:

- Systems, models and patterns, and
- Processes, procedures and tools of technology

Skill assessed: Selects picture of a part of a simple man-made system

Materials

- pictures: battery, sink handle, chain, key, flashlight

Student sits here facing materials

1. Present 4 pictures (battery, sink handle, chain, key).	
2. Say: ***Some things are made up of parts.***	
3. Point to each picture as you say: ***This is a battery, a sink handle, a chain, and a key.***	
4. Present the picture (flashlight).	
5. Say: ***This is a flashlight.***	
Beginning prompt	*Response*
6. Say: ***Find what should go in the flashlight.***	• ***points to battery***

Biological Sciences-Subcategories:

- Structures and functions of organisms, and
- Continuity of life
- Ecological behavior and systems,

Skill assessed: Describes 1 unsafe food handling/preparation practice in a scenario described

Materials

- none

1. Say: ***I am going to tell you a story and ask you a question about someone who did not make sure food stayed safe to eat.***	
2. Say: ***A man used a knife to cut raw chicken on a cutting board. After he cut the raw chicken, he started making the salad. He placed the vegetables for the salad on the same cutting board and started cutting them with the same knife.***	
Beginning prompt	*Response*
3. Say: ***Tell me one thing that the man did wrong.***	• ***says "did not clean the knife"***
Alternate prompts	*Alternate responses*
• *What did the man do wrong?*	• *says "used the same knife without washing it"* • *says "did not clean the cutting board"* • *says "used the same cutting board without washing it"*

Physical Science-Subcategories:

- Structure, properties and interaction of matter and energy, and
- Principles of motion and force

Skill assessed: Sorts 7 objects into 2 groups based on a new attribute - items are presorted - items differ on up to 4 attributes

Materials

- objects: small black thick ankle sock, large black thin mid-calf sock, large black thick ankle sock, small black thin mid-calf sock, small white thick ankle sock, small white thin mid-calf sock, large white thick mid-calf sock

1. Present 7 objects (small black thick ankle sock, large black thin mid-calf sock, large black thick ankle sock, small black thin mid-calf sock, small white thick ankle sock, small white thin mid-calf sock, large white thick mid-calf sock). *Do not name the items.*	
2. Say: ***These socks differ in size, shape, thickness, and color.***	
3. Sort 7 socks into two groups (large and small).	
4. Point to the 2 groups as you say: ***I sorted the socks into two groups by size.***	
Beginning prompt	*Response*
5. Say: ***Now you sort these into two groups based on something other than size.***	• ***sorts items into 2 groups based on shape, thickness, or color***

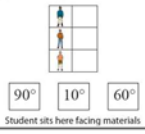
Earth and Space Science-Subcategories:

- Weather, climate and atmospheric processes
- Humans and the environment

Skill assessed: Completes a table showing people wearing different clothing/accessories by matching temperatures

Materials

- table: people (in winter coat, in jacket, in shorts)
- cards: 90°, 10°, 60°



1. Present the table showing different people.	
2. Point to the table as you say: ***This is a table of different people.***	
3. Point down through the column for people as you say: ***This column shows different people.***	
4. Point down through the empty column as you say: ***This column will show the temperature outside when each person may wear the clothes they have on.***	
5. Present 3 cards (90°, 10°, 60°). *Do not name the temperatures.*	
Beginning prompt	*Response*
6. Say: ***Match each person to the temperature he's dressed for.***	• ***puts together 90° and shorts, 10° and winter coat, 60° and jacket***

IN MAY, 2008 THE PASA SCIENCE ASSESSMENT WAS TAKEN BY 5,260 STUDENTS AT GRADES 4, 8 AND 11 IN 501 SCHOOL DISTRICTS ACROSS PENNSYLVANIA

Ongoing Tasks, Needs and Challenges:

- Expand and refine training for administration and scoring,
- Develop broader representation of science (test) content,
- Conduct study of the test validity,
- Conduct study of teachers' knowledge and practices,
- Develop and field test recommended science "frameworks" and teaching practices for students with significant cognitive disabilities, and
- Conduct further analysis of open-ended items*

Alignment of alternate assessments

- A few alignment studies of alternate assessments have been completed
- All low complexity models looked at math or reading/language arts alignment to standards
- Low complexity use a Likert scale to rate assessment items and the degree of agreement with the standards
- One high complexity model measured science as well as other content areas
- High complexity use multiple measures like performance match, content match, and depth match to determine the level of correspondence between the alternate standards, performance indicators, or alternate assessment items and the national standards or state standards

Alignment Study of PASA using Links for Academic Learning

- Links for Academic Learning conducted on PASA-Math and PASA-Reading in 2008
- Initial alignment study has been conducted on the PASA-Science by asking science teachers to determine whether or not assessment items were science based
- Use of some of the criteria from Links for Academic Learning to conduct an initial alignment study

What you're going to be doing

- Complete review of alternate science anchors and regular science anchors
- Data will answer how closely the alternate science anchors link to regular science anchors
- Similar to LAL by using experts to complete review and descriptive statistics collected
- Differs from LAL by looking at state science anchors and not national science standards; not rating alternate anchors as academic

Steps in Coding Alternate Science Assessment Anchors to Regular Education Assessment Anchors

Step 1: Determine if alternate assessment anchor links to regular education anchor

If yes, - continue onto step 2 for that alternate assessment anchor.
If no, - stop rating of that alternate assessment anchor and move onto next alternate assessment anchor.

Step 2: Determine what science domain the alternate assessment anchor will be categorized

Panelists will look at the 4 possible domains listed in the regular education assessment anchor document and determine the science domain the alternate assessment anchor should be categorized.

Step 3: Determine the anchor domain for the alternate assessment anchor

Panelist will find the corresponding anchor domain the alternate assessment anchor should be categorized. The anchor domain can be found at the top of each page of the regular education assessment anchors and is coded by a letter and number (A.1).

Step 4: Determine the corresponding assessment anchor strand for the alternate assessment anchor

Once the panelist has indicated an anchor domain, he/she will indicate which particular strand of that anchor domain the alternate assessment anchor most closely resembles. The assessment anchor strand can be found at the beginning of each assessment anchor and is coded by a letter and two numbers (A.2.1)

Determine grade level being reviewed

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
4	Identify appropriate instruments for a specific task.				
4	Describe change in natural or human-made system.				
4	Identify characteristics and needs of living things.				
4	Identify living and nonliving things in the environment.				
4	Identify routines related to different seasonal time periods.				
4	Identify/Describe the source/effects of pollution in the community.				
4	Identify/Describe edible and non-edible things in the environment.				
4	Describe observable physical properties of matter.				
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

Review Alternate Assessment Anchor

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
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4	Identify characteristics and needs of living things.				
4	Identify living and nonliving things in the environment.				
4	Identify routines related to different seasonal time periods.				
4	Identify/Describe the source/effects of pollution in the community.				
4	Identify/Describe edible and non-edible things in the environment.				
4	Describe observable physical properties of matter.				
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

Step 1: Determine if alternate assessment anchor links to regular education anchor

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
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4	Identify/Describe edible and non-edible things in the environment.				
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4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

logically defined by an assessment anchor for that alternate anchor (need regular education science assessment anchors document for remainder of questions)

Step 2: Determine what science domain the alternate assessment anchor will be categorized

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
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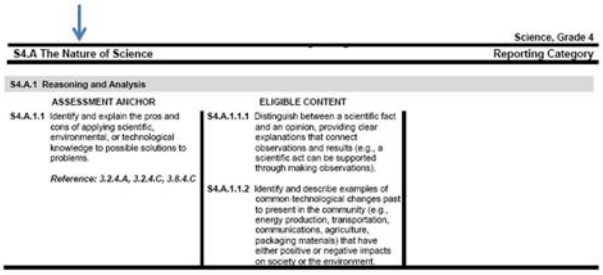
4	Describe observable physical properties of matter.				
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

How to determine category



Science, Grade 4

S4.A The Nature of Science — Reporting Category

S4.A.1 Reasoning and Analysis

ASSESSMENT ANCHOR	ELIGIBLE CONTENT
S4.A.1.1 Identify and explain the pros and cons of applying scientific, environmental, or technological knowledge to possible solutions to problems. *Reference: 3.2.4.A, 3.2.4.C, 3.8.4.C*	S4.A.1.1.1 Distinguish between a scientific fact and an opinion, providing clear explanations that connect observations and results (e.g., a scientific act can be supported through making observations).
	S4.A.1.1.2 Identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either positive or negative impacts on society or the environment.

Step 3: Determine the anchor domain for the alternate assessment anchor

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
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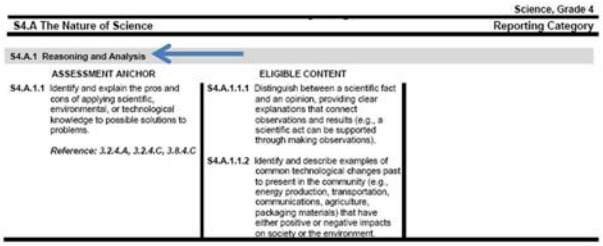
4	Describe observable physical properties of matter.				
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

How to determine domain



Science, Grade 4

S4.A The Nature of Science — Reporting Category

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ASSESSMENT ANCHOR	ELIGIBLE CONTENT
S4.A.1.1 Identify and explain the pros and cons of applying scientific, environmental, or technological knowledge to possible solutions to problems. *Reference: 3.2.4.A, 3.2.4.C, 3.8.4.C*	S4.A.1.1.1 Distinguish between a scientific fact and an opinion, providing clear explanations that connect observations and results (e.g., a scientific act can be supported through making observations).
	S4.A.1.1.2 Identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either positive or negative impacts on society or the environment.

Step 4: Determine the corresponding assessment anchor strand for the alternate assessment anchor

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
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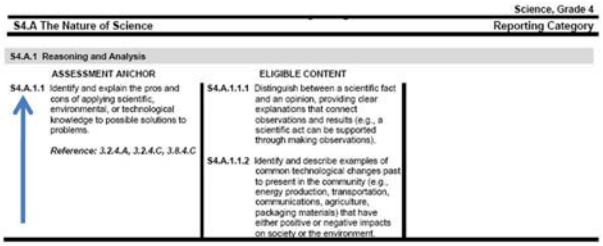
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

How to determine strand



Science, Grade 4

S4.A The Nature of Science — Reporting Category

S4.A.1 Reasoning and Analysis

ASSESSMENT ANCHOR	ELIGIBLE CONTENT
S4.A.1.1 Identify and explain the pros and cons of applying scientific, environmental, or technological knowledge to possible solutions to problems. *Reference: 3.2.4.A, 3.2.4.C, 3.8.4.C*	S4.A.1.1.1 Distinguish between a scientific fact and an opinion, providing clear explanations that connect observations and results (e.g., a scientific act can be supported through making observations).
	S4.A.1.1.2 Identify and describe examples of common technological changes past to present in the community (e.g., energy production, transportation, communications, agriculture, packaging materials) that have either positive or negative impacts on society or the environment.

You're turn

- Take out sample coding form and complete

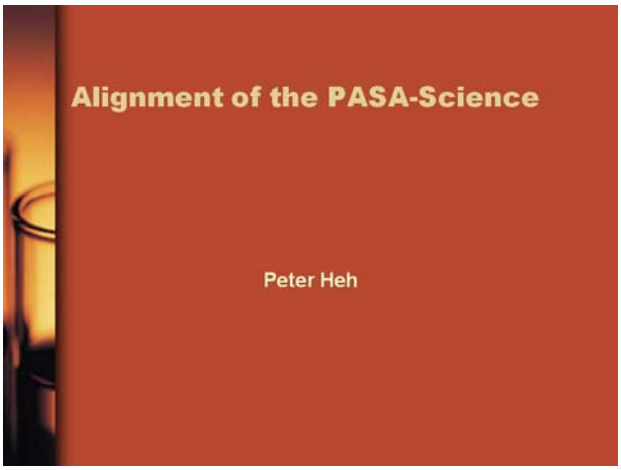
For Homework

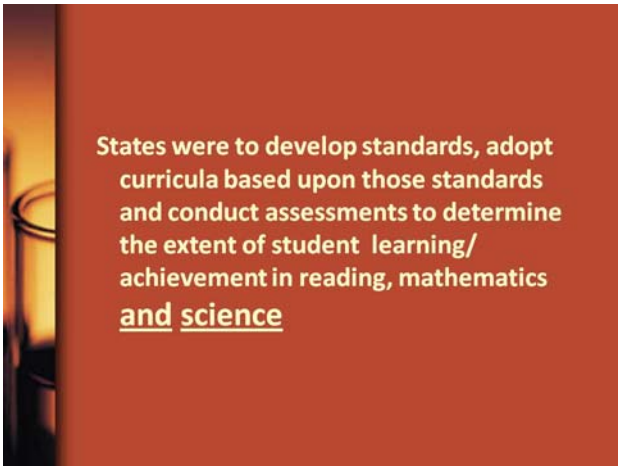
- Read directions that are provided inside of the CD case
- Copy coding form from CD to desktop
- Complete coding form using similar steps used in training
- Email completed form to Pete Heh at: pwh2@pitt.edu
- If having problems, call Pete Heh at: 412-648-7249
- Return completed form by April 30, 2009

Any Questions??

APPENDIX B

POWERPOINT OF ALIGNMENT TRAINING FOR TEACHERS





What is PASA?
(The Pennsylvania Alternate System of Assessment)

- A performance assessment of students' knowledge and skills in reading, mathematics and science
- The content is based upon and developed from the PA Academic standards
- Items are developed which assess skills that are meaningful to the students' lives
- Students are assigned to take one of three different conceptual levels of the assessment (A, B or C)
- Students are video-taped performing 20-25 tasks
- Students' tapes are scored using a rubric which measures independence and content knowledge

Differentiation of "Levels" of Performance

- (1) Degree of Independence, and
- (2) Level of Conceptual Understanding

Indicators of Independence:

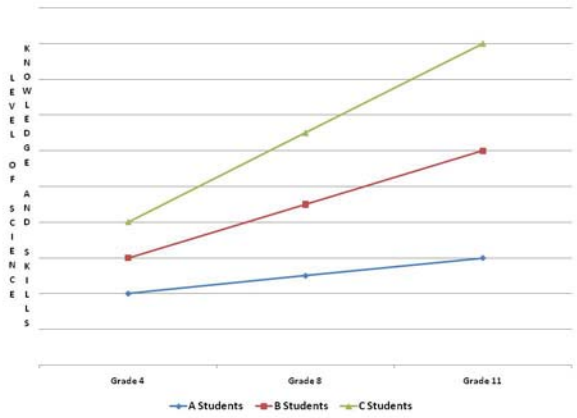
- Engagement with the task,
- Type and amount of prompting,
- Type and amount of assistance,
- Interaction with the test materials,
- Types of modifications needed

Indicators of Conceptual Understanding:

- Matches Items,
- Sorts groups of items,
- Identifies items,
- Identifies/describes functions of items,
- Classifies items,
- Labels items,
- Applies knowledge about items, and
- Produces responses to open-ended questions

Three Different Conceptual Levels of the Assessment:

- A Level – Concrete tasks, related to personal experiences, orienting, matching, sorting, receptive labeling, objects as test materials, extensive prompting and assistance;
- B Level – Representation using pictures, limited test and science vocabulary, related to familiar surroundings and experience, receptive and expressive labeling, sorting, classifying, identifying function, limited assistance; and
- C Level – Symbolic representation using text and complex pictures, extensive test and science vocabulary, related to experiences beyond personal familiarity, labeling, applying knowledge, producing responses to open-ended questions



Research on Science for Students with Disabilities

Mastropieri & Scruggs

- Extensive early work with students with high incidence disabilities
- Most done in general education classes
- Focus on adaptations of the general education curriculum, and
- Students learning much of the same content as general education students

Research on Science for Students with Significant Cognitive Disabilities

Diane Browder and colleagues:

- Substantial contributions to the development of alternate assessments,
- Research on general education curriculum access and validity studies of alternate assessments,
- Recent review of literature on science instruction for students with significant cognitive disabilities

Research on Science for Students with Significant Cognitive Disabilities – (some of) What We Know

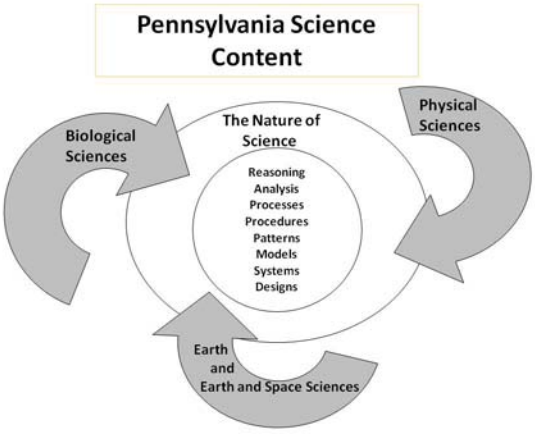
- Few studies have been conducted on teaching "science" to students with significant cognitive disabilities,
- Little consensus exists as to what constitutes "science" for students with significant cognitive disabilities,
- No (published) validation studies have been conducted on alternate science achievement standards or assessments,
- Most (science) alternate assessments are based on portfolios, checklists or IEP reviews

PASA Science: Our Research and Development Efforts

- Reinterpretation of the state science standards anchors and eligible content,
- Consultation with special education teachers,
- Consultation with general education teachers,
- Development of alternate eligible content, tasks and skills with science consultants,
- Two statewide pilot tests of assessment tasks,
- Analysis of data, revisions of tasks and realignment of alternate anchors and eligible content,
- "Final" assessment development and preparation

What we learned:

- Science items can be designed and written in the same format as the reading and math items,
- Teachers were able to administer the science items,
- The students' tapes could be reliably scored,
- Teachers indicated that the majority of the pilot test items were appropriate for the students' level,
- Teachers indicated that the majority of the pilot test items constituted "science,"
- Many teachers indicated that they taught similar content, and
- Logical progressions of the alternate achievement standards, benchmarks, and eligible content could be developed across grade and task levels



PSSA Science Assessment Reporting Categories

A. The Nature of Science
B. Biological Sciences
C. Physical Sciences
D. Earth and Space Sciences

DEVELOPMENT OF THE PASA SCIENCE ASSESSMENT

PSSA	PASA
Standard	
Anchor	Alternate Anchor
Eligible Content	Alternate Eligible Content
Skill Assessed	Skill Assessed
Assessment Item	Assessment Item

PSSA Science

Standard

3.3 Biological Sciences: 3.3.4.A & 3.3.4.B

4.3 Environmental Health: 4.3.4.A & 4.3.4.C

4.6 Ecosystem and their Interactions: 4.6.4.A

Anchor

Biological Sciences: S4.B.1 Structure and Function of Organisms

S4.B.1.1 Identify and describe similarities and differences between living things and their life processes.

Eligible Content

S4.B.1.1.5 Describe the life cycles of different organisms (e.g., moth, grasshopper, frog, seed, producing plant).

Skill Assessed

Use a diagram to answer a question about the life cycle of a grasshopper and a butterfly.

PASA Science

Alternate Anchor

Biological Sciences: S8.B.1 Structure and Function of Organisms

S8.B.1.1 Identify and describe structural characteristics of living things and their diverse needs for survival.

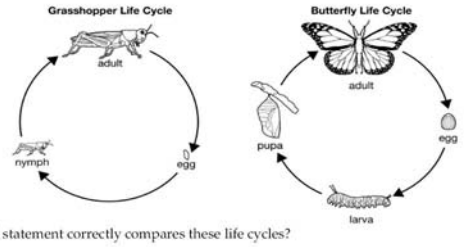
Alternate Eligible Content

S8.B.1.1.3 Describes life cycles of plants and animals including both vertebrates (birds, mammals, reptiles and fish) and invertebrates (complete or incomplete metamorphosis of insects).

Skill Assessed

Sequences 4 stages in the life cycle - stages are substantially different in appearance.

B.1.1.5
Use the diagrams below to answer question 1.



1. Which statement correctly compares these life cycles?

A Butterflies lay eggs and grasshoppers do not lay eggs.
B Butterflies have wings throughout their life cycle and grasshoppers do not.
C Butterflies have more legs as adults than do grasshoppers as adults.
D Butterflies go through more body-shape changes than do grasshoppers.*

A *Butterflies and grasshoppers both lay eggs.*
B *Neither butterflies nor grasshoppers have wings throughout their life cycles.*
C *Butterflies and grasshoppers both have six legs.*
D *Key: Butterflies go through one more body-shape change than do grasshoppers.*

Skill 12

8 C Science

Skill assessed: Sequences 4 stages in the lifecycle - stages are substantially different in appearance

Materials

- pictures: eggs, butterfly, larva, pupa

1. Present 4 pictures of a butterfly (eggs, butterfly, larva, pupa). *Do not name the pictures.*	
2. Point to each picture as you say: ***These are pictures of a butterfly at different stages of the lifecycle.***	
Beginning prompt	*Response*
3. Say: ***Put the stages in the order that they would occur in the lifecycle.*** Point to the student's far left as you say: ***Start here with the first stage.***	• ***puts cards in order - eggs, larva, pupa, butterfly***
Alternate prompts	*Alternate responses*
Before moving on to the next item: 4. **Remove** all materials on the table.	

Science Areas Represented in the 2008 Assessment

- Nature of Science
- Earth and Space Science
- Physical Science
- Biological Science

Nature of Science-Subcategories:

- Systems, models and patterns, and
- Processes, procedures and tools of technology

Skill assessed: Selects picture of a part of a simple man-made system

Materials

- pictures: battery, sink handle, chain, key, flashlight

Student sits here facing materials

1. Present 4 pictures (battery, sink handle, chain, key).	
2. Say: ***Some things are made up of parts.***	
3. Point to each picture as you say: ***This is a battery, a sink handle, a chain, and a key.***	
4. Present the picture (flashlight).	
5. Say: ***This is a flashlight.***	
Beginning prompt	*Response*
6. Say: ***Find what should go in the flashlight.***	• ***points to battery***

Biological Sciences-Subcategories:

- Structures and functions of organisms, and
- Continuity of life
- Ecological behavior and systems,

Skill assessed: Describes 1 unsafe food handling/preparation practice in a scenario described

Materials

- none

1. Say: ***I am going to tell you a story and ask you a question about someone who did not make sure food stayed safe to eat.***	
2. Say: ***A man used a knife to cut raw chicken on a cutting board. After he cut the raw chicken, he started making the salad. He placed the vegetables for the salad on the same cutting board and started cutting them with the same knife.***	
Beginning prompt	*Response*
3. Say: ***Tell me one thing that the man did wrong.***	• ***says "did not clean the knife"***
Alternate prompts	*Alternate responses*
• *What did the man do wrong?*	• *says "used the same knife without washing it"* • *says "did not clean the cutting board"* • *says "used the same cutting board without washing it"*

Physical Science-Subcategories:

- Structure, properties and interaction of matter and energy, and
- Principles of motion and force

Skill assessed: Sorts 7 objects into 2 groups based on a new attribute - items are presorted - items differ on up to 4 attributes

Materials

- objects: small black thick ankle sock, large black thin mid-calf sock, large black thick ankle sock, small black thin mid-calf sock, small white thick ankle sock, small white thin mid-calf sock, large white thick mid-calf sock

1. Present 7 objects (small black thick ankle sock, large black thin mid-calf sock, large black thick ankle sock, small black thin mid-calf sock, small white thick ankle sock, small white thin mid-calf sock, large white thick mid-calf sock). *Do not name the items.*	
2. Say: ***These socks differ in size, shape, thickness, and color.***	
3. Sort 7 socks into two groups (large and small).	
4. Point to the 2 groups as you say: ***I sorted the socks into two groups by size.***	
Beginning prompt	*Response*
5. Say: ***Now you sort these into two groups based on something other than size.***	• ***sorts items into 2 groups based on shape, thickness, or color***

Earth and Space Science-Subcategories:

- Weather, climate and atmospheric processes
- Humans and the environment

Skill assessed: Completes a table showing people wearing different clothing/accessories by matching temperatures

Materials

- table: people (in winter coat, in jacket, in shorts)
- cards: 90°, 10°, 60°

Student sits here facing materials

1. Present the table showing different people.	
2. Point to the table as you say: ***This is a table of different people.***	
3. Point down through the column for people as you say: ***This column shows different people.***	
4. Point down through the empty column as you say: ***This column will show the temperature outside when each person may wear the clothes they have on.***	
5. Present 3 cards (90°, 10°, 60°). *Do not name the temperatures.*	
Beginning prompt	*Response*
6. Say: ***Match each person to the temperature he's dressed for.***	• ***puts together 90° and shorts, 10° and winter coat, 60° and jacket***

IN MAY, 2008 THE PASA SCIENCE ASSESSMENT WAS TAKEN BY 5,260 STUDENTS AT GRADES 4, 8 AND 11 IN 501 SCHOOL DISTRICTS ACROSS PENNSYLVANIA

Ongoing Tasks, Needs and Challenges:

- Expand and refine training for administration and scoring,
- Develop broader representation of science (test) content,
- Conduct study of the test validity,
- Conduct study of teachers' knowledge and practices,
- Develop and field test recommended science "frameworks" and teaching practices for students with significant cognitive disabilities, and
- Conduct further analysis of open-ended items*

Alignment of alternate assessments

- A few alignment studies of alternate assessments have been completed
- All low complexity models looked at math or reading/language arts alignment to standards
- Low complexity use a Likert scale to rate assessment items and the degree of agreement with the standards
- One high complexity model measured science as well as other content areas
- High complexity use multiple measures like performance match, content match, and depth match to determine the level of correspondence between the alternate standards, performance indicators, or alternate assessment items and the national standards or state standards

Alignment Study of PASA using Links for Academic Learning

- Links for Academic Learning conducted on PASA-Math and PASA-Reading in 2008
- Initial alignment study has been conducted on the PASA-Science by asking science teachers to determine whether or not assessment items were science based
- Use of some of the criteria from Links for Academic Learning to conduct an initial alignment study

What you're going to be doing

- Complete review of alternate science items and alternate eligible content
- Data will answer how closely the alternate science items link to alternate eligible content
- Similar to LAL by using experts to complete review and descriptive statistics collected

Grade and Level of Assessment

Assessment Item and description

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects objects that is on/under/in another object** The student is given three sets of objects (paper under a box, paper on top of a box, paper next to a box). He/she selects the paper that is on the box.			S4.C.3.1.3		
4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

Steps in Coding Assessment Items to Alternate Content Standards

Step 1: Determine if assessment item is science

To make these decisions, reviewers are asked whether the item can be logically defined by an assessment anchor domain).

Step 2: Determine if assessment items that were not rated as science are foundational

If item is not rated as science, panelist must then determine if the item is a foundational skill (skills which are an assumed competence across all grade levels specific to an academic context such as turning the pages of a book. These skills may be appropriate for some students with significant cognitive disabilities).

Step 3: Look up the Alternate Eligible Content to determine content link

Panelist will find the corresponding alternate eligible content for the assessment item and rate item's content link as one of the following:

0 – No link – the item does not measure the alternate eligible content.
1 – Far Link – the item measures has some of the original alternate eligible content.
2 – Near Link – the alternate eligible content is specific and the item clearly measures the content.

Step 4: Determine if assessment item was rated as "no link," identify reason why:

If item rated as 'no link,' the panelist must then identify why the assessment item doesn't link using one of the below codes:

1 – mismatch (mis) – an error in identifying the correct alternate eligible content.
2 – overstretching (over) – the item has lost the intention or meaning of the alternate eligible content.
3 – backmapping (back) – fitting a functional activity to alternate eligible content.

Step 1: Determine if assessment item is science

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects objects that is on/under/in another object** The student is given three sets of objects (paper under a box, paper on top of a box, paper next to a box). He/she selects the paper that is on the box.			S4.C.3.1.3		
4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

Step 2: Determine if assessment items that were not rated as science are foundational

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects objects that is on/under/in another object** The student is given three sets of objects (paper under a box, paper on top of a box, paper next to a box). He/she selects the paper that is on the box.			S4.C.3.1.3		
4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

Step 3: Look up the Alternate Eligible Content to determine content link

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects objects that is on/under/in another object** The student is given three sets of objects (paper under a box, paper on top of a box, paper next to a box). He/she selects the paper that is on the box.			S4.C.3.1.3		
4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

Step 3: Look up the Alternate Eligible Content to determine content link

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
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4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

0 – No link – the item does not measure the alternate eligible content.
1 – Far Link – the item measures has some of the original alternate eligible content.
2 – Near Link – the alternate eligible content is specific and the item clearly measures the content.

Where to find alternate eligible content

Science, Grade 4

S4.A The Nature of Science — **Reporting Category**

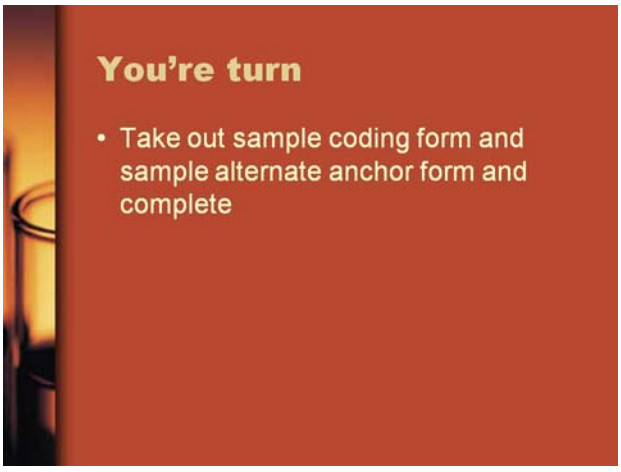
S4.A.2 Processes, Procedures and Tools of Scientific Investigation

ALTERNATE ASSESSMENT ANCHOR	ALTERNATE ELIGIBLE CONTENT	
S4.A.2.1 Apply knowledge of scientific investigation to represent and describe data summarized in a pictograph.	S4.A.2.1.1 Describe patterns of data in natural, physical, and man-made systems.	
	S4.A.2.1.2 Identify and enter data in a pictograph given information about the x-axis and y-axis.	
S4.A.2.2 Identify appropriate instruments for a specific task.	S4.A.2.2.1 Apply technology to solve simple everyday problems.	

Step 4: Determine if assessment item was rated as "no link," identify reason why:

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects objects that is on/under/in another object** The student is given three sets of objects (paper under a box, paper on top of a box, paper next to a box). He/she selects the paper that is on the box.			S4.C.3.1.3		
4	A	**Select picture used to complete a pictograph** The student is given a pictograph (boys in a classroom). He/she is then given a picture of a boy. He/she puts the boy on the graph (places in column with boys).			S4.A.2.1.2		
4	A	**Matches quantity displayed on a pictograph** The student is given a pictograph (rainy days in three months). He/she is then given a set of 14 rainy days. He/she matches the set on the graph that has the same number of rainy days (14 rainy days).			S4.A.2.1.1		
4	B	**Selects object that is in front of/behind/beside/next to/in another object** The student is given four sets of objects (spoon next to a bowl, spoon in a bowl, spoon behind a bowl, spoon in front of a bowl). He/she selects the spoon that is next to the bowl.			S4.C.3.1.3		
4	B	**Sorts 4 pictures to 4 existing groups to complete a pictograph** The student is given a pictograph (types of pets owned). He/she is then given four pictures (dog, bird, dog, fish). He/she adds the new pets to the graph (puts each picture on top of corresponding column on pictograph).			S4.A.2.1.2		
4	B	**Names value ≤ 5 shown using the y-axis of a pictograph** The student is given a pictograph (rainy days in four months). He/she will name how many rainy days there were in March (five).			S4.A.2.1.1		

1 – mismatch (mis) – an error in identifying the correct alternate eligible content.
2 – overstretching (over) – the item has lost the intention or meaning of the alternate eligible content.
3 – backmapping (back) – fitting a functional activity to alternate eligible content.



For Homework

- Read directions that are provided inside of the CD case
- Copy coding form from CD to desktop
- Complete coding form for your assigned grade level using similar steps used in training
- Email completed form to Pete Heh at: pwh2@pitt.edu
- If having problems, call Pete Heh at: 412-648-7249
- Return completed form by April 30, 2009

Any Questions??

APPENDIX C

4TH GRADE CODING FORM: COMPARING ALTERNATE SCIENCE ASSESSMENT ANCHOR TO REGULAR EDUCATION ASSESSMENT ANCHORS

4th Grade Coding Form (Alternate Science Assessment Anchor to Regular Education Assessment Anchors) Name:

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
4	Identify appropriate instruments for a specific task.				
4	Describe change in natural or human-made system.				
4	Identify characteristics and needs of living things.				
4	Identify living and nonliving things in the environment.				
4	Identify routines related to different seasonal time periods.				
4	Identify/Describe the source/effects of pollution in the community.				
4	Identify/Describe edible and non-edible things in the environment.				
4	Describe observable physical properties of matter.				

Grade	Alternate Anchor	Does item link to assessment anchors? 1 – yes 0 – no	If yes, what category: A – Nature of Science, B – Biological Sciences, C – Physical Sciences, D – Earth and Space Sciences	What anchor domain? (A.1 – Reason and Analysis; A.2 – Processes, Procedures and Tools for Scientific Investigations; A.3 – Systems, Models and Patterns, etc.)	What strand? (e.g., A.2.1, A.2.2, B.1.3, etc.)
4	Identify the effect of the interactions between the force, mass, slope, friction, and speed on the motion of an object.				
4	Identify the types and uses of Earth's resources.				
4	Identify basic weather conditions.				

APPENDIX D

4TH GRADE LEVEL A CODING FORM: COMPARING PASA-SCIENCE ASSESSMENT ITEMS TO ALTERNATE CONTENT STANDARDS

4th Grade level A Coding Form (Assessment Items to Alternate Content Standards) Name:

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Orients toward materials** The student is given three objects (scissors, fork, cat). He/she looks at or touches the objects.					
4	A	**Selects tool used to complete a task** The student is given three objects (scissors, bowl, calculator). He/she selects the object used to complete a specific task (cut paper).			S4.A.2.2.1		
4	A	**Selects object named that is part of a man-made system** The student is given three objects (battery, soap, pencil). He/she then hears a sentence (Some flashlights use batteries). He/she will then select an object named (battery).			S4.A.3.1.1		

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects food eaten by animals/people** The student is given three objects (grapes, glove, washcloth). He/she selects the item that people can eat (grapes).			S4.B.1.1.1		
4	A	**Selects plant/animal with structure named** The student is given three objects (cat, cup, sponge). He/she selects the item that has a structure named (paws – cat).			S4.B.1.1.2		
4	A	**Selects picture of living/non-living thing** The student is given three pictures (dog, rock, can). He/she selects the picture representing a living thing (dog).			S4.B.3.1.1		
4	A	**Selects object that is safe/unsafe to eat** The student is given three objects (lollipop, glue stick, crackers). He/she selects the item that is not safe to eat (glue stick).			S4.B.3.4.1		
4	A	**Matches 2 objects based on physical property** The student is given three objects (white fork, black spoon, clear knife). He/she is the given another object (white fork). He/she matches the items that have the same shape (white forks).			S4.C.1.1.1		
4	A	**Selects object that is a solid or a liquid after listening to a sentence** The student is given three objects (bottle of water, boy, sock). He/she then hears a sentence (Water is a liquid). He/she select the liquid (bottle of water).			S4.C.1.1.2		

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Selects object that represents food** The student is given three objects (pear, notebook, bottle of glue). He/she selects the object that looks like food (pear).			S4.D.1.2.1		
4	A	**Selects object that can be recycled after listening to a sentence** The student is given three objects (plastic animal, soda can, baseball). He/she then hears a sentence (Cans can be recycled). He/she selects what can be recycled (soda can).			S4.D.1.2.2		
4	A	**Selects clothing/accessory worn when it is hot/cold** The student is given three objects (bracelet, flip flops, gloves). He/she selects what is worn when it is cold (gloves).			S4.D.2.1.1		
4	A	**Selects picture of weather condition named** The student is given three pictures of a scene (house with sunny weather, house with windy weather, house with rainy weather). He/she selects the picture that shows rain (house with rainy weather).			S4.D.2.1.2		
4	A	**Selects weather symbol named on weather map** The student is given a weather map with three weather symbols (sun, rain, thunderstorm). He/she selects the symbol for sunny (sun).			S4.D.2.1.3		

Grade	Level	Assessment Item	Is item Science? 1 – yes 0 – no	If item rated as not science, is item foundational skill 1 – yes 0 – no	State Alternate Anchor and Eligible Content Link (e.g., A.1.1.1, B.1.1.1, etc.)	Rate content link 0 – no link 1 – far link 2 – near link	If no link, identify reason why: 1 – mis 2 – over 3 – back
4	A	**Matches weather symbols** The student is given three pictures (cloud, shirt, bike). He/she is then given another picture (cloud). He/she matches the weather symbols (clouds).			S4.D.2.1.3		

APPENDIX E

PASA-SCIENCE RATINGS GRADE 4 LEVEL A

	1. ***Very Important*** **–** this skill is necessary and useful in my child's classroom and in most everyday situations. **2.** ***Important*** **–** this skill may be helpful in my child's classroom and in some everyday situations. **3.** ***Not Important*** **–** this skill will not be helpful in my child's classroom or in most everyday situations. **4.** ***Really Not Important*** **–** this skill is unnecessary for my child's success in his/her classroom and is not important in everyday situations.	**Very Important**	**Important**	**Not Important**	**Really Not Important**
1.	**Selects tool used to complete a task** The student is given three objects (scissors, bowl, calculator). He/she selects the object used to complete a specific task (cut paper).				
2.	**Selects object named that is part of a man-made system** The student is given three objects (battery, soap, pencil). He/she then hears a sentence (Some flashlights use batteries). He/she will then select an object named (battery).				

3.	**Selects food eaten by animals or people** The student is given three objects (grapes, glove, washcloth). He/she selects the item that people can eat (grapes).				
4.	**Selects plant/animal with structure named** The student is given three objects (cat, cup, sponge). He/she selects the item that has a structure named (paws – cat).				
5.	**Selects picture of living/non-living thing** The student is given three pictures (dog, rock, can). He/she selects the picture representing a living thing (dog).				
6.	**Selects object that is safe/unsafe to eat** The student is given three objects (lollipop, glue stick, crackers). He/she selects the item that is not safe to eat (glue stick).				
7.	**Matches 2 objects based on physical property** The student is given three objects (white fork, black spoon, clear knife). He/she is the given another object (white fork). He/she matches the items that have the same shape (white forks).				
8.	**Selects object that is a solid or a liquid after hearing a sentence** The student is given three objects (bottle of water, boy, sock). He/she then hears a sentence (Water is a liquid). He/she select the liquid (bottle of water).				
9.	**Selects object that represents food** The student is given three objects (pear, notebook, bottle of glue). He/she selects the object that looks like food (pear).				

10.	**Selects object that can be recycled after listening to a sentence** The student is given three objects (plastic animal, soda can, baseball). He/she then hears a sentence (Cans can be recycled). He/she selects what can be recycled (soda can).				
11.	**Selects clothing/accessory worn when it is hot/cold** The student is given three objects (bracelet, flip flops, gloves). He/she selects what is worn when it is cold (gloves).				
12.	**Selects picture of weather condition named** The student is given three pictures of a scene (house with sunny weather, house with windy weather, house with rainy weather). He/she selects the picture that shows rain (house with rainy weather).				
13.	**Selects weather symbol named on weather map** The student is given a weather map with three weather symbols (sun, rain, thunderstorm). He/she selects the symbol for sunny (sun).				
14.	**Matches weather symbols** The student is given three pictures (cloud, shirt, bike). He/she is then given another picture (cloud). He/she matches the weather symbols (clouds).				

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