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Difference in science achievement for students with learning disabilities taught in small group versus inclusion setting.

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Abstract

Placement of students with disabilities in their least restrictive environment (LRE) is an important part of a student's individualized education plan (IEP). The debate as to whether LRE is a full inclusion classroom or mainstreaming a student into an inclusion classroom for part of the day and allowing them to be in a small group classroom when needed has yet to be determined based on the literature available. Therefore the research question for this study was as follows: what difference is there in learning for secondary students with learning disabilities in the area of science when taught in a small group instructional setting versus being instructed in an inclusion co-taught setting? A pre-experimental static-group comparison design with a pre-posttest and unit probes was used to evaluate the effect of educational setting on the academic performance of students with disabilities who were taught environmental science in a co-taught inclusion setting with those taught in a small group setting. There were three students with high incidence disabilities in each condition (inclusion and small group). The content as well as instruction were the same with the only difference between the groups being the instructional setting. Upon analysis of the pretest and posttest results as well as the unit probes, there were no significant differences between the groups. Future research should include larger sample sizes in each group with the participants randomly assigned as well as replicating this study with younger participants.

Keywords: full inclusion, mainstreaming, secondary students

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Before 1975 only one in five students with disabilities attended public school leaving more than one million children with disabilities no access to public education (Aron & Loprest, 2012). Students with disabilities were denied basic educational services in the United States, with many not even allowed to attend school and some were even placed in state institutions (Aron & Loprest, 2012; Keaney, 2012). Those fortunate enough to attend school were placed in segregated and/or separate facilities and not integrated at all with their peers without disabilities (Keaney, 2012). Parents of children with disabilities used the landmark *Brown v. Board of Education* ruling to argue that students with disabilities were being segregated based on their disability, much like African American students were being segregated based on their skin color (Keaney, 2012). With the passage of the Education for All Handicapped Children Act of 1975 (EAHCA) by Congress a new era in special education was inaugurated. Among ensuring a free and appropriate public education (FAPE) for all students, EAHCA also required students with disabilities to have an IEP. As a joint effort between parents and school officials, the IEP addresses the educational needs of the student and one important facet is the placement of the student in his/her LRE (Keaney, 2012). Two of the questions not addressed by this ruling were what is an "appropriate" education and how much time must a child spend in the general education setting to satisfy LRE? The Supreme Court ruled in 1982, that to be appropriate, a special education program must be provided in the LRE (Osborne & Dimattia, 1994); however because every student is unique, providing guidelines for LRE is very difficult (Osborne & Dimattia, 1994).

Description and detail of what is a disability

There are several terms that need to be defined in order to fully understand the laws on special education and how they should be implemented. A person with a *disability* is defined as including any person who has a physical or mental impairment that substantially limits one or more major life activities, has a record of such impairment, or is regarded as having such impairment (Aron & Loprest, 2012). For a student to qualify for special education services in school, the disability must impair his/her academic or behavioral functioning within the school environment. The U.S. Department of Education (2006) lists the areas of impairment/disability for students to receive special education services as: mental retardation; hearing impairments including deaf/hard of hearing; speech/language impairments; serious emotional disturbance; orthopedic impairments; autism; traumatic brain injury; other health impairments; specific learning disabilities (SLD); blindness; and multiple disabilities. Of all the disability areas that students can qualify for special education and related services, SLD are the most common type of disability among school aged children (Aron & Loprest, 2012). The U.S. Department of Education (2006) defines SLD as a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, which disorder may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. It is important to understand the population of students with disabilities that one teaches, in particular SLD, because so many students are labeled in this category (see Figure 1).

As mentioned earlier, the EAHCA of 1975 outlines rules and regulations on how a student with a disability should be educated. One important aspect of the act stated that courts and schools must operate from the principle that the LRE for a student with a disability who receives special education services is the general education setting where assistive services and

support can be provided as needed (Keaney, 2012). The question that still remains is how much time should a student receiving special education services spend in the general education setting? Full inclusion is defined as students with disabilities learning exclusively in a regular education classroom, alongside peers without disabilities but still getting support, adaptations, or modifications required by their IEPs (Idol, 2006). With full inclusion, 100% of a student's school day is spent in the general education setting (Osborne & Dimattia, 1994). Others interpret LRE as mainstreaming students with disabilities. Mainstreaming is defined as the practice of placing students with disabilities in general education classes with appropriate instructional support but this may or may not be for the entire school day (Osborne & Dimattia, 1994; Kavale, 2002). Sometimes it may be necessary to remove a student with disabilities from the general education classroom for a portion of the school day in order to provide the appropriate education mandated by the Individuals with Disabilities Education Act (IDEA; Osborne & Dimattia, 1994). Schools still do not agree on LRE. Some schools interpret that LRE is the full inclusion setting while others see it as mainstreaming.

The Least Restrictive Environment

In the past, the pendulum of special education service models has swung from one extreme to the other. The first being educating students with disabilities in self-contained settings, separated from students without disabilities and only interacting with them in non-instructional times such as recess, lunch, and class changes (Yale & Katsiyannis, 2004). Then the pendulum swung in the opposite direction and students with disabilities were being educated in a fully inclusive setting, meaning 100% of their school day was spent with their peers with typical development in the general education setting (Evans & Lunt, 2002). These extreme shifts in opinion by educators and policy makers as to where a child should spend their school day makes

it very difficult to really determine the LRE for each student who receives special education services. With the shift of LRE being the full inclusion setting for most students with disabilities, the individualized LRE for that student is lost.

Rozalski, Stewart, and Miller (2010) reviewed important court rulings to give clarity into how to determine a student's LRE. Two basic principles made clear by previous court rulings are that (a) LRE is the general education setting and (b) any other setting is considered restrictive and needs justification for placement (Rozalski et al., 2010). The authors did make clear that LRE is not the same placement for everyone. Although the general education setting may be the ideal LRE for most students, some students with disabilities require more supports to be academically and socially successful, therefore, their LRE may be a more restrictive setting such as the general education classroom part of the day and pull-out specialized instruction the rest of the day, or even a self-contained classroom setting (Rozalski et al., 2010). Due to the need for additional placement options for some students with disabilities, the continuum of alternative placements (CAP) extends from what is considered the least restrictive, the general education classroom with no support to the most restrictive, hospital or residential institution; however there are many options in between (Rozalski et al., 2010).

According to Rozalski et al. (2010), four questions need to be considered when deciding the LRE for students with IEPs. First, what are the academic benefits between the special education and general education setting? Second, what social benefits are there for the student with disabilities being educated with their peers without disabilities? Third, what social benefits are there for the student without disabilities in being educated with their peers with disabilities? Fourth, what are the associated costs of educating the individual with disabilities in either setting? The students' needs are the first priority and if they cannot be met in the general

education setting, with or without accommodations and modifications, then the CAP should be considered for the most appropriate option for meeting the student's educational needs (see Figure 2).

Since the early 1980's, there has been a growing trend in the number of special education students enrolled in regular schools (about 95%) and many students with disabilities are spending more and more time in the general education setting (Aron & Loprest, 2012). For example in the 2008-2009 school year, 58% of students with disabilities spent 80% or more of their day in a regular education classroom which was an increase from 46% during the 1995-1996 school year (Aron & Loprest, 2012). With the increase in students with disabilities being served in the general education setting, it becomes even more important to make sure that general education with supports is their appropriate setting. IEP teams cannot assume because inclusion is the LRE for one student that it is for another student as well. Each child is different and each child should be looked at on an individual basis.

Benefits of Inclusion

Opponents of inclusion still use as an argument for educating students with disabilities in a separate setting is that students without disabilities would be negatively impacted by having students with disabilities in the general education classroom with them; however, Kalambouka, Farrell, Dyson, and Kaplan (2007) showed that in fact there was no adverse effect on students without disabilities when students with disabilities were included in their general education classes with 81% showing a positive or neutral effect. In their meta-analysis they looked at 26 studies from schools in Ireland, Australia, Canada, and the United States to see the impact of placing students with disabilities, who had IEPs, in classes with their peers without disabilities. With the use of questionnaires and grades on summative tests, the researchers in the various

studies found that students with high incidence disabilities such as emotional behavioral disabilities (EBD), sensory/physical disabilities, cognitive disabilities, and SLD did not negatively impact the students without disabilities by being in the same classroom. This is important because the researchers proved that students without disabilities are not adversely affected by having students with high incidence disabilities in their classes.

The previous researchers evaluated the effect of students with disabilities in the general education classroom on their peers without disabilities whereas Ruijs, Peetsma, and Van der Veen (2010) investigated whether academic and social-emotional functioning of students with disabilities was affected by the presence of additional students with disabilities being in the same general education (inclusion) classroom. The researchers looked at 42,068 primary age students in the Netherlands. The researchers used teacher questionnaires, language and arithmetic tests as well as student questionnaires to examine academic and social-emotional functioning for students with IEPs to see if their scores were affected by being in general education inclusion classes where they were the only students with an IEP or if having other students with IEPs caused them to have difficulties or deficits. The researchers found there were no differences in academic functioning between students with IEPs in inclusion classes with other students with IEPs or if a student with an IEP was in an inclusion classroom alone; however, social-emotional functioning was found to be different. On the teacher questionnaire of students with IEPs, the students with the IEP in inclusion classes with other students with an IEP scored lower on well-being and behavior compared to students who were the only student with an IEP in an inclusive class (Ruijs et al., 2010). In the area of cognitive problems, students with IEPs scored better when in inclusion classes with other students with IEPs than if they were in an inclusion class alone, therefore there might be a benefit to having classmates with IEPs (Ruijs et al., 2010).

Either way there appears to be a benefit to students with disabilities being educated in an inclusive setting whether it is with other students with IEPs or if they are the only student with an IEP in the class.

Like Ruijs et al. (2010), Idol (2006) also looked at the benefits of inclusion for students with disabilities in the elementary, middle, and high school settings. The study took place in a large metropolitan school district in a southwestern city of the United States. Interviews were conducted with 120 principals and teachers asking their perceptions of inclusive education as well as the level of inclusion their school was currently implementing (i.e. full inclusion of all students with disabilities or mainstreaming with pull-out resource or self-contained service). An interesting finding was that the educators interviewed stated students with disabilities and students without disabilities both benefitted from inclusion and Idol (2006) went as far as to state students must be in an inclusive setting to fully achieve their potential. However, Idol (2006) did concede that in order for inclusion to be successful certain criteria must be in place; administrative support, a positive attitude about inclusion, the availability of different service delivery options based on the needs of the students with disabilities, assistance to teachers on how to provide support, and professional development, are required for students with disabilities to benefit from the inclusion setting.

Peetsma, Vergeer, Roeleveld, and Karsten (2001) also compared student success in different educational settings for students with disabilities. They looked at student development between self-contained and regular education classes. They included 34 students from the Netherlands in first and second grade with learning and behavioral disabilities or mild mental retardation in their study. The students were given tests of cognitive functioning. What the researchers found was that the students with disabilities in the regular education setting made

more progress in cognitive development of language and math than their counterparts educated in special education self-contained classes. Also questionnaires and interviews of the students' teachers were given to assess the student's psychosocial functioning and development. When the questionnaires were analyzed, psychosocial development was more favorable for students with disabilities educated in self-contained special education classes (Peetsma et al., 2001).

Many researchers advocating for inclusive education for students with disabilities focused on students with high incidence disabilities, such as: SLD, autism and other health impairments including attention deficit hyperactivity disorder (ADHD**;** Aron & Loprest, 2012; Evans & Lunt, 2002; Idol, 2006; Kalambouka et al., 2007; Peetsma et al., 2001; Rozalski et al., 2010; Ruijs et al., 2010; Yale & Katsiyannis, 2004). Therefore, Buckley, Bird, Sacks, and Archer (2006) looked at the benefit of inclusion for students with low incidence disabilities. The focus of their study was achievement of teenagers with Down syndrome, educated in either an inclusion classroom or a self-contained classroom. The study was originally conducted in 1986 with similar participants and then recreated in 1999 although the research was not published until 2006. The 1999 research took place in a high school in Hampshire, United Kingdom where questionnaires were given to 46 teenagers with Down syndrome and surveys were given to their teachers reporting progress in the areas of speech and language, literacy, socialization, daily living skills and behavior. Of these 46 teenagers who participated in the study, 28 were placed in special schools containing just students with disabilities and 18 in inclusive schools (Buckley et al., 2006). The researchers found that there were no significant differences between the two groups for daily living skills and socialization at the time of the study. There was however, a large gain in expressive language and literacy skills for those in inclusive classrooms, as well as fewer behavior difficulties (Buckley et al., 2006). Although gains were not observed in all areas

examined based on these results, full inclusion tends to lead to improved literacy and numeracy skills as well as general knowledge for students with low incidence disabilities (Buckley et al., 2006).

Inclusion is not just a benefit to students with disabilities in academic classes but also in their Career and Technical Education (CTE) classes as well. Casale-Giannola (2012) researched the strengths and needs of inclusive education in vocational classes. Two different high schools in New Jersey were used in this study where data were collected on 55 participants with various learning disabilities via classroom observations and surveys. The researchers found that the same areas students with disabilities struggle within their academic classes such as reading, math, or socialization; they struggle within their career technical classes. By helping students with disabilities in the CTE classes with support from a special education teacher, the students with disabilities were able to succeed simultaneously in their academic and vocational classes (Casale-Giannola, 2012).

Benefits of Small Group Instruction

Schools are required by federal law to integrate students with disabilities to the greatest extent possible with peers without disabilities which often happen to be a general education classroom; however, there are times when students would not benefit from full inclusion due to the nature or severity of their disability (Rozalskiet al., 2010). In these cases, inclusion is not the LRE and a more restrictive environment may be necessary (Rozalskiet al., 2010). Although many researchers have looked at the benefits of full inclusion other researchers have studied the limitations of inclusion. Evans and Lunt (2002) assessed the attitudes of educators related to inclusion and whether there are limits to inclusion through the use of questionnaires and focus groups. A total of 60 questionnaires from school psychologists, teachers, health care

professionals, and social workers in England and Wales were returned and those participants contributed to focus group discussions. Among those who participated a common thread was found. On the whole, the participants agreed that students with disabilities should be mainstreamed; however, total inclusion was "idealistic and unrealistic" (Evans & Lunt, 2002, p.11). They expressed this opinion due in part to government policy as well as culture, organization, and expectations of schooling. Since the beginning of special education was not that long ago and, at its start, students with disabilities were treated differently than their peers without disabilities, that to now have them in the regular education classroom without a shift in views and opinions of how to best meet the needs of students with disabilities it is "unrealistic." They said societal views must be shifted in order for inclusion to be successful (Evans & Lunt, 2002).

Opponents to inclusion argue that the general education classroom is not an appropriate place for students with disabilities to be educated (Kavale, 2002). Inclusive instruction is undifferentiated, large-group instruction dominated, where teachers are more concerned with conformity than accommodations (Baker & Zigmond, 1990). Baker and Zigman (1990) examined an urban school district with around 42,000 students during the 1987-88 school year. Located in a primarily African-American neighborhood, they studied one elementary school in the district for one year as the school was implementing a full inclusion program for their students with disabilities. Through observations, surveys, and interviews of teachers, parents, and students with disabilities, it became evident that without an overhaul to how general education teachers are trained, how they are given their resources, and the support required for full inclusion, it cannot be successful (Baker & Zigmond, 1990). Teachers are not use to having to share their classroom with another teacher, nor are they given quality co-teacher training, which

is vital for the inclusion classroom to run properly (Baker & Zigmond, 1990). Although their findings are over 20 years old, there is still some truths to the points the researchers make for more training and resources for inclusion to be successful.

Due to many students with disabilities having trouble with distractibility and keeping focused, they require a quiet environment where they can receive extra support which arguably cannot be provided in an inclusion setting due to size and number of students (Kavale, 2002). Zigmond and Baker (1994) conducted a longitudinal study to see if the inclusion setting is a more appropriate educational setting for a student with a learning disability. The study was conducted over 2 years in which "Randy," an intermediate-grade student with a SLD was observed to see whether a general education classroom could provide him the opportunity to learn and make more progress than when he received instruction in a special education resource classroom (Zigmond & Baker, 1994). In year one of the study, "Randy" was in a self-contained special education resource room to learn reading. In year two, Randy was placed in an inclusion classroom for the entire school day as part of Project Mainstream Experiences for Learning Disabled (MELD). Data were collected both years and the researchers found that while there were more opportunities to learn to read in the inclusion setting, "Randy" did not have significant improvements in reading achievement when he was in an inclusion setting for reading (Zigmond & Baker, 1994). Zigmond and Baker (1994) concluded special education students "did not get a special education" in an inclusion classroom (p.116). Due to the size of the classroom, number of students, and the ratio of teachers to students, the individualized instruction necessary for students with disabilities often cannot be given in the same way as in a self-contained classroom (Zigmond & Baker, 1994). Randy performed better in reading when he was given the

specialized instruction available in a small group setting. This might be generalized to other students with disabilities that they too could perform better in a small group setting.

The objective of special education services is to give individualized instruction to students based on their needs (Mesibov & Shea, 1996). This cannot always be accomplished in the general education setting. Some students with disabilities require the highly structured, learning environment of a small group classroom. According to advocates of inclusion, the benefits are increased expectations, modeling of appropriate behavior by normally developing peers, increased learning, better self-esteem, more acceptance of differences by peers without disabilities, and less isolation and stigma for students with disabilities and their families (Mesibov & Shea, 1996). However, students with autism have fundamental deficits in language, therefore, verbal explanations of material and expectations maybe ineffective for them. Also, students with autism have poor imitation skills, so to ask them to imitate the behavior of their peers often does not work (Mesibov & Shea, 1996). Many students with autism require specialized instruction techniques which the full inclusion model does not provide but whereas being in a self-contained classroom it can makes it easier for students with autism to learn cognitive information as well as practice social skills (Mesibov & Shea, 1996). Mesibov and Shea (1996) addressed whether or not full inclusion was the best setting for students with autism in their review of literature on inclusion and students with autism. Based on their review of literature, they found that there has not been enough research or empirical evidence to support removing self-contained classes entirely for students with autism. Therefore, the need for a CAP is still necessary to meet the diverse needs of students with IEPs.

Students with disabilities are still falling short of their peers without disabilities in educational achievements, are often held to lower standards, are less likely to take advantage of

high school academic curriculum, and are more likely to drop out of school (Aron & Loprest, 2012). Aron and Loprest (2012) found that the regular education classroom seems to be the preferred setting for students with disabilities across all school grades; however, based on this current review of literature there does not seem to be enough research either for full inclusion nor self-contained to determine the best setting for students with disabilities. At best, anecdotal case studies and testimonies have been used to make the case for inclusion being the LRE and very little empirical evidence is given for either setting (Kavale, 2002). Kavale and Forness (2000) put it eloquently when they wrote, "A solution that simply calls for full inclusion without accompanying empirical support is neither logical nor rational" (p. 289). This is why placement of secondary students with learning disabilities in inclusion classrooms for content instruction such as science needs to be investigated. Therefore, the purpose of this study is to answer the following research question: What difference is there in learning for secondary students with learning disabilities in the area of science when taught in a small group instructional setting versus being instructed in an inclusion co-taught setting?

Method

Setting

The study took place in one inclusion co-taught environmental science class and one small-group environmental science class in a public high school in the northwest region of Georgia. The school was attended by 9th through 12th graders. During the 2010-2011 school year, which was the last time demographics were available, approximately 1,650 students attended the school. That same school year had approximately 171 students with disabilities school wide. Generally for this high school, class sizes in inclusion co-taught courses averaged 32 students with 10-15 of those being students with disabilities. Small-group courses averaged

between 6-12 students, all of whom are students with disabilities taught in a room by themselves by a special education teacher.

Two classes were used for this study. One class was a co-taught inclusion environmental science class and the other class was a small-group environmental science class. The co-taught inclusion environmental science class contained 26 students, 7 of whom were students with disabilities in either SLD or OHI. There were 14 males and 12 females with 11 African American, 11 Caucasian, and 4 Hispanic students. The percentage of students who are classified as economically disadvantaged was 48%. The small-group class consisted of 7 students, all of whom had either EBD, SLD, or OHI disabilities. There were 6 males and 1 female with all 7 students being Caucasian. The percentage of students who were classified as economically disadvantaged was 71.4%. Classes were established prior to the study by the scheduling administrator and students with disabilities were placed in the appropriate environmental science classroom setting based on the services outlined in their IEPs.

Participants

Participants included students with SLD in the researcher's environmental science classrooms during the 2013-2014 school year. The researcher individually went through the IEPs of students in her Environmental Science classes to select 3 participants from each setting. Although the setting the students received their instruction in was different, efforts were taken for the students selected from the small group and inclusion settings to be as similar as possible in regard to (a) disability area; (b) accommodations and modifications given; (c) age; (d) placement and setting for special education services in other academic and non-academic classes; (e) number of years served with special education; (f) End of Course Test (EOCT) score in biology; and (g) Lexile score in reading level. Students, who have taken environmental science

before or, are not being served for an area of SLD or OHI, were excluded from participating in the study. Once the students were identified, parental consent (see Appendix A) and student assent (see Appendix B) were secured. A total of 3 students (Kristina, Anna, and Steven) were selected to participate in the study from the co-taught inclusion classroom and 3 students (Sarah, Matthew, and Jacob) from the small-group classroom.

Small-Group Participants

Sarah. Sarah was a 17 year old Caucasian female who was a sophomore. She was classified as having a SLD in reading comprehension. Her Lexile Score was a 985 and she made a 58 on the previous year's biology end of course test (EOCT). Her instructional accommodations included study guides for tests and prompting by teacher when Sarah was off-task and not focused. Her classroom testing accommodations included small-group testing and extended time to complete tests. Sarah had 2 classes in the general education setting without supports, 1 class in the inclusion co-taught setting, and 4 classes in the small-group setting. Sarah entered into special education services when she was 7 years old.

Matthew. Matthew was a 16 year old Caucasian male who was a sophomore. He was classified as having an OHI in the area of ADHD which affected him primarily in being able to pay attention as well as having weak reading comprehension skills. His Lexile Score was 605 and he made a 55 the previous year's biology EOCT. His instructional accommodations were to read assignments aloud as requested by the student, copies of notes as requested by student, oral and written directions, and paraphrase directions. His testing accommodations included small group setting for tests, read tests aloud, and extended time to take tests. Matthew had 1 general education class without support and 6 small-group classes. Matthew entered into special education services when he was 8 years old.

Jacob was a 15 year old Caucasian male who was a sophomore. He was classified as having a SLD in the area of processing deficits in fine motor skills, perceptual speed, and basic reading comprehension. His Lexile Score was 825 and he made a 54 the previous year's biology EOCT. His instructional accommodations were to be given study guides before tests. His testing accommodations included small group setting for tests, read tests aloud, and extended time to take tests. Jacob had 2 general education class without supports, 1 inclusion co-taught class, and 4 small-group classes. Jacob entered into special education services when he was 9 years old.

Co-taught Inclusion Participants

Kristina was a 15 year old Caucasian female who was a sophomore. She was classified as having an OHI in the area of ADHD however; she exhibited symptoms that are usually associated with SLD such as general cognitive impairment in the area of metacognitive executive functioning and significant impairment in working memory. Her Lexile Score was 835 and she made a 68 the previous year's biology EOCT. Her instructional accommodations included allowing class time for Kristina to copy assignments into an agenda, chunking long term assignments into smaller segments with due dates, copies of notes, and her teacher to check progress and provide feedback often in the first few minutes of each assignment. Her classroom testing accommodations included small-group testing, explain or paraphrase directions for better understanding, and extended time to complete tests. Sarah had 2 classes in the general education setting without supports, 3 classes in the inclusion co-taught setting, and 2 classes in the small-group setting. Kristina entered into special education services when she was 14 years old.

Anna was a 16 year old African American female who was a sophomore. She was classified as having a SLD in the areas of perceptual reasoning and processing speed. Her Lexile Score was 1020 and she made a 68 on the previous year's biology EOCT. Her instructional

accommodations included preferential seating, extended time on assignments, and use of an agenda to record assignments. Her classroom testing accommodations included small-group testing and extended time to complete tests. Anna had 2 classes in the general education setting without supports, 4 classes in the inclusion co-taught setting, and 1 class in the small-group setting. Anna entered into special education services when she was 11 years old.

Steven was a 15 year old African American male who was a sophomore. He was classified as having a SLD with a significant discrepancy between his cognitive and his achievement in the academic area of reading. His Lexile Score was 975 and he made a 63 the previous year's Biology EOCT. His instructional accommodations were preferential seating, copies of notes at students request; teacher is to check for comprehension, extended time for in class assignments of 30 minutes and extended time for long term assignments of 1 day. His testing accommodations included small group setting for tests and extended time to take tests. Steven had 2 general education classes without supports, 4 inclusion co-taught classes, and 1 small-group class. Stephen entered into special education services when he was 14 years old.

Teachers and Researchers

Co-Teacher. The general education co-teacher for the inclusion class participated in the study as well. There was no way to conduct the research without his participation in keeping the instruction the same in both classroom settings and he assisted with keeping fidelity by not knowing which students were in the study and blindly grading assignments from both research groups. A teacher consent form (see Appendix C) was signed by the regular education teacher to show he voluntarily agreed to participate in the study. This teacher had a bachelor's degree from the University of Georgia in science education and had been teaching life science since 2007. He held a T-4 certification and had been co-teaching for the last four years, which during that time;

he had taught students with various disabilities. He was familiar with the accommodations and modifications required of students in the special education program and familiar with the skills necessary to be successful in Environmental Science. He had taught Environmental Science for six years and was very comfortable with the content of the curriculum. The teacher had received professional development training on successful co-teaching strategies. He has taught students in various science classes including Biology, Environmental Science, and Zoology. He exceeded the standard as evidenced by his annual evaluations as well as being nominated numerous times for Teacher of the Year.

Researcher. The researcher was a special education teacher who had a T-5 certification. She had a bachelor's degree in biology education and a master's degree in adolescent education-science emphasis both from Kennesaw State University. This was her sixth year teaching. She spent her first two years teaching at another high school in the same school district where she did co-teach both years. The last four years were at her current high school teaching special education science. She received her special education certification after teaching by passing the Georgia Assessments for the Certification of Educators (GACE). Her first two years as a general education science teacher and this was her first year co-teaching environmental science with the general education teacher in the study.

Research Design

Due to the convenience sample of participants available, a pre-experimental static-group comparison design (Gay, 1996) with weekly probes was used to evaluate the effect of educational setting on the academic gains of students with disabilities who were taught environmental science in a co-taught inclusion setting with those taught in a small group setting. A pre-experimental static-group comparison group design is used when a researcher is

comparing the effect of a treatment or an independent variable on a skill or behavior of two non-randomly assigned groups of participants through the use of a pre and posttest (Gay, 1996). Once the participants were selected, their group average achievement on a subject-wide benchmark for environmental science was used as their pre-test. Weekly probes were collected and graphed for each group to show the differences in student performance by group on summative assessments at the end of each unit to allow a visual analysis of student learning between the groups. At the end of the semester, the benchmark was given again, as the posttest, to see which setting showed the greatest gains in average group scores from pre to post assessment. Since the material was taught in the same way, all of the resources were identical and every effort was used to keep uniformity a strict comparison between the two groups was done to see which setting showed greater improvement from pre to posttest on the benchmark assessment as well as a higher average on summative grades and unit tests on the weekly probes. Although causation cannot be proven with a pre-experimental static-group comparison design with weekly probes, this design can be used for preliminary or exploratory research and can provide information that is helpful for teachers when making educational decisions (Gay, 1996).

Independent Variable

The independent variable for this study was the setting in which the students receive their Environmental Science instruction. Two different instructional settings were compared. The first setting was the inclusion classroom which was a co-taught class consisting of two teachers; general education and special education with 27 total students, 7 students with disabilities, in a normal sized science lab classroom. The second setting was a self-contained non science lab classroom, half the size of the inclusion classroom, having just one special education teacher with 7 students, all of whom were students with disabilities.

Dependent Variable

Student learning in the area of Environmental Science was the dependent variable. For this study, learning was measured by grades earned on standardized tests as well as weekly probes and unit tests. Students in both settings did receive the same instruction and the same assessments therefore the only difference between the groups was the setting as described above.

Measures

The assessments that were used to assess student learning in the area of environmental science were their group average grades on summative assignments, unit tests, and the environmental science subject-wide assessment which was given at the beginning of the semester as a pre-test and then at the end of first semester as the post-test. Their average grades by group on these assessments were graphed and compared between the inclusion classroom and self-contained classroom.

Pre-test/Posttest Assessment. Unfortunately the school did not receive the district benchmark assessment in time to give it to students as their pre-test. Instead the environmental science teachers at the school used the final from the previous year (see Appendix D). All four teachers, including the researcher and her general education co-teacher, gave the environmental science final as their pre-test to have data to compare at their bi-weekly subject team meetings as well as for the researcher to use in her research. Environmental science is not an EOCT class therefore the final was used in place of the district benchmark as their pre-test, midterm (posttest for the study), and at the end of the school year, posttest. The structure of the test was 75 multiple choice questions in length. The assessment covers all the topics covered in the environmental science course. These topics include water use and pollution, atmosphere and climate change, cycles of matter and energy, biomes, non-renewable and renewable resources,

interaction of human population with ecosystems, recycling, as well as much more that has to do with the environment and human interactions. It was administered during class time and scored using a Scantron machine.

Quizzes and Unit Exams. After the completion of a unit, students were assessed via a quiz or unit exam depending on the size of the unit. Smaller topics lend themselves to being assessed using a quiz while other units were greater in length and depth and were assessed with a test. The quizzes were shorter and covered less information than tests. Students took a quiz on the scientific method and laboratory safety (see Appendix E), ecosystems (see Appendix F), and ecology (see Appendix G) then they took the unit 1 test (see Appendix H) over ecosystems and ecology. The format of the unit test was multiple choice, short answer, and modified true/false. The scores for both groups were collected by the researcher after being graded by the researcher's co-teacher to ensure impartial grading. The topic of biomes is not as easy to assess on a test like other environmental topics and the researcher and her co-teacher wanted students to become experts on a particular biome and teach the other students in the class about the characteristics of the biome. Students created a biome presentation over an assigned biome (see Appendix I) using online presentation software and presented to the class. The researcher and her co-teacher then went over biomes to fill in any missing information the students did not include in their presentations. Students took a quiz over biomes (see Appendix J), learned about aquatic ecosystems next and then tested over biomes and aquatic ecosystems (see Appendix K). Students then took a test over land use, food, and agriculture (see Appendix L).

Implementation Procedures

The recruitment process for participants began the second week of school. During pre-planning, the researcher discussed her research plan with her co-teacher and got his consent to

participate in the study (see Appendix C). The co-teacher needed no training seeing as he would only be performing his usual teaching duties. Since the research design was comparing small group versus inclusion co-taught instruction, all students in the researcher's small group and co-taught environmental science classes were considered as possible participants. Any students who met the exclusion criteria were not considered. Students meeting the inclusion criteria had parental consent letters given to them to take home to their parents (see Appendix A). Once parental consent was received, those students whose parents agreed to have their child participate were given assent letters (see Appendix B). The researcher talked with the students asked to participate to explain the study and answer any questions they had. Once parental consent, assent and consent letters were obtained, baseline data collection began. All students whether participating in the research study or not, were required to take the pre-assessment for environmental science. This was given the fourth week of school. The data received from this assessment was used to track progress over the course of the year by giving the test at the beginning of the semester, at mid-term in late December and once again at the end of the school year. All students were required to take the pre-test but for those participating in the research, these data were used, for the purpose of the study, as a pre-test to see where the individual student's starting point of environmental science knowledge was at the beginning of the semester before they began instruction on environmental science.

To ensure that the students were receiving the same content instruction in both settings, the researcher followed the same lesson plans in her small-group class as in the co-taught inclusion class. A weekly lesson plan template (see Appendix M) was created showing what was covered each day of the study in both instructional settings. The information included gives details of the lesson such as whether it was a lecture with notes given, the students completed a

study guide, or there was a test on that day. Also any variance between one setting over the other was noted (see Appendix N). For example, the inclusion class had a fire drill which left them less time to complete their assignments so they were instructed to finish it at home and so those students did not have the assistance of the teacher like the inclusion group class had on receiving assistance. This could affect their grade on the upcoming quiz or test.

Data Analysis

This study was conducted using a pre-experimental static-group design with weekly probes (Gay, 1996). The pre/post test data were collected and compared to see which group had the most gain from pre to post-test. Whereas the data from the probes were averaged by group and graphed on the same graph to allow visual comparison of group scores for each assessment/probe. Although a true causal relationship relation cannot be determined through this design, these data can be used to make instructional decisions and as preliminary research findings (Gay, 1996).

Reliability

To ensure reliability, the researcher's co-teacher in environmental science graded the pre-test/posttest as well as quizzes, projects, and unit tests for both co-taught and small group settings. The co-teacher did not know which of the 7 students with disabilities in his inclusion class were included in the study therefore he had no way to be partial when grading. The assessments of the small-group students were coded so that the co-teacher grading the assessments did not know the identity of which student he was grading. Once graded, he then returned the coded assessments to the researcher for recording. Whatever grade was given by the co-teacher, which was the grade entered.

Fidelity of Implementation

Due to the fact that instruction took place in two separate settings, it was imperative that the researcher ensure fidelity of instruction between the settings. The key factor for this study was to ensure that the only difference for the students is the setting and not the type/content or amount of instruction. Everything else that can be controlled for while students were in the settings was controlled. Students covered the same material, were instructed the same way, did the same assignments, completed the same homework, took the same tests and quizzes and as much as possible one classroom's instruction mimicked the other. That is why the lesson plans for each week were created (see Appendix N) to show the weekly agenda the class covered. Although lesson plan templates are meant to be used before a lesson is implemented, the researcher used this template differently. The inclusion class was earlier in the day and the small group class was in the afternoon. The researcher made note while the inclusion class was underway and during her planning period she noted what was covered in class, how long each segment lasted, as well as any events that occurred that could not be controlled for such as a fight, fire drill, or class assembly. She then with as much fidelity as possible repeated the lesson schedule in the small group setting as was completed in the inclusion setting. She took note of any differences between the two groups that could cause one setting to have an advantage over the other. Since the general education co-teacher has his own class to teach during the period of small group instruction, he cannot collect fidelity data therefore it was left up to the implementer.

Results

Analysis focused on mean scores between students in the inclusion and small group setting on their pre-test versus posttest as well as their mean scores on 8 summative tasks. Table 1 shows the pre-test versus posttest averages of the two groups. The inclusion group showed a 32

point increase from pre to posttest with scores being 15, 32, and 40 on the pre-test and 57, 62, and 64 on the posttest while the small-group class showed a 34.2 point increase with scores being 21.3, 36, and 36 on the pre-test and 55, 68, and 73 on the posttest.

The scores for the 8 summative assessments for both groups are shown in Figure 3. Through visual analysis of the graph it is apparent that the groups scored similarly on the majority of the assessments with the biggest visual differences noted between the group scores on the first and last assessment given. The inclusion group had a mean score of 59 for the 8 assessments with a range of 32 to 90 across all assessments. The small group had a mean score of 58 on the 8 assessments with a range of 23.3 to 93 across the 8 assessments. Based on the numbers imputed it is apparent that both settings scored similarly on assessments with similar averages and ranges.

Discussion

The purpose of this research was to answer the research question: What difference in science achievement for students with learning disabilities taught in small group versus inclusion setting. In order to answer this research question, a pre-experimental static-group comparison design (Gay, 1996) along with graphed weekly summative assignments such as tests, quizzes, and projects were used to assess the students' level of learning when taught the same material in the same way but in different settings. The hope was that one setting; either small-group or inclusion would show a greater gain from pre to posttest and better scores on the summative assessments. However, as apparent in Table 1 and Figure 3, there were not significant differences between the scores of students in the two settings. The pre-test, which was also used as the posttest, showed a 32 point increase for inclusion students whereas the small group showed a 34.2 point increase.

Although the small-group class had a greater improvement the increase over the inclusion group is negligible and not indicative of a significant difference in learning.

On the 8 summative assignments, the small group class performed better than the inclusion class on 4 however, the reverse is also true with the inclusion class performing better than the small group on 4 out of the 8 assessments. All of the summative assessments were multiple choice quizzes and tests except for one, the Biome Presentation (see Appendix G), which was a performance based assessment and was the 5th assessment of the 8 assessments given. Instead of merely completing a study guide and studying before taking the test, students had to research one of the world's biomes and create a computer presentation over the material and present it in front of the class. On this assessment the small group averaged 40.7 and the inclusion averaged 42. With this being a performance-based assessment rather than a paper/pencil assessment, students really had to show what they knew and could not merely guess the right answer nor have the ability to use the process of elimination to pick the right answer from 4 possible choices. This is a situation where it helped having 2 teachers in the inclusion classroom. Not only did the participants in the inclusion classroom have 30 or so peers to observe do their presentations for ideas for their own presentations, they also had the guidance and instruction from 2 teachers to aid them in their work. The researcher thought that in the small-group the students would have more one-on-one time with her but the reality was that each student in the class needed so much attention that the other students had to sit and wait until the instructor was free whereas in the inclusion setting the students could get the help of the other teacher as well as other students if they had a question or needed help. Neither group did exceptionally well on the assignment averaging scores of 40.7 small-group and 42 inclusion

group however, this was the first project assigned of the year and although given a detailed rubric students had not had much practice with a performance-based task.

What was captured from the research is that in a perfect world, either group, small-group or co-taught would have benefitted from being in a small-group setting. Although they would only have access to one teacher and there would be less peer collaboration the small size, less distraction and one-on-one attention would make up for that. However, the world is not perfect and teachers deal with the constraints put upon them in the classroom. Also it is quite possible that the small-group students would have done worse in the co-taught inclusion setting. They require such individualized attention which they would not have received in the co-taught setting. All-in-all placement just needs to be based on individual students. There is no right placement for all students with learning disabilities.

Limitations

When considering the results of this research several limitations have to be considered. The primary limitation was the small sample size. With only having 3 students in the small-group setting and 3 in the inclusion setting limited the type of research design that could be used to determine if there was a true difference in student learning between instructional settings. A pre-experimental static group design that is used for preliminary findings or exploration findings and not to determine true cause and effect (Gay, 1996) This design is implemented with 2 groups that are not randomly assigned to different conditions, but are already in place or are samples of convenience (Gay, 1996). Therefore, this is another reason that the findings from this study cannot be generalized without further support by additional research.

Another concern associated with the small number of participants is how much one student's score could change the group average on each summative assessment. With only

having 3 students in each group if one decided not to study or struggled with an assessment more than the others the average for that group would be negatively skewed. For example, the Scientific Method and Laboratory Safety quiz (see Appendix C) the inclusion setting the scores were 90, 85, and 50 whereas in the small-group setting they were 93, 85, and 85. The one student who received a 50 caused the average score to become 75 when if that student had made a score more in line with the other students in their group the average for the inclusion group would have been much greater. With a larger sample size one student's score would not have had such an impact on the average of the whole group.

Another difference in the classes that could not be controlled was the time of day when the students received the instruction. The inclusion class was the 1st period of the day whereas the small-group was the 6th period. Time of day may have played a role as the students in inclusion group during the 1st period may have been more focused earlier in the day than the students in the small group who did not have class until the 6th period of the day and may have been tired or more distracted later in the afternoon.

Finally, the last limitation that needs to be considered when interpreting the results of this study was the student population that made up the remainder of both classes. For the small-group class there were 4 other students who were in the class while the instruction was taking place with participants of the study. Three of whom were students with EBD who had behavior problems that often disrupted the small group instruction. So much of the researchers time was spent dealing with behavior problems that the original hope of having more one-on-one time with each student in the small-group class never came to fruition. There was some sort of outburst almost every day and the other students in the classroom suffered due to the teacher having to spend so much of the instructional time addressing the behaviors of the students who

were in the small-group classroom and not participating in the study. In the inclusion class, due to scheduling, there was a handful of Junior Reserve Officers' Training Corps (JROTC) in the class. These students are a bit more driven and hard working as a result of being in the JROTC program. Some of them were seated beside the students participating in the inclusion class group for the study and may have had a positive influence on those participants by modeling appropriate behavior as well as by possibly providing additional academic support beyond that of the teachers in the classroom.

Implications for Practice

Based on the results, my suggestion would be that students with disabilities are so individualized that each student needs to be looked at on a case-by-case basis. That is what an IEP is; an Individualized Education Program. If a student requires a smaller setting to receive his or her instruction then a small-group classroom is where they should be placed but consideration must to be given to make sure each and every student is in their LRE to receive their education. Just because a student has been in a small-group classroom in the past does not mean that they should continue to be in that setting. Also, it may be that for a subject a student is struggling in, such as math, a small group setting is more beneficial or that in more discussion based courses such as social studies a student benefits more from being in a larger inclusion setting. Each year at their annual IEP, or any time necessary, placement should be considered and evaluated. If the student can benefit from the inclusion setting or even supportive or consultative services, then those placements should be considered. The goal of special education is to give students what supports they need to be successful in the classroom but also to help those same students to not rely on those supports forever.

Future Research

The debate over inclusion setting for all is not over. There are benefits to small-group instruction even if those did not seem evident in this research study due to extenuating circumstances. Future researcher should evaluate small-group instruction versus inclusion class instruction for different academic subject such as math, social studies, language arts, and other sciences and not just Environmental Science. Another way that the research could be continued on is to have the co-taught inclusion group educated in a small-group setting and vice versa to see if being placed in the opposite setting caused a group to improve their academic achievement. This would further support the small-group or co-taught inclusion setting as a better placement. Future research would also be beneficial in evaluating the difference in student performance based on instructional setting with different age groups of students. This study focused on high school students and future researchers should evaluate the effects of instructional setting on the academic achievement of student in elementary and middle school.

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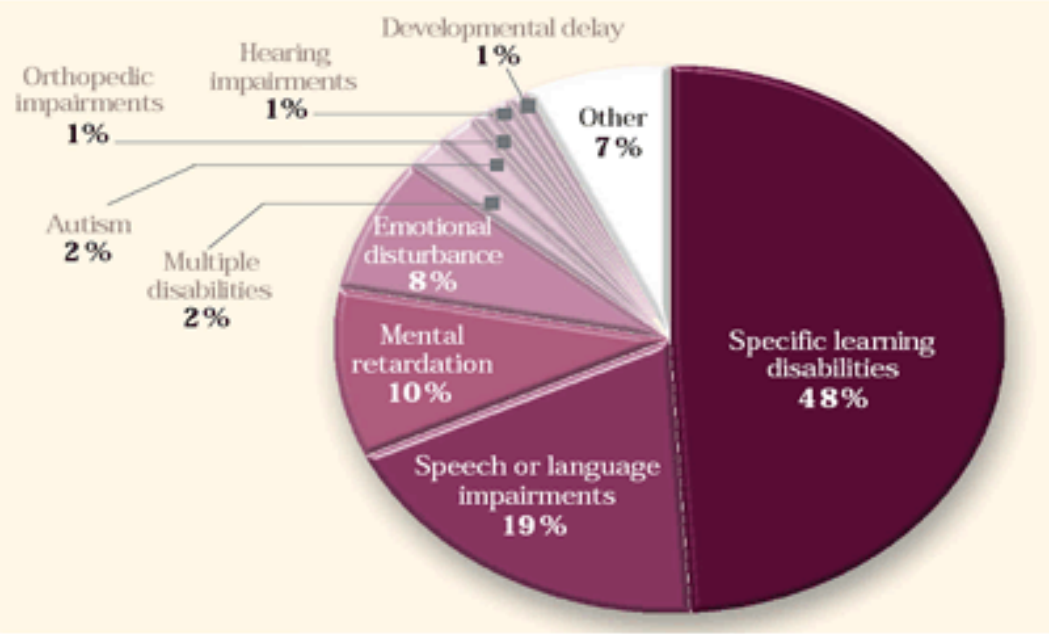
Table 1. Pre-test/Posttest Scores

	Pre-test	Posttest
Inclusion	29	61
Small Group	31.1	65.3

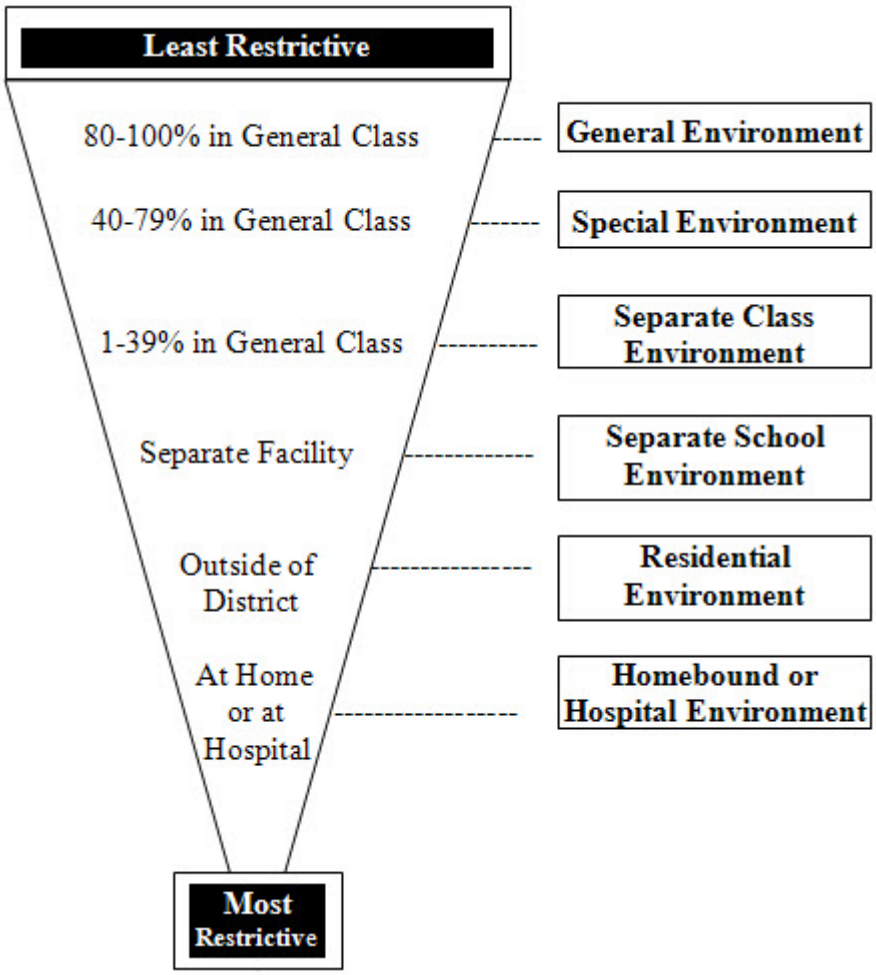
Pre-test and Posttest were the identical test given at the beginning and end of intervention.

Figure 1: Special Education Population by Disability



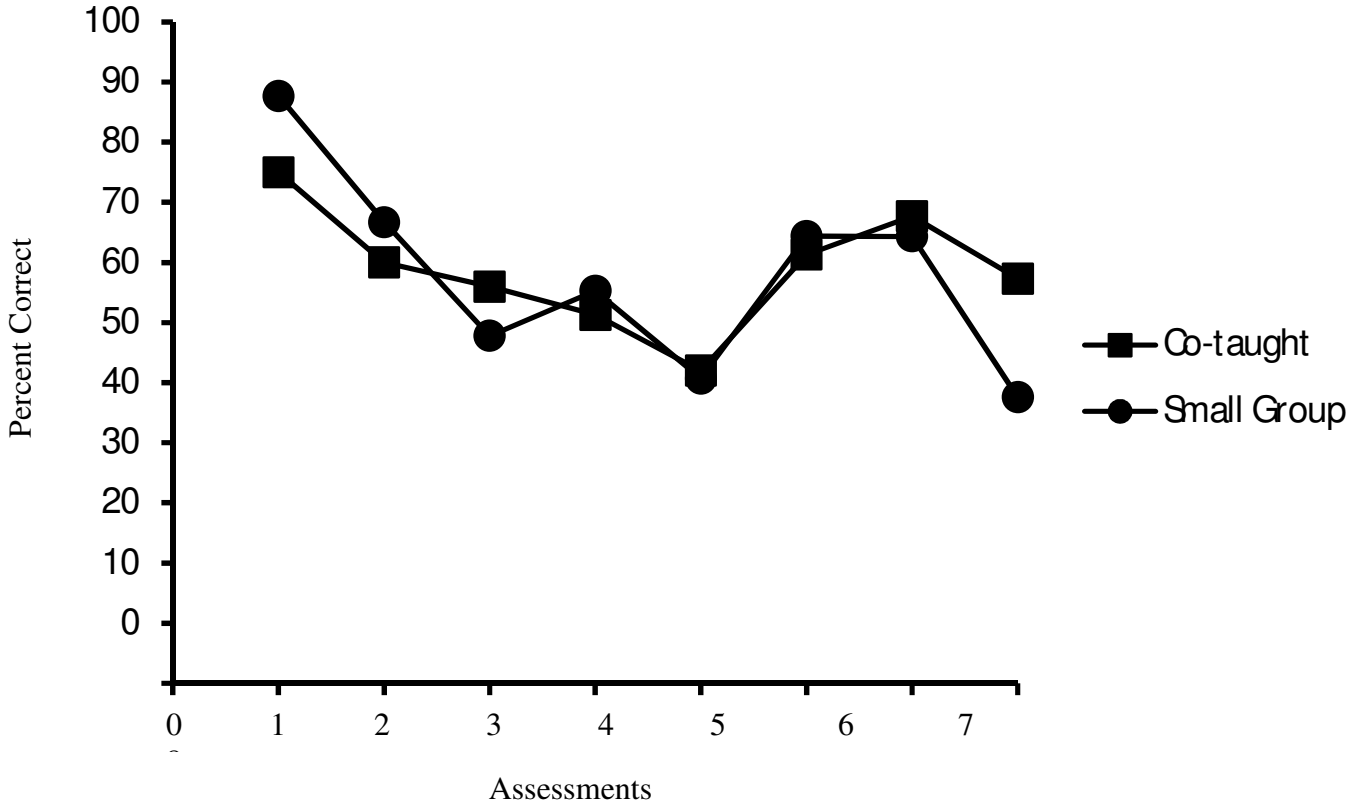
SOURCE: Education Week analysis of data from the U.S. Department of Education, Office of Special Education Programs, Data Analysis System, 2002-03.

Figure 2: The continuum of alternate placements.



Source: Laramie County School District 1 - Continuum for Special Education Services

Figure 3. Graphed Summative Data



Appendix A: Parental Consent Form

IRB Parent/Guardian Consent Form

I, _____, give permission for my child, _____, to be a participant in the research, "What difference is there in learning for secondary students with learning disabilities in the area of science when taught in a small group "pull-out" instructional setting versus being instructed in an inclusion setting?," which is being conducted by Elizabeth Yeager, who can be reached at ***-***-****. I understand that my child's participation is voluntary; I can withdraw my consent at any time. If I withdraw my consent, my child's data will not be used as part of the study and will be destroyed.

The following points have been explained to me:

1. The purpose of this study is to compare the difference teaching setting has on learning for students with disabilities.
2. The procedures are as follows: my child will be asked to allow the researcher to collect their scores on the environmental science benchmark assessments as well as weekly quizzes and unit exams.
3. You will be asked to sign two identical consent forms. You must return one form to the investigator before the study begins, and you may keep the other consent form for your records.
4. My child may find that some questions are invasive or personal. If your child becomes uncomfortable answering any questions, he or she may cease participation at that time.
5. Your child will not likely experience physical, psychological, social, or legal risks beyond those ordinarily encountered in daily life or during the performance of routine examinations or tests by participating in this study.
6. Your child's individual responses will be confidential and will not be release in any individually identifiable form without your prior consent unless required by law.
7. The investigator will answer any further questions about the research (see above telephone number).
8. In addition to the above, further information, including a full explanation of the purpose of this research, will be provided at the completion of the research project on request.

Signature of Investigator	Date
Signature of Parent or Guardian (If participant is less than 18 years of age)	Date

Research at Georgia College & State University involving human participants is carried out under the oversight of the Institutional Review Board. Address questions or problems regarding these activities to Mr. Marc Cardinalli, Director of Legal Affairs, CBX 041, GCSU, (478) 445-2037

Appendix B: Assent Form

IRB Minor Assent Form

I, _____, agree to participate in the research, "What difference is there in learning for secondary students with learning disabilities in the area of science when taught in a small group "pull-out" instructional setting versus being instructed in an inclusion setting?," which is being conducted by Elizabeth Yeager, who can be reached at ***-***-****. I understand that my participation is voluntary; I can stop at any time. If I withdraw my consent, my data will not be used as part of the study and will be destroyed.

The following points have been explained to me:

1. I will be asked to allow the researcher to record scores received on the environmental science benchmark assessments as well as on weekly quizzes, and unit tests.
2. I will be asked to sign two identical consent forms. One form must be returned to the investigator before the study begins, and I can keep the other consent form.
3. If I become uncomfortable answering any questions, I can stop participating at that time.
4. I am not putting myself in any more physical, psychological, social, or legal danger than I would ordinarily encounter in daily life or during the performance of routine examinations or tests.
5. My information will be kept secret, and no one will know that the answers or results are mine, unless I tell them.
6. If I have any questions about this research, I can ask the researcher by calling the telephone number above.
7. If I want to know more about the research, I can ask for more information.

Signature of Investigator Date

Signature of Minor Participant Date

Research at Georgia College & State University involving human participants is carried out under the oversight of the Institutional Review Board. Address questions or problems regarding these activities to Mr. Marc Cardinalli, Director of Legal Affairs, CBX 041, GCSU, (478) 445-2037

Appendix C: Consent Form

IRB Consent Form

I, _____, agree to participate in the research, "What difference is there in learning for secondary students with learning disabilities in the area of science when taught in a small group "pull-out" instructional setting versus being instructed in an inclusion setting?," which is being conducted by Elizabeth Yeager, who can be reached at (***) ***-****. I understand that my participation is voluntary; I can withdraw my consent at any time. If I withdraw my consent, my data will not be used as part of the study and will be destroyed.
The following points have been explained to me:

1. The purpose of this study is to compare the difference teaching setting has on learning for students with disabilities.
2. The procedures are as follows: you will be asked to grade the Benchmark Assessment as well as weekly probes and unit tests for the students selected to be in the study. Next you will relay the scores to the researcher for coding, recording, and analyzing.
3. The participants' names will not be listed on the data sheet. Therefore, the information gathered will be confidential.
4. You will be asked to sign two identical consent forms. You must return one form to the investigator before the study begins, and you may keep the other consent form for your records.
5. You may find that some questions are invasive or personal. If you become uncomfortable answering any questions, you may cease participation at that time.
6. You are not likely to experience physical, psychological, social, or legal risks beyond those ordinarily encountered in daily life or during the performance of routine examinations or tests by participating in this study.
7. Your individual responses will be confidential and will not be release in any individually identifiable form without your prior consent unless required by law.
8. The investigator will answer any further questions about the research (see above telephone number).
9. In addition to the above, further information, including a full explanation of the purpose of this research, will be provided at the completion of the research project on request

Signature of Investigator	Date
Signature of Participant	Date
Signature of Parent or Guardian (If participant is less than 18 years of age)	Date

Research at Georgia College & State University involving human participants is carried out under the oversight of the Institutional Review Board. Address questions or problems regarding these activities to Mr. Marc Cardinalli, Director of Legal Affairs, CBX 041, GCSU, (478) 445-2037

Appendix D: Pre/Post Test

1. Which of the following situations best describes the use of a renewable resource?
   a. filling a car with gasoline
   b. building wooden furniture
   c. mining copper
   d. burning coal in a power plant
2. Which of the following lists contains the names of developed countries?
   a. Algeria, Guatemala, India
   b. Ecuador, Zaire, Colombia
   c. Brazil, Sudan, Namibia
   d. France, Canada, New Zealand
3. Which was *not* a result of the Industrial Revolution?
   a. increased pollution
   b. loss of natural environment
   c. increase in quality of living
   d. over hunting of large mammals
4. In which country is the average individual likely to be using the greatest amount of natural resources?
   a. Peru
   b. United States
   c. China
   d. Egypt
5. In which country is the population likely to be increasing most rapidly?
   a. Kenya
   b. Germany
   c. Australia
   d. Norway
6. Which of the following is *not* considered a part of Earth's system?
   a. hydrosphere
   b. atmosphere
   c. geosphere
   d. envirosphere
7. _____ gases in the atmosphere, including _____, trap radiated heat and help maintain surface air temperature.
   a. Condensed, nitrogen
   b. Greenhouse, water vapor
   c. Flammable, CO_2
   d. Inert, oxygen
8. Currents at the surface of the ocean are driven by
   a. tectonic plates.
   b. gravity.
   c. salinity.
   d. wind.
9. What kind of habitat does a red backed salamander need to survive?
   a. damp forest floor
   b. sunny top of a tree
   c. dry forest floor
   d. sunny desert rock

10. Which of the following kingdoms include organisms that can make their own food?
    a. protists and plants
    b. plants and animals
    c. fungi and plants
    d. fungi and protists

11. Which of the following is not true of an adaptation?
    a. It is an advantage to an organism in certain environments.
    b. It increases an organism's chance of reproducing.
    c. It increases an organism's chance of survival.
    d. It decreases an organism's chance of evolving.

12. One way that bacteria and fungi are important to the environment is that they
    a. produce oxygen.
    b. use the sun's energy to make their own food.
    c. are a major food source in many ecosystems.
    d. break down dead organisms.

13. Phytoplankton are important protists because they are the initial source of
    a. food in most land ecosystems.
    b. food in most ocean and freshwater ecosystems.
    c. oxygen in the atmosphere.
    d. Both (a) and (b)

14. Which kind of organism obtains energy directly from the sun?
    a. decomposers
    b. herbivores
    c. omnivores
    d. producers

15. If an insect eats a plant and a bird eats the insect, about how much energy from the plant is stored in the insect for the bird to use?
    a. 90 percent
    b. 50 percent
    c. 10 percent
    d. 1 percent

16. Which gas makes up 78 percent of our atmosphere but can be used by plants only when transformed by bacteria first?
    a. nitrogen
    b. oxygen
    c. hydrogen
    d. carbon dioxide

17. Which of the following plants is likely to be a pioneer species?
    a. rose bush
    b. grass
    c. shrub
    d. oak tree

18. If you visited a savanna, you would be likely to see
    a. large herds of grazing animals such as rhinos, zebras, and gazelles.
    b. a dense forest.
    c. snow and ice.
    d. a coastal ecosystem.

19. Animals that live in the desert
    a. hibernate in winter.
    b. are usually nocturnal.
    c. usually have thin skin to absorb water.
    d. include camels, moose, and various reptiles.

20. Which of the following best describes the relationship between climate and latitude?
    a. A latitude of 0° has a climate of extreme temperature ranges.
    b. The lower the latitude, the drier the climate.
    c. There is no relationship between latitude and climate.
    d. The greater the latitude, the colder the climate.

21. Which of the following statements is not correct?
    a. Grasslands have rich soil that supports abundant plant life.
    b. The tundra is a fragile biome because conditions are severe, and the ecosystem is easily disrupted.
    c. Chaparral fires are beneficial because they destroy trees that compete for light and space.
    d. Tropical rain forests are resistant to change since so many nutrients are within the plants instead of the soil.

22. Where would you expect to find burrowing animals?
    a. desert
    b. tundra
    c. temperate grasslands
    d. all of the above

23. Which aquatic ecosystem is negatively affected by runoff?
    a. rivers
    b. oceans
    c. estuaries
    d. all of the above

24. What distinguishes nekton from benthos?
    a. One lives in freshwater and the other in salty water.
    b. One swims freely and the other often lives attached to a hard surface.
    c. One is a predator and the other is a primary producer.
    d. none of the above

25. Threats to ocean ecosystems include
    a. nutrient runoff and industrial waste discharge.
    b. entanglement of marine mammals in trawl nets and over fishing.
    c. sewage and algal blooms.
    d. All of the above

26. The harvesting of coral damages coral reef ecosystems because
    a. coral re-grows too fast.
    b. coral grows too slowly.
    c. coral moves to deep water.
    d. All of the above

27. Which of the following organisms has the highest reproductive potential?
    a. dogs
    b. elephants
    c. bacteria
    d. humans

28. An example of a population would be all
    a. trees in a forest.
    b. red maple trees in a forest.
    c. plants in a forest.
    d. animals in a forest.

29. Each of the following is an example of a parasite *except*
    a. a roundworm in a human's intestine.
    b. a cow in a pasture.
    c. a tick on a cat.
    d. mistletoe on a tree.

30. The relationship between a Canadian lynx & a snow-shoe hare is an example of
    a. parasite and host.
    b. predator and prey.
    c. competition.
    d. mutualism.

31. In which of the following types of interactions is neither species harmed?
    a. predation
    b. competition
    c. parasitism
    d. commensalism

32. Thick fur in deer is *not* an example of coevolution, because
    a. thick fur is an adaptation.
    b. deer with thick fur live longer.
    c. thick fur evolved in response to a cold climate, not in response to other organisms.
    d. in the lowlands, where the climate was sunny and warm, deer that did not have thick fur became separated from other deer that did have thick fur.

33. A species of plant has exponential growth after it is introduced into an area where it has never been. Which statement best describes exponential growth?
    a. Each individual plant grows much larger than usual.
    b. The population immediately decreases.
    c.Within a few years the population increases dramatically.
    d. The species' reproductive potential declines.

34. Between 1880 and 1930 human population doubled due to
    a. the Industrial Revolution.
    b. a combination of high birth rates and lowered death rates.
    c.improvements in societal infrastructure and services.
    d. All of the above

35. Countries that have entered the third stage of demographic transition are most probably characterized by
    a. weak or developing economies.
    b. death rates that far exceed birth rates.
    c.societal conditions that favor smaller families.
    d. populations with a high proportion of young people.

36. Which of the following is a reason that wood is considered a limited resource in many developing countries?
    a. Wood is used in place of money to buy food.
    b. Fuel wood lets people purify their water by boiling it.
    c. Excess wood is used to construct shantytowns.
    d. People cut down trees faster than they can grow.

37. During Stage 2 of a population's demographic transition, the death rate
    a. increases.
    b. decreases.
    c. remains the same.
    d. is zero.

38. Which of the following is *not* a strategy that would reduce population size?
    a. limiting education for women
    b. public advertising
    c.economic incentives
    d. legal punishments

39. Age structure data include all of the following except
    a. members of a population who are between 5 and 11 years old.
    b. the ratio of males to females in a population.
    c. the amount of population change due to immigration or emigration.
    d. the ratio of older people to younger people in a population.

40. When neighborhood residents noticed a large number of dead fish in a local creek, they traced the problem to a nearby gas station. It turned out that a gasoline tank had developed a leak. This is an example of
    a. point-source pollution.
    b. nonpoint-source pollution.
    c. thermal pollution.
    d. groundwater pollution.

41. Most large cities get water for households and industries from
    a. deep wells.
    b. rivers or lakes.
    c.pumps connected to springs.
    d. removing salt from seawater.

42. An inexpensive solution to providing more fresh water is
    a. desalination.
    b. drilling more wells into aquifers.
    c.water conservation.
    d. building more dams.

43. Which of the following might occur as a result of plastic trash accumulating in the ocean?
    a. Turtles mistake clear plastic bags for jellyfish and die of intestinal blockage.
    b. Sea birds are strangled by plastic six-pack rings.
    c. Sea mammals such as seals become entangled in clear plastic fishing lines and drown.
    d. all of the above

44. Noise pollution can cause
    a. high blood pressure.
    b. hearing loss.
    c. loss of sleep.
    d. All of the above

45. Which type of building would *most* likely have poor indoor air quality?
    a. one in a cool climate with a good ventilation system
    b. one in an urban area where windows are often open
    c. one that is tightly sealed and air-conditioned
    d. one that has not been repainted or re-carpeted in several years

46. What contributes most to acid precipitation?
    a. burning of fossil fuels
    b. formaldehyde
    c. radon
    d. all of the above

47. Which of the following is often used to remove poisonous gases from industrial emissions before they are released into the atmosphere?
    a. catalytic converters
    b. scrubbers
    c. ventilation
    d. crushed limestone

48. Which of the following pH measurements of rainwater would indicate acid precipitation?
    a. pH 6.0
    b. pH 4.1
    c. pH 7.3
    d. pH 9.6

49. Which of the following has *not* resulted from urban sprawl?
    a. suburbs
    b. overgrazing
    c. loss of farmland
    d. traffic congestion

50. Which environmental problem is *not* caused by deforestation?
    a. reduction of wildlife habitat
    b. soil erosion
    c. urban sprawl
    d. increased atmospheric CO2

51. Which of the following most effectively allows forests to recover from tree harvesting?
    a. cutting all of the trees and then replanting the area with seedlings
    b. cutting only medium-sized or mature trees
    c. allowing the forest to reseed itself
    d. cutting only young trees and then replacing them with seedlings

52. Where do most Americans live?
    a. in urban areas
    b. on producing farms
    c. in rural areas
    d. none of the above

53. Regardless of where people live, they depend on resources produced in
    a. urban areas.
    b. rural areas.
    c. ocean areas.
    d. wilderness areas.

54. Farmland may become desertified if
    a. domestic animals are allowed to overgraze the land.
    b. too many crops are grown on the land and the land gradually loses its fertility.
    c. there is no fertile soil left to grow plants due to erosion.
    d. All of the above

55. Which of the following actions contributes to soil erosion?
    a. using compost as fertilizer
    b. practicing crop rotation
    c. driving farm machinery over fields
    d. all of the above

56. _____ land is land on which it is possible to grow crops.
    a. Organic
    b. Arable
    c. Vegetative
    d. All of the above

57. Which of the following farm practices is new?
    a. fertilizing crops
    b. irrigation
    c. pest control
    d. none of the above

58. When a farmer uses no-till farming methods,
    a. seeds are planted among the roots of the previous crop.
    b. more erosion is likely.
    c. only organic fertilizers are used.
    d. All of the above

59. Crushed ore is melted at high temperatures to separate impurities from molten metal during
    a. open-pit mining.
    b. hydrothermal solution mining.
    c. smelting.
    d. dredging.

60. The process by which land sinks with little or no horizontal movement is known as
    a. compounding.
    b. quarrying.
    c. reclamation.
    d. subsidence.

61. Minerals are arranged in a regular, repeating geometric pattern of
    a. atoms.
    b. aggregates.
    c. metals.
    d. evaporites.

62. Which of the following is *not* a method of subsurface mining?
    a. room-and-pillar mining
    b. long wall mining
    c. solution mining
    d. open-pit mining

63. Gangue minerals
    a. are valued for their rarity and durability.
    b. have no commercial value.
    c. are the most difficult of all materials to mine.
    d. are native elements.

64. Reclamation is the process of
    a. removing coal from a subsurface seam.
    b. extracting ore minerals from gangue minerals.
    c. returning land to its original, or better, condition after mining operations have been completed.
    d. protecting the habitats of local wildlife.

65. What is the main reason why fewer nuclear power plants are being built today, compared to 40 years ago?
    a. Nuclear fusion power plants are being developed instead.
    b. Federal laws were passed prohibiting the development of new nuclear power plants.
    c. Nuclear power plants have become too expensive to generate electricity at a reasonable cost.
    d. all of the above
66. Which of the following fuels does *not* release carbon dioxide when it is used to produce electricity?
    a. uranium-235
    b. natural gas
    c. oil
    d. coal
67. Electric generators work by
    a. converting oil into electricity.
    b. turning turbines in a dam.
    c. converting mechanical energy into electrical energy.
    d. rubbing copper against a substance that does not conduct electricity.
68. Nuclear fusion
    a. produces more radioactive waste than nuclear fission.
    b. creates "daughter" nuclei.
    c. involves splitting of atomic nuclei.
    d. involves the combining of atomic nuclei.
69. Which of the following is a correct statement about fossil fuels?
    a. oil is more plentiful than coal
    b. fossil fuels are not replaced by natural processes
    c. the use of fossil fuels pollutes the atmosphere
    d. untapped reserves offer an unlimited supply
70. What are the five major factors influencing the value of a particular fuel?
    a. energy content, cost, availability, safety, and by-products
    b. source, atomic weight, transportation costs, energy type, and combustibility
    c. location, availability, marketing, popularity, and by-products
    d. energy content, cost, atomic weight, popularity, and safety
71. In developing countries, you are most likely to find biomass used
    a. to generate electricity.
    b. for manufacturing.
    c.as a source of hydropower.
    d. for heating and cooking.

72. Which of the following description of hybrid cars is correct?
    a. Hybrid cars do not use gasoline engines.
    b. Hybrid cars have not been made yet.
    c. Hybrid cars are energy-efficient.
    d. Hybrid cars rely on biomass fuel.

73. Which of the following statements does *not* describe problems associated with modern landfills?
    a. Chemicals leaking out of the waste stored there may pollute wells or groundwater supplies.
    b. All materials buried in landfills decompose in three years.
    c. Explosive gases can be produced by landfills and may build up in the basements of nearby buildings.
    d. all of the above

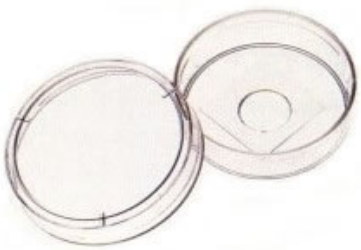
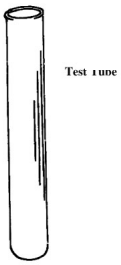
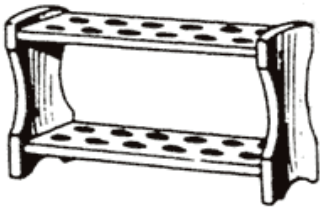
74. Which items make up the largest percentage of waste produced by households and businesses?
    a. aluminum cans
    b. plastic bottles & cans
    c. paper products
    d. yard waste such as tree limbs

75. Which of the following is *not* considered hazardous waste?
    a. dead batteries such as those used in flashlights and radios
    b. rotting meat and other food waste
    c. metals such as lead and mercury
    d. both (a) and (c)

Appendix E: Scientific Method and Laboratory Safety Quiz

The Scientific Method, Lab Equipment, and Lab Safety Quiz

Match the equipment to the name of the equipment.

Equipment	Name
1. 	**A**. Petri Dish
2. 	**B**. Test Tube Rack
3. 	**C**. Beaker
4. 	**D**. Safety Goggles
5. 	**E**. Test Tube

Choose the best answer to the following prompts

11. Flammable materials, like alcohol, should never be dispensed or used near
    A. an open door.
    B. an open flame.
    C. another student.
    D. a sink.
12. If a laboratory fire erupts, immediately
    A. notify your instructor.
    B. run for the fire extinguisher.
    C. throw water on the fire.
    D. open the windows.
13. Approved eye protection devices (such as goggles) are worn in the laboratory
    A. to avoid eye strain.
    B. to improve your vision.
    C. only if you don't have corrective glasses.
    D. any time chemicals, heat or glassware are used.
14. When you finish working with biological specimens, always
    A. treat your hands with skin lotion.
    B. wash your hands thoroughly with soap and water.
    C. wipe your hands on a towel.
    D. wipe your hands on your clothes.
15. If you do not understand a direction or part of a lab procedure, you should
    A. figure it out as you do the lab.
    B. try several methods until something works.
    C. ask the instructor before proceeding.
    D. skip it and go on to the next part.
16. After completing an experiment, all chemical wastes should be
    A. left at your lab station for the next class.
    B. disposed of according to your instructor's directions.
    C. dumped in the sink.
    D. taken home.

17. What is the most important thing to do before starting a lab:
    A. Put on goggles
    B. Put on your lab apron
    C. Pick up your materials from the lab cart
    D. Read the entire lab
18. You are heating a substance in a test tube. Always point the open end of the tube
    A. toward yourself.
    B. toward your lab partner.
    C. toward another classmate.
    D. away from all people.

19.You have been injured in the laboratory (cut, burn, etc.). First you should
   A. visit the school nurse after class.
   B. see a doctor after school.
   C. tell the science instructor at once.
   D. apply first aid yourself.
20. When gathering glassware and equipment for an experiment, you should
   A. read all directions carefully to know whatequipment is necessary.
   B. examine all glassware to check for chips or cracks.
   C. clean any glassware that appears dirty.
   D. All of the above.

21. To mix an acid with water, pour
   A. The liquid of the smaller container into the larger container
   B. Small amounts of each liquid into a third container.
   C. The acid into the water.
   D. The water into the acid.

22. Long hair in the laboratory must be
   A. cut short.
   B. held away from the experiment with one hand.
   C. always neatly groomed.
   D. tied back or kept entirely out of the way with a hair band, hairpins, or other confining device.

23. In a laboratory, the following should not be worn.
   A. loose clothing.
   B. dangling jewelry.
   C. sandals.
   D. all of the above.

24. The following footwear is *best* in the laboratory.
   A. sandals
   B. open-toed shoes
   C. closed-toed shoes
   D. shoes appropriate for the weather

Appendix F: Ecosystems Quiz

Ecosystems: Everything Is Connected

MATCHING

In the space provided, write the letter of the term or phrase that best matches the description.

___**1.** Air, water, and rocks	**a.** habitat
___ **2.** Living organisms & dead organisms	**b.** abiotic factors
___ **3.** Place where an organism lives	**c.** population
___ **4.** Black widow spider	**d.** species
___ **5.** All the black widow spiders in a certain area	**e.** biotic factors

MULTIPLE CHOICE

In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

_____ **6.** Which of the following is an ecosystem?
- **a.** Vacant lot
- **b.** Oak tree
- **c.** Coral reef
- **d.** All of the above

_____ **7.** The energy in most ecosystems comes from
- **a.** Green plants
- **b**. The sun
- **c.** Wind
- **d.** The soil

_____ **8.** The organism most likely to belong to the same species are
- **a.** People at a football Game
- **b.** Bacteria inside a person's body
- **c.** Birds in a forest
- **d.** Organisms in a pond

9. Which of the following statements about an organism's habitat is *not* true?
- **a.** Most organisms can survive if they are taken away from their habitat.
- **b.** An organism's habitat is the place where it lives.
- **c.** A habitat has specific characteristics than an organism needs to live there.
- **d.** A habitat contains biotic and abiotic factors.

10. The community of a pond is made up of all the
- **a.** Biotic and abiotic factors
- **b.** Resources organisms need
- **c.** Habitats in and around the water
- **d.** Populations of fish, insects, & other living organisms.

For 11-20, write "B" for biotic factors and "A" for Abiotic factors

11. animals
12. temperature
13. air
14. dead leaves
15. organisms' waste products
16. water
17. rocks
18. a pine tree
19. sand on a beach
20. a dead zebra

Put the following in order from lowest level (1) to highest level (5) of organization

21. population
22. ecosystem
23. organism
24. community
25. biosphere

Appendix G: Ecology Quiz

Ecology Quiz:
Section: Energy Flow in Ecosystems
MATCHING: Write the letter of the term or phrase that best matches the description.

___ **1.** An organism that makes its own food

___ **2.** The process of breaking down food to yield energy

___ **3.** Organisms that get their energy by eating other organisms

___ **4.** The Process in which plants make sugar molecules from sunlight

___ **5.** Consumers that get their food by breaking down dead organisms

___ **6.** The many feeding relationships possible in an ecosystem

a. cellular respiration
b. decomposer
c. producer
d. consumer
e. photosynthesis
f. food web

MULTIPLE CHOICE: In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

7. What term is used to describe a linear sequence in which energy is transferred from one organism to the next?
a. food web
b. food chain
c. trophic level
d. energy pyramid

8. Which organism is likely to be in the bottom trophic level in a food chain?
a. leopard seal
b. alga
c. krill
d. killer whale

9. What is the ultimate source of energy for almost all organisms except those living deep in the ocean near a Thermal vent?
a. producers
b. consumer
c. the sun
d. bacteria

10. What are organisms that eat both plants and animals called?
a. herbivores
b. carnivores
c. omnivores
d. autotrophs

Section: The Cycling of Materials

MATCHING: Write the letter of the term or phrase that best matches the description.

___ **1.** The process in which nitrogen is cycled between the atmosphere, bacteria, and other organisms

___ **2.** The movement of phosphorus from The environment to organisms and then back to the environment

___ **3.** The process by which carbon is cycled between the atmosphere, land, water, and organisms

___ **4.** Organisms that can transform unusable nitrogen in the atmosphere into chemical compounds containing nitrogen that can be used by other organisms

___ **5.** Breaks down decaying organisms

___ **6.** Part of the nitrogen cycle

___ **7.** Evidence of excessive use of fertilizer

___ **8.** The result of burning fossil fuels

a. carbon cycle
b. increased atmospheric CO_2
c. phosphorus cycle
d. algal bloom
e. atmospheric nitrogen
f. decomposers
g. nitrogen-fixing bacteria
h. nitrogen cycle

MULTIPLE CHOICE: In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

9. Which of the following is one of the largest carbon reservoirs on Earth?
a. limestone
b. fossil fuels
c. Amazon rain forest
d. Atlantic Ocean

10. Which of the following is not part of the nitrogen cycle?
a. nitrogen gas in space
b. nitrogen in the atmosphere
c. nitrogen compounds in animal waste
d. nitrogen compounds in the soil

Section: How Ecosystems Change

MATCHING: Write the letter of the term or phrase that best matches the description.

___ **1.** A common type of succession that occurs on a surface where an ecosystem has previously existed

___ **2.** The first organisms to colonize any newly available area and begin the process of ecological succession

___ **3.** A final and stable community

___ **4.** A type of succession that occurs on a sur-Face where no ecosystem existed before

___ **5.** A type of succession that occurs on abandoned farmland

___ **6.** A gradual process of change and replacement of the types of species in a community

a. ecological succession
b. primary succession
c. secondary succession
d. pioneer species
e. climax community
f. old-field succession

MULTIPLE CHOICE: In the space provided, write the letter of the term or phrase that best completes each statement or best answers each question.

7. What type of vegetation would you expect to find on an abandoned farm that has remained undisturbed for 150 years?
a. short grasses
b. shrubs
c. young pine trees
d. tall, mature oak trees

8. What type of vegetation Would you expect to find on Newly formed volcanic Islands?
a. lichens
b. short grasses
c. shrubs
d. young trees

9. What type of succession occurs after a natural process such as a volcanic eruption or flood?
a. primary succession
b. secondary succession
c. old field succession
d. climax community

10. The eruption of Mount St. Helens was formed by
a. primary succession
b. secondary succession
c. old-field succession
d. forest succession

Appendix H: Unit 1 Test

Ecology Test

On a piece of notebook paper, respond to the following prompts.

MATCHING: Write the letter of the term that best matches the description.

A. carbon dioxide
B. cellular respiration
C. autotroph
D. algal bloom
E. heterotroph

1. an organism that uses energy and matter to make its own food
2. an atmospheric gas that increases when fossil fuels are burned
3. evidence of excessive fertilizer use
4. organism that must consume other organisms to survive
5. processes glucose and produces carbon dioxide as a waste product

MULTIPLE CHOICE QUESTIONS-Part 1: Write the letter of the term or phrase that best completes each statement or best answers each question.

6. What is the original source of energy for almost all organisms except those living deep in the ocean near a thermal vents?
    A. molecular bonds
    B. consumers
    C. the sun
    D. bacteria
7. Which of these consumers might depend directly on rabbits for its energy?
    A. grasshopper
    B. coyote
    C. cow
    D. horse
8. A consumer that eats only producers is called a(n)
    A. omnivore
    B. carnivore
    C. detritivore
    D. herbivore
9. Which diagram is used to model the linear sequence of energy transfer as one organism eats another organism?
    A. food web
    B. food chain
    C. trophic level
    D. energy pyramid
10. Which diagram models the many possible feeding relationships in an ecosystem?
    A. food web
    B. food chain
    C. energy pyramid
    D. energy transfer
11. Which organism would occupy the trophic level with the most available energy?
    A. bobcat
    B. bird
    C. carrot
    D. grasshopper

12. From where do producers get their carbon to build glucose?
    A. the atmosphere
    B. carbohydrates in plants
    C. fossil fuels
    D. animal remains
13. Which of the following is not a fossil fuel?
    A. coal
    B. petroleum/oil
    C. natural gas
    D. fuel wood
14. Which process in the nitrogen cycle occurs around lightning and the roots of legumes?
    A. fixation
    B. ammonification
    C. denitrification
    D. nitrification
15. Which of the following is NOT a result of energy loss as you travel up the trophic levels?
    A. 90% of energy consumed lost as heat
    B. less organisms at upper trophic levels
    C. even distribution of energy from top to bottom
    D. limited number of trophic levels
16. Which of these is a large nitrogen reservoir that is unusable by most organisms?
    A. soil
    B. atmosphere
    C. ocean
    D. space
17. Without these organisms, matter and energy would stop cycling after other organisms died.
    A. producers
    B. primary consumers
    C. decomposers
    D. tertiary consumers

SHORT ANSWER/FILL IN THE BLANK: Respond to the following prompts. Do not rewrite the question.

18. With regards to matter, earth is mostly a(n) _____ system.
19. With regards to energy, earth is a(n) _____ system.
20. What are the products of photosynthesis?
21. What are the products of cellular respiration?
22. _____ is the term for rain, hail, sleet, and snow.
23. Name a human activity that increases the amount of CO_2 in the atmosphere.
24. Name one of the elements you studied that is common in animal waste and fertilizer.
25. Phosphorus rarely occurs in this state of matter, making the phosphorus cycle very slow.

For 26 – 33, choose A. for primary succession or B. for secondary succession

26. occurs on exposed rock after a glacier retreats
27. occurs after a forest fire
28. occurs on top of an abandoned, paved parking lot
29. occurs on abandoned farmland
30. occurs over a filled in lake
31. occurred after the 1980 eruption of Mount St. Helens
32. occurs on new volcanic islands
33. occurs after a flood

MULTIPLE CHOICE QUESTIONS part 2: Write the letter of the term or phrase that best completes each statement or best answers each question.

34. How do lichens contribute to primary succession?
    A. Lichens begin to break down rock to form soil.
    B. Lichens decompose organic matter from animals and plants.
    C. Lichens are nitrogen-fixing bacteria.
    D. Lichens convert carbohydrates into fossil fuels.
35. What type of vegetation would you expect to find on an abandoned farm that has been undisturbed by humans for 150 years?
    A. short grasses
    B. young pine trees
    C. shrubs
    D. tall, mature oak trees
36. A glacier retreats to expose bare rock. What will be the most likely pioneer species in this scenario?
    A. grasses
    B. shrubs
    C. lichens
    D. oak trees

37. A fire sweeps through a forest and burns all the trees to the ground. What will be the most likely pioneer species in this scenario?
    A. grasses
    B. shrubs
    C. lichens
    D. oak trees
38. Which community is a likely climax community in Paulding County?
    A. a regularly mowed park
    B. a sustainably farmed pine forest
    C. a hardwood forest
    D. a stable, tundra community
39. Some natural disasters such as _____ help forest communities by allowing some trees to release their seeds, by clearing away deadwood, and by encouraging new growth.
    A. fire
    B. flood
    C. tornado
    D. earthquake
40. On new islands formed by volcanic activity, you will most likely find _____ succession.
    A. old field
    B. volcanic
    C. primary
    D. secondary

Appendix I: Biome Presentation Instructions and Rubric

Biome Project:

Shared on Google Drive with *email inserted here

REMEMBER:

- Keep a list of websites and books you use. You will need them to cite your sources in APA format on http://www.bibme.org/
- Use your time wisely. We will be in the computer lab 3 days. Break up your work accordingly.
- If you finish early, proofread your work, have a friend proofread your work, then have *teachers name* proofread your work. Then fix it. Add to it. Practice it.
- You are NOT "done" until you've presented.

Slides to include:

Check them off as you complete them.

1. ____ Map of the world indicating where your biome is found. A map will be provided for you to color in, but find an image online as well to include in your presentation. Cite your source beneath the image.
2. ____ Climatogram for your biome: Be able to describe the annual trends in temperature and precipitation. Cite your source beneath the image.
3. ____ Plant Adaptations: Find 5 plant species, and describe each species' adaptations which allow them to live in their habitat.
4. ____ Animal Adaptations: Find 5 animal species, and describe each species' adaptations which allow them to live in their habitat.
5. ____ Create a food chain that includes a producer species, a primary consumer species, a secondary consumer species, and a tertiary consumer. Label each trophic level. See Mr. Murray if you have the Savanna.
6. ____ 2 paragraph description of your biome and its abiotic and biotic factors. This will be included in your presentation, but should not be read verbatim in class. Summarize the main points.
7. ____ Three causes of environmental damage to your biome (threats from humans): Why is each issue a problem?
8. ____ Fixing the Problems: Identify three things that humans can do to slow down or stop the damage from the issues you described in #5. Be specific. "Don't litter," "Recycle," and "Don't pollute," are not acceptable.
9. ____ Invasive Species: Find three invasive species in your biome. How is each one they causing damage?
10. ____ Endangered and Threatened Species. Find 3 endangered or threatened species (Learn the difference.)
    a. Indicate the species' common name and S*cientific name*.
    b. Is the species endangered or threatened?
    c. How many of them are left? This may be a range. (Ex: 1,000 - 1,500)
    d. What is being done to help the species recover?
11. ____ Citations page: Give credit to all the sources you used using APA format. You can use bibme.org for help here.

Biome Resources

- Enchanted Learning: http://www.enchantedlearning.com/biomes/
- Berkeley Biomes: http://www.ucmp.berkeley.edu/exhibits/biomes/
- Nature.com http://www.nature.com/scitable/knowledge/library/terrestrial-biomes-13236757
- UC Santa Barbara: http://kids.nceas.ucsb.edu/biomes/
- Missouri Botanical Gardens: http://www.mbgnet.net/
- Bio-Expedition: http://bioexpedition.com/biomes/
- National Geographic: http://www.nationalgeographic.com/ Search at the top for your biome.
- Blue Planet Biomes: http://www.blueplanetbiomes.org/world_biomes.htm

Endangered Species

- WWF: http://worldwildlife.org/species/directory

Earth's Endangered: http://www.earthsendangered.com/

Appendix J: Biomes Quiz

Section: What is a Biome?

MATCHING: Match the descriptions on the left with the correct terms on the right. Write your answer on the line provided.

___ **1.** Driest biome

___ **2.** Wettest biome

___ **3.** Coldest biome

___ **4.** Located between 30° and 60° latitude

___ **5.** Located just below the Arctic Circle

a. grasslands
b. desert
c. taiga
d. tundra
e. tropical rain forest

MULTIPLE CHOICE: In the space provided, write the letter of the word or statement that best answers the question or completes the statement.

___ **6.** The distance north or south of the equator; as measured in degrees, is called
a. altitude **c.** longitude
b. latitude **d.** magnitude

___ **7.** The main factor that determines what type of plants grow in a biome is
a. temperature **c.** altitude
b. precipitation **d.** both (a) and (b)

___ **8.** Biomes with higher temperatures and less precipitation tend to have
a. shorter and less dense vegetation
b. taller and denser vegetation
c. taller and less dense vegetation
d. shorter and denser vegetation

___ **9.** Biomes that are located between 30° north latitude and 30° south latitude might be
a. tropical rain forest **c.** tundra
b. grasslands **d.** taiga

___ **10.** Which of the following describes the relationship among latitude, altitude, & climate?
a. climate becomes colder as you get closer to sea level
b. climate becomes warmer as you move up a mountain
c. climate becomes warmer as you move toward the poles

d. climate becomes colder as you move up a mountain

Section: Forest Biomes?

MATCHING: Match the descriptions on the left with the correct terms on the right. Write your answer on the line provided.

___ **1.** Emergent layer

___ **2.** Canopy

___ **3.** Understory

___ **4.** Tropical rain forest

___ **5.** Taiga

a. dense shade
b. Arctic
c. bright light
d. filtered light
e. near the equator

MULTIPLE CHOICE: In the space provided, write the letter of the word or statement that best answers the question or completes the statement.

___ **6.** Which of the following biomes receives 200 to 450 cm of rain per year?
a. desert **c.** tropical rain forest
b. taiga **d.** grassland

___ **7.** You are walking through a forest with the greatest species diversity. This forest is located in a region
a. near the equator **c.** with wide temperature ranges
b. near the Arctic Circle **d.** in the Pacific Northwest

___ **8.** You are walking through a forest that receives relatively little rainfall and has acidic soil. This forest is located in a region
a. near the equator **c.** dominated by maple trees
b. near the Arctic Circle **d.** with abundant undergrowth

___ **9.** As you walk through the forest on a chilly day, you can hear the fallen leaves crunch underfoot. This forest is located
a. near the equator **c.** at about 40^{o} North latitude
b. where annual rainfall is 200 cm **d.** in an area with very thin soil

___ **10.** You are walking through a forest that gets large amounts of rain, has high humidity, and has moderate temperatures year-round. Where is this forest found?
a. somewhere near the equator
b. somewhere near the Arctic Circle
c. in a forest with the greatest species diversity
d. the Pacific Northwest

Section: Grassland, Desert, and Tundra Biomes

MATCHING: Match the descriptions on the left with the correct terms on the right. Write your answer on the line provided.

___ **1.** Most fertile soil

___ **2.** Mediterranean climate

___ **3.** Permafrost soil layer

___ **4.** Less than 25 cm rain per year

___ **5.** Giraffes and rhinos

a. savanna
b. tundra
c. chaparral
d. desert
e. temperate grassland

MULTIPLE CHOICE: In the space provided, write the letter of the word or statement that best answers the question or completes the statement.

___ **6.** Animals such as pronghorn antelope, bison, and badgers dot the land-Scape. Where are these animals located?
a. near the equator
b. the Arctic
c. the North American prairie
d. Africa

___ **7.** Which of the following receives about 25 com of rain per year?
a. shortgrass prairie
b. middlegrass prairie
c. tallgrass prairie
d. desert

___ **8.** Which of the following is located primarily in coastal areas with Mediterranean climates?
a. tallgrass prairie **c.** tundra
b. savanna **d.** chaparral

___ **9.** Permafrost can be found in which of the following?
a. tallgrass prairie **c.** tundra
b. savanna **d.** chaparral

___ **10.** Which of the following biomes has been affected by human activity?
a. tundra **c.** temperate grasslands
b. chaparral **d.** all of the above

Appendix K: Biomes and Aquatic Ecosystems Test

Biomes and Aquatic Ecosystems Test

Section 1 – Key Terms

Match the description to the key term on the right.

1. Category for bottom dwelling organisms in aquatic ecosystems
2. Area where fresh river water meets salty ocean water
3. Distance from the equator, measured in degrees
4. Increase of nutrients in an aquatic ecosystem
5. Organisms that cannot swim against currents
6. Deeper layers of tundra soil, frozen year-round
7. Free swimming organisms
8. Distance above sea level, often measured in meters
9. Long term trends in precipitation and temperature
10. Dense layer of leaves, blocking up to 95% of sunlight

A. Plankton
B. Nekton
C. Benthos
D. Eutrophication
E. Permafrost
F. Estuary
G. Altitude
H. Latitude
I. Canopy
J. Climate

Section 2 – Adaptations

Match the adaptation to the biome in which it would be most advantageous.

11. Feeding at different heights
12. Leaves that promote burning
13. Ability to absorb sunlight
14. Slow decomposition and ability to survive drought
15. Loss of leaves in the winter
16. Water retention & nocturnal lifestyle
17. Dwarf forms with wide, shallow roots
18. Tolerance of acidic soil

A. Tropical Rain Forest
B. Temperate Deciduous Forest
C. Taiga
D. Savanna
E. Temperate Grassland
F. Chaparral
G. Desert
H. Tundra

Section 3 – Threats

Match the human activity or result of human activities to the biome or aquatic ecosystem it would most damage.

19. Overgrazing
20. Damming
21. Draining and filling
22. Eutrophication/Algal bloom
23. Bleaching
24. Slash and burn farming
25. Overfishing
26. Interruption of food chain

A. Lakes
B. Oceans
C. Rivers
D. Wetlands
E. Coral Reefs
F. Tropical Rainforests
G. Tundra
H. Temperate Grassland

27. With about 50% of the world's species, this biome has the highest biodiversity.
    A. temperate deciduous forest
    B. chaparral
    C. tropical rainforest
    D. savanna
28. Animals in the savanna migrate in response to
    A. predation.
    B. temperature.
    C. humidity.
    D. rainfall.
29. This behavior .allows animals to survive periods of drought in the desert.
    A. hibernation
    B. estivation
    C. mastication
    D. activation
30. Which herd animal would you most likely find in the tundra?
    A. moose
    B. whitetail deer
    C. wildebeest
    D. buffalo
31. Changing fur color from brown to white is an advantage in this biome.
    A. chaparral
    B. temperate grassland
    C. desert
    D. taiga
32. Which biome features hot temperatures year round with wet and dry seasons?
    A. temperate grasslands
    B. tropical rainforests
    C. temperate rainforests
    D. tropical grasslands
33. Which biome features trees with deep roots in rich soil that drop their leaves in the cold winter?
    A. temperate deciduous forest
    B. savanna
    C. temperate rainforest
    D. taiga

34. Marine wetlands that feature grass as their main plant life are
    A. mangrove swamps.
    B. saltwater marshes.
    C. the everglades.
    D. freshwater marshes.
35. The water in an estuary would be described as
    A. marine
    B. freshwater
    C. brackish
    D. nutrient poor
36. Bacterial action in eutrophic lakes can be described as
    A. feeding on decaying plant and animal waste.
    B. lowering dissolved oxygen levels, often leading to fish kills.
    C. both A and B
    D. neither A or B
37. Mangrove trees' tall roots are an adaptation to
    A. salt water.
    B. tides.
    C. tropical heat.
    D. droughts.
38. Coral polys hunt by
    A. actively chasing their prey.
    B. occupying the primary consumer trophic level.
    C. waiting to sting passing prey.
    D. building limestone skeletons.
39. Crayfish, barnacles, and clams are classified as
    A. plankton.
    B. nekton.
    C. benthos.
    D. migratory.
40. Whales, turtles, and sharks are classified as
    A. plankton.
    B. nekton.
    C. benthos.
    D. fish.

Appendix L: Land Use and Agriculture Test

Land Use and Agriculture Test

1. A condition that occurs when a person does not consume enough calories or get enough nutrients
    A. Famine
    B. Malnutrition
    C. Anemia
    D. essential amino acids
2. Yield refers to…
    A. calories in a food
    B. reliance on new food
    C. amount of food an area can produce
    D. a movement toward glasswort, quorn, and other low impact foods
3. People in developed nations consume diets higher in these nutrients than the rest of the world.
    A. Carbohydrates
    B. Proteins
    C. Lipids
    D. both B & C
4. Humans need to eat 8 essential amino acids to build proteins, because…
    A. the body cannot make these nutrients
    B. those are all the amino acids in existence
    C. they are needed for energy
    D. they are delicious
5. The green revolution introduced seeds with…
    A. higher yields
    B. need for fertilizer
    C. need for pesticides
    D. all of the above
6. This is the term for the portion of earth's land that is usable to grow crops.
    A. rangeland
    B. arable land
    C. national parks
    D. topsoil

7. Which organisms contribute to fertile soil?
    A. bacteria
    B. fungi
    C. earthworms
    D. all of the above
8. Without topsoil, plants cannot grow. Topsoil is lost due to many farming methods through this process.
    A. erosion
    B. lying fallow
    C. leeching
    D. grazing
9. Allowing land to lie fallow can prevent desertification, which is sped up by…
    A. overgrazing
    B. plowing
    C. high pressure irrigation
    D. all of the above
10. Inorganic fertilizers are now used with partially decomposed organic material called…
    A. manure
    B. duck feces
    C. compost
    D. nitrogen fixation
11. What is the term for chemicals used to kill insects, weeds, and other pests?
    A. insecticide
    B. pesticides
    C. herbicide
    D. pathogens
12. What is the best term for organisms that occur where they are not wanted and cause economic damage
    A. insects
    B. aphids
    C. boll weevils
    D. pests

13. What is the ability to survive exposure to a particular pesticide?
    A. immunity
    B. determination
    C. resistance
    D. persistence
14. Human health concern(s) associated with pesticide use are _____.
    A. cancer
    B. nervous system disorders
    C. illness
    D. all of the above
15. With regards to persistence, what benefits does the Bt toxin have over DDT?
    A. Insects do not develop resistance to Bt
    B. Bt breaks down after a few days
    C. DDT goes through biomagnification
    D. Humans are not harmed by either, so it doesn't matter
16. Use of living organisms to control pests is called _____.
    A. biological pest control
    B. integrated pest management
    C. pesticide regulation
    D. salinization
17. Natural plant defenses may include _____.
    A. repellant chemicals
    B. tougher skin
    C. inorganic pesticides
    D. both A & B
    E. all of the above
18. Pheromones and x-rays are often used by farmers to _____.
    A. repel pests
    B. kill pests
    C. disrupt breeding of pests
    D. attract pests

19. Plants with the Bt toxin trait were created using technology in which genetic material in a living cell is modified for medical an industrial use. This is the term for this technology.
    A. nitrogen fixation
    B. genetic engineering
    C. sustainable agriculture
    D. organic farming
20. This is the raising of aquatic organisms for human consumption.
    A. aquaculture
    B. fishing
    C. no fishing zones
    D. over harvesting
21. Which of the following would be classified as a ruminant?
    A. duck
    B. chicken
    C. cow
    D. pig
22. What is a method that governments use to prevent overharvesting?
    A. no fishing zones
    B. rabbit season
    C. duck season
    D. wide net fishing
23. These nutrients, provided by chickens, make them an important food source.
    A. essential amino acids
    B. carbohydrates
    C. unsaturated fats
    D. cellulose
24. What is an environmental problem associated with aquaculture
    A. fish waste as pollution
    B. draining local water
    C. damage to wetlands
    D. all of the above

25. What is the main cause of malnutrition today
    A. lack of fatty foods
    B. choice
    C. poverty
    D. the green revolution
26. Which statement is true about urban and rural land?
    A. Urban and rural lands are covered in buildings.
    B. Urban land has over 2,500 people. Rural has open space.
    C. Urban and rural lands have few people
    D. Urban and rural lands are kept natural
27. Which of the following is NOT an ecosystem service?
    A. Regulation of climate
    B. Maintenance of biodiversity
    C. Water treatment facility
    D. Purification of air and water
28. Which is NOT an advantage of slow urbanization?
    A. Inadequate infrastructure
    B. Sufficient roads to handle traffic
    C. Adequate mass transit systems
    D. Planned green spaces
29. Which is NOT a downside of an urban crisis?
    A. Traffic jams
    B. Substandard housing
    C. Air and water pollution
    D. Minimized heat island
30. Which is NOT marginal land?
    A. Sandy regions
    B. Steep mountains
    C. Tundra
    D. Midwestern plains
31. Which would NOT reduce the effects of a heat island?
    A. More parking lots
    B. Planting trees
    C. More reflective rooftops
    D. More natural greenbelts

32. What is the term for computer systems for storing, viewing, and manipulating geographic information?
    A. Global positioning systems
    B. Geographic information systems
    C. Skynet
    D. Telescope
33. Which is NOT a benefit of mass transit systems?
    A. Less traffic
    B. Less land lost to parking
    C. Less air pollution
    D. Less time to read
34. Which term best matches "open spaces in a city"?
    A. Park
    B. Court
    C. City hall
    D. Wilderness area
35. Which is not an advantage of open spaces?
    A. Cooler temperatures
    B. Increased pollen
    C. Flood prevention
    D. Area for relaxing
36. Which is NOT an effect of overgrazing?
    A. Multiple watering holes
    B. More invasive species
    C. Less grazing area
    D. Erosion
37. Which is NOT method of preventing overgrazing?
    A. limit herd sizes
    B. leave land alone so vegetation can recover
    C. multiple watering holes
    D. rotating breed of cattle
38. Which harvesting method removes only mature and medium aged trees?
    A. Clear cutting
    B. Deforestation
    C. Selective cutting
    D. Random cutting

39. Which harvesting method removes all trees from an area?
    A. Clear cutting
    B. Deforestation
    C. Selective cutting
    D. Random cutting
40. Which is NOT a disadvantage of deforestation?
    A. reduction of wildlife
    B. loss of topsoil through erosion
    C. maintaining biodiversity
    D. both a and b
41. Where has reforestation been successful in North America?
    A. The Midwest
    B. The Rocky Mountains
    C. New England
    D. The Gulf Coast
42. What was the first national park
    A. The Great Smoky Mountains
    B. Olympic National Park
    C. Death Valley
    D. Yellowstone
43. Which of the following is NOT allowed in wilderness areas?
    A. Roads
    B. Fishing
    C. Research
    D. Hiking
44. Which is not an advantage of protected areas?
    A. prevention of wildlife extinction
    B. recreation
    C. research
    D. climate change
45. Which is not a threat to protected areas?
    A. litter
    B. human activity nearby
    C. volunteers
    D. pollution

Appendix M: Lesson Plan Template

LESSON TITLE:	TIME ALLOCATION: 50 minutes *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED:	
MATERIALS:	PRIOR KNOWLEDGE NEEDED: MODIFICATIONS MADE FOR SPECIAL NEEDS:
PROCEDURE AND ACTIVITIES	TIME ALLOCATIONS
EVALUATION AND ASSESSMENT:	

Appendix N: Completed Lesson Plans

08/01/13-08/02/13

LESSON TITLE: Introduction to Environmental Science	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event. CT-class shortened by 20 min. due to advisement on 08/01.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	
MATERIALS: *Syllabus *Quiz *Lab Safety Rules *Lab Worksheet	**PRIOR KNOWLEDGE NEEDED:** Basic lab Safety **MODIFICATIONS MADE FOR SPECIAL NEEDS:** None

WEEKLY PROCEDURE AND ACTIVITIES

Thursday 08/01-Introduction
CT-Students took "50 misconceptions in science quiz"
-Watched youtube video that explained the answers.
-Began going over syllabus.
SG- Students took "50 misconceptions in science quiz"
-Watched youtube video that explained the answers.
-Began going over syllabus.
-Started Day 1 Powerpoint

Friday 08/02-Lab Safety
CT-Day 1 Powerpoint
-Safety Scenarios read aloud to class. Students responded with what was wrong.
-Went over lab safety rules.
-Students completed a "Safety Scavenger Hunt" individually
SG-Safety Scenarios read aloud to class. Students responded with what was wrong.
-Went over lab safety rules.
-Students completed a "Safety Scavenger Hunt" as a group. Teacher would read scenario and students made it a contest of who could match up the rule with the scenario the quickest.

EVALUATION AND ASSESSMENT:
Teachers informally evaluated students grasp of lab safety rules. Students will take a summative test later over lab safety.

08/05/13-08/09/13

LESSON TITLE: How Ecosystems Work	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.	
MATERIALS: *w.s. “The times and troubles of the scientific method” *Ecological Footprint Quiz *Data graphing w.s.	**PRIOR KNOWLEDGE NEEDED:** Steps of the scientific method How to make and read graphs **MODIFICATIONS MADE FOR SPECIAL NEEDS:**

PROCEDURE AND ACTIVITIES

Monday 08/05- Discussion of steps of the Scientific Method. Students watched video off youtube about the steps of the Scientific Method and answered questions on a worksheet.

Tuesday 08/06- Students took Ecological Footprint Quiz to see their carbon footprint left on earth. Students compared their footprint with those of other students and graphed results.

Wednesday 08/07- Went over what their graph from previous day should have looked like. Watched Mythbusters video on Balloon Flight. While watching video, students filled in the steps of the Scientific Method the participants on the show were using. Students began notes in introduction to Environmental Science.

Thursday 08/08- Students worked in groups to complete “Tragedy of the Commons” Lab ***CT** students turned in lab questions at end of class. **SG** students turned questions in the next day. Finished introduction to Environmental Science lecture.

Friday 08/09- Students used the entire class period to take quiz over The Scientific Method and Lab Safety.

EVALUATION AND ASSESSMENT:
Students were assessed informally by teacher(s) walking around the room to check for understanding.
Ecological Footprint graphs were turned in and given an formative grade.
Students turned in “Tragedy of the Commons” Lab for a formative grade.
All students (CT & SG) were tested in a small group setting consistent with their IEP. Students in the SG class had the quiz questions read aloud to them.
Quiz was a summative grade.

08/12/13-08/16/13

LESSON TITLE: Levels of Organization	**TIME ALLOCATION: 50 minutes** *SG class shortened by 10 min on 8/14 due to fire drill.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV1. Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society. e. Distinguish between abiotic and biotic factors in an ecosystem and describe how matter and energy move between these. SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. b. Recognize and give examples of the hierarchy of the biological entities. SEV3. Students will describe stability and change in ecosystems. a. Describe interconnections between abiotic and biotic.	
MATERIALS: *Powerpoint *Markers/crayons *Construction paper *Handouts *Venn Diagram	**PRIOR KNOWLEDGE NEEDED:** Basic knowledge of how Earth cycles it's resources. Levels of organization **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Copy of notes and note taking assistance Students in both studies were tested in the small group setting consistent with their IEP.

PROCEDURE AND ACTIVITIES

Monday 08/12- Powerpoint over Chap. 4.1 and 5.

Covered - Levels of organization
- How each level is interconnected
- Biotic vs. Abiotic
- Began Levels of Organization diagram

Tuesday 08/13- Students used the class period to complete a diagram of the levels of organization for one organism. *Organism-Population-Community-Ecosystem-Biosphere

Wednesday 08/14- Students worked on 3 handouts.
- Map skills dealing with habitat and critical thinking dealing with analogies.
- Active reading over ecosystems and in particular abiotic vs. biotic.
- Principles of Ecology dealing with key vocab from current chapters being studied.

Thursday 08/15- Quiz over ecosystems. Students then created a Venn Diagram comparing and contrasting biotic vs. abiotic. Students began to take Cycles notes.

Friday 08/16- **CT** took notes on the water, carbon, nitrogen, and phosphorus cycle.
SG was given a copy of the notes and listened during lecture.

*Both groups completed "Identify the missing process in the nutrient cycle." activity

EVALUATION AND ASSESSMENT:

Students turned in diagram from 08/13 to be formatively assessed.
Students took quiz on 08/15 which was evaluated summatively.
Teachers walked around room during Venn Diagram to informally assess students' level of understanding of abiotic vs. biotic as well as while students were filling in nutrient cycle activity.

08/19/13-08/23/13

LESSON TITLE: Cycles of Matter and Energy Food Webs	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.

GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED:

SEV1. Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society.

a. Interpret biogeochemical cycles including hydrologic, nitrogen, phosphorus, oxygen, and carbon cycles. Recognize that energy is not recycled in ecosystems.

MATERIALS: *paper *colored pencils *Cycles notes	**PRIOR KNOWLEDGE NEEDED:** Parts and steps of the different cycles. **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Notes given on 08/21 to **SG** students

PROCEDURE AND ACTIVITIES

Monday 08/19- Students were divided into one of three groups. (4-5 students per group)

-Nitrogen
- Phosphorus
- Carbon

Within their group, they were assigned a role/step. They had to answer 4 questions related to their step and as a whole create a visual aid.

Tuesday 08/20-Students continued work from previous day on Cycles group.

Wednesday 08/21- Students took notes over the cycling of energy in ecosystems.

Thursday 08/22- **CT** went to the media center to research organisms found in different biomes. In groups of 2 they created a rough draft of a food web**. SG** were given similar resources and worked individually on creating a food web for organisms in a certain biome.

Friday 08/23- CT went back to media center to continue research and create a food web. Researcher was in a co-teaching training meeting with a different co-teacher. **SG** worked on vocab for chapter 5 with the sub and finished their food webs.

EVALUATION AND ASSESSMENT:

Teacher(s) walked around to get a gauge of how the students were progressing in their knowledge of the Earth's cycles**. CT** presented their projects in front of class where they were graded formatively. **SG** did not present and turned theirs in for grading.

08/26/13-08/30/13

LESSON TITLE: Food Webs	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV1. Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society. b. Relate energy changes to food chains, food webs, and to trophic levels in a generalized ecosystem, recognizing that entropy is a primary factor in the loss of usable food energy during movement up the trophic levels. SEV3. Students will describe stability and change in ecosystems. b. Explain succession in terms of changes in communities through time to include changes in biomass, diversity, and complexity. c. Explain how succession may be altered by traumatic events.	
MATERIALS: *Notes *Food webs handouts * Ecological Succession w.s.	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Notes given on 08/28 to **SG** students Students in both studies were tested in the small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 08/26**- **CT** worked with their partners to create a food web for their biome. **SG** finished their biome food webs on Friday. As a group they were given examples of food webs and had to identify where organisms went. **Tuesday 08/27**- **CT** finished their food webs project. Next they worked on vocab from chapter 5 which SG did the previous Friday. **SG** was given animals and plants from different biomes and they had to make food webs with what they were given. **Wednesday 08/28**- Students took notes over Ecological Succession **Thursday 08/29**- Students took the pre-test for environmental science. **Friday 08/30**- Students completed the pre-test. Next worked on an Ecological Succession worksheet and then worked on a study guide for their up-coming test.	
EVALUATION AND ASSESSMENT: Food webs were collected and analyzed to see what levels students understanding was currently. Feedback was given on the food webs so students could see where they needed assistance. Students' scores on the pre-test were compared for all students taking environmental science. There was no area that stood out as the students already having a grasp on.	

09/02/13-09/06/13

LESSON TITLE: Concept Review Biomes	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: Students were reviewing and taking Unit 1 Test. Standards addressed on previous lesson plans were reviewed. SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: *study guide	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students in both studies were tested in the small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 09/02**- Labor Day. No School. **Tuesday 09/03**- Study Guide **Wednesday 09/04**- Study Guide **Thursday 09/05**- Unit #1 Test **Friday 08/30**- **CT**-Took notes over characteristics of biomes. **SG** had an assembly so they did not have class.	
EVALUATION AND ASSESSMENT: Summative test over Unit #1	

09/02/13-09/06/13

LESSON TITLE: Biomes	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: *study guide	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students in both studies were tested in the small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 09/02**- Labor Day. No School. **Tuesday 09/03**- Study Guide **Wednesday 09/04**- Study Guide **Thursday 09/05**- Unit #1 Test **Friday 08/30**- **CT**-Took notes over characteristics of biomes. **SG** had an assembly so they did not have class.	
EVALUATION AND ASSESSMENT: Summative test over Unit #1	

09/09/13-09/13/13

LESSON TITLE: Biomes	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: *study guide	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Note taking assistance

PROCEDURE AND ACTIVITIES

Monday 09/09- Notes over Biomes *Researcher was in GHSGT make-up testing. Therefore she was absent from the **CT** class. However, she discussed with her co-teacher the information they covered and mimicked it in her **SG** class.

Tuesday 09/10- Finished notes over Biomes *Researcher was in GHSGT make-up testing. Therefore she was absent from the **CT** class. However, she discussed with her co-teacher the information they covered and mimicked it in her **SG** class.

Wednesday 09/11- *Both classes were shortened due to early release. Students colored in a map of where the different biomes are located. *Researcher was in GHSGT make-up testing. Therefore she was absent from the **CT** class. However, she discussed with her co-teacher the information they covered and mimicked it in her **SG** class.

Thursday 09/12- Students continued to investigate the location of the different biomes of the world and colored in their locations.

Friday 09/13- Students filled in a table on the back of the map with characteristics of each biome.

EVALUATION AND ASSESSMENT:
All assessments this week were informal in nature. Teachers circulated the room speaking with students and aiding them where needed.
The Biome map and table were turned in and graded as a daily formative grade.

09/16/13-09/20/13

LESSON TITLE: Biomes	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: *Biomes brochure rubric	**PRIOR KNOWLEDGE NEEDED:** Earth's biomes **MODIFICATIONS MADE FOR SPECIAL NEEDS:**

PROCEDURE AND ACTIVITIES

Monday 09/16- Students were given an individual project to create a travel brochure of an assigned biome.

Tuesday 09/17- Students worked in class on their brochure.

Wednesday 09/18- Students completed a "Guided Reading" assignment using the textbook over chapter 6.

Thursday 09/19- Students watched a Planet Earth video over the Earth's biomes and took notes over the video.

Friday 09/20- *The researcher was out on a personal day. **CT** completed active reading assignments from their workbook. **SG** completed vocab for chapter 6 and answered questions at the end of chapter 6.

EVALUATION AND ASSESSMENT:
All assessments this week were informal in nature. Teachers circulated the room speaking with students and aiding them where needed assistance creating their brochure.
The Biome Brochure was turned in and graded as a daily formative grade.

09/23/13-09/27/13

LESSON TITLE:	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED:	
MATERIALS:	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**
PROCEDURE AND ACTIVITIES *Students were on fall break. No assignments were given.	
EVALUATION AND ASSESSMENT:	

09/30/13-10/04/13

LESSON TITLE: Biome Presentation	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: *Computer * Biome Presentation instructions	**PRIOR KNOWLEDGE NEEDED:** General knowledge of key terms related with chap. 6-biomes **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students given oral and written directions.
PROCEDURE AND ACTIVITIES **Monday 09/30**- Students were taken to the computer lab and given directions on how to create a google drive account. Day 1 was spent creating an "all about me" presentation to get them acquainted with using googledoc. **Tuesday 10/01**- Students signed up for a biome different than the biome they created a brochure for. They began researching and putting together their presentation. **Wednesday 10/02**- Students continued to work on their presentation in the computer lab. **Thursday 10/03**- Students continued to work on their presentation in the computer lab. **Friday 10/04**- Students continued to work on their presentation in the computer lab.	
EVALUATION AND ASSESSMENT: All assessments this week were informal in nature. Teachers circulated the computer lab speaking with students and aiding them where needed assistance creating their presentation.	

10/07/13-10/11/13

LESSON TITLE: Biome Presentation Continued	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome.	
MATERIALS: * Computer * Biome Presentation instructions * Textbook	**PRIOR KNOWLEDGE NEEDED:** Information about selected biome as well as other biomes. **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students given one-on-one assistance when needed.

PROCEDURE AND ACTIVITIES

Monday 10/07- **CT** students presented biome presentations. **SG** had technology problems in the computer lab so they had an extra day to complete their presentation.

Tuesday 10/08- **CT** continued to present. **SG** presented.

Wednesday 10/09- **CT** students whom did not present because they were not done were allowed to go to the computer lab and have one last day to finish up. Students left behind were given chap. 6 vocabulary to work on and textbook questions to complete. One **SG** student was not ready to present so she was allowed to go to the media center to finish up. The rest of the class did chap. 6 vocabulary and textbook questions.

Thursday 10/10- Planet Earth Video on biomes continued.

Friday 10/11- Concept review for chapter 6 completed.

EVALUATION AND ASSESSMENT:
Biome presentation was a summative grade.

10/14/13-10/18/13

LESSON TITLE: Aquatic Ecosystems	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. d. Characterize the components that define fresh-water and marine systems. Abiotic Factors – to include light, dissolved oxygen, phosphorus, nitrogen, pH and substrate. Biotic Factors – plant and animal adaptations characteristic to that system.	
MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students quizzed in small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 10/14**- Biomes Quiz. **Tuesday 10/15**- Students worked on chapter 7 vocab. **CT** read chap 7 in book silently. **SG** read chap 7 aloud. **Wednesday 10/16**- Planet Earth video on Aquatic Ecosystems. **Thursday 10/17**- Aquatic Ecosystems notes **Friday 10/18**- Freshwater/Marine Ecosystems organizational chart	
EVALUATION AND ASSESSMENT: Biome quiz was a summative grade. Teachers circulated the room to assist students with filling in their organizational chart. While doing this they were able to informally assess their grasp of the information.	

10/21/13-10/25/13

LESSON TITLE: Aquatic Biomes	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. d. Characterize the components that define fresh-water and marine systems. Abiotic Factors – to include light, dissolved oxygen, phosphorus, nitrogen, pH and substrate. Biotic Factors – plant and animal adaptations characteristic to that system.	
MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** Characteristics that make up a biome **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Note taking assistance
PROCEDURE AND ACTIVITIES **Monday 10/21**- Aquatic Ecosystems Story **Tuesday 10/22**- Frayer Model for one aquatic ecosystem **Wednesday 10/23**- Finish Frayer Model and begin chap. 7 study guide **Thursday 10/24**- Worked on chap. 7 study guide **Friday 10/25**- Planet Earth Video on Aquatic Biomes	
EVALUATION AND ASSESSMENT: Frayer Model was turned in, graded, and given feedback.	

10/28/13-11/01/13

LESSON TITLE: Concept Review	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV2. Students will demonstrate an understanding that the Earth is one interconnected system. c. Characterize the components that define a Biome. Abiotic Factors – to include precipitation, temperature and soils. Biotic Factors – plant and animal adaptations that create success in that biome. d. Characterize the components that define fresh-water and marine systems. Abiotic Factors – to include light, dissolved oxygen, phosphorus, nitrogen, pH and substrate. Biotic Factors – plant and animal adaptations characteristic to that system.	
MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** Characteristics that make up a biomes and aquatic ecosystems **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students tested in small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 10/28**- Review chap. 7 concepts **Tuesday 10/29**- Review chap. 6 concepts **Wednesday 10/30**- Chap.6 & & Unit Test **Thursday 10/31**- Test recovery **Friday 11/01**- Test recovery continued	
EVALUATION AND ASSESSMENT: Students took a unit test over chapters 6 and 7. Based on their scores. Recovery was offered. Students got their tests back and for the questions they got wrong, they put the correct answer, found the page in the book that discussed the content of the question and then wrote a sentence that supported their new answer.	

11/04/13-11/08/13

LESSON TITLE: City Planning and Land Use	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources b. Describe how technology is increasing the efficiency of utilization and accessibility of resources. c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency.	
MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**
PROCEDURE AND ACTIVITIES **Monday 11/04**- **CT** took notes over Chap. 14. **SG** did a worksheet to preview the concepts in chapter 14 due to the researcher being out for co-teaching training. **Tuesday 11/05**- **CT** finished notes and began City Planning Activity**. SG** took notes over Chap. 14. **Wednesday 11/06**- City Planning Activity where students were divided into groups of 3-4 and had to map out and design a city. Students had to include marginal land, fresh water, wetlands, homes, shops, and utilities. The city needed to be as ecological friendly as possible. **Thursday 11/07**- City Planning Activity continued. **Friday 11/08**- Finished Chap. 14 notes.	
EVALUATION AND ASSESSMENT: Teachers informally evaluated students while they were working on their city planning activity. Teachers were able to talk with each group and begin to understand why they created their city plan how they did.	

11/11/13-11/15/13

LESSON TITLE: City Planning and Land Use	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources b. Describe how technology is increasing the efficiency of utilization and accessibility of resources. c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency. f. Describe the need for informed decision making of resource utilization. (i.e. energy and water usage allocation, conservation, food and land, and long-term depletion)	
MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**

PROCEDURE AND ACTIVITIES

Monday 11/11- Completed study guide over Chap. 14.

Tuesday 11/12- Teach-to-Learn (TTL) Activity. Students were assigned a section of chapter 14/ a certain concept or topic. They had to become experts on that topic and teach the rest of the class.

Wednesday 11/13- Continued to work on TTL Activity.

Thursday 11/14- Presented TTL topic to class.

Friday 11/15- Answers given for study guide over Chap. 14. Began Chap. 15 notes.

EVALUATION AND ASSESSMENT:
Teachers graded students on their TTL activity and gave them feedback over what they turned in and presented.

11/18/13-11/22/13

LESSON TITLE: Land Use and Agriculture	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.

GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED:
SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources
b. Describe how technology is increasing the efficiency of utilization and accessibility of resources.
c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency.
f. Describe the need for informed decision making of resource utilization.
(i.e. energy and water usage allocation, conservation, food and land, and long-term depletion)
SCSh9. Students will enhance reading in all curriculum.
c. Building vocabulary knowledge
• Demonstrate an understanding of contextual vocabulary in various subjects.
• Use content vocabulary in writing and speaking.
• Explore understanding of new words found in subject area texts.

MATERIALS: * Notes * Textbook	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**

PROCEDURE AND ACTIVITIES

Monday 11/18- Completed notes over Chap. 15.

Tuesday 11/19- TED Talk over the option of eating insects for food. Students participated in discussion after.

Wednesday 11/20- Hunger in the Horn of Africa Activity

Thursday 11/21- Science Article review and discussion

Friday 11/22- Animals and Agriculture Stories

EVALUATION AND ASSESSMENT:
This week teachers really focused on literacy and writing. Students read 2 separate articles and had to answer questions and participate in discussion based on what they read and their opinion. Teachers were able to see what information the students really grasped and were able to address misconceptions.

11/25/13-11/29/13

LESSON TITLE:	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED:	
MATERIALS:	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**
PROCEDURE AND ACTIVITIES *Students were on Thanksgiving break. No assignments were given.	
EVALUATION AND ASSESSMENT:	

12/02/13-12/06/13

LESSON TITLE: Land Use and Agriculture	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV4. Students will understand and describe availability, allocation and conservation of energy and other resources b. Describe how technology is increasing the efficiency of utilization and accessibility of resources. c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency. f. Describe the need for informed decision making of resource utilization. (i.e. energy and water usage allocation, conservation, food and land, and long-term depletion)	
MATERIALS: *Notes *Vocabulary ch.14 & 15	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**

PROCEDURE AND ACTIVITIES

Monday 12/02- Connect-the-Terms Activity for chap. 15

Tuesday 12/03- Begin study Guide for Chap. 15.

Wednesday 12/04- Finish up study guide

Thursday 12/05- Review game

Friday 12/06- Test over Chap. 14 & 15.

EVALUATION AND ASSESSMENT:
Students were evaluated by summative assessment.

12/09/13-12/13/13

LESSON TITLE: Human Populations	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: SEV5. Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems. a. Describe factors affecting population growth of all organisms, including humans. Relate these to factors affecting growth rates and carrying capacity of the environment. b. Describe the effects of population growth, demographic transitions, cultural differences, emergent diseases, etc. on societal stability. c. Explain how human activities affect global and local sustainability. f. Describe how political, legal, social, and economic decisions may affect global and local ecosystems.	
MATERIALS: *Notes *Vocabulary chap. 9	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:**
PROCEDURE AND ACTIVITIES **Monday 12/09**- Human Populations notes **Tuesday 12/10**- Notes continued **Wednesday 12/11**- Human Population Statements activity **Thursday 12/12**- Chap. 9 review guide *Chapter 9 will not be assessed separately and will just have questions added to the mid-term. **Friday 12/13**- Begin mid-term study guide.	
EVALUATION AND ASSESSMENT: Students were evaluated based on their ability to make an argument for or against a human population view on the Human Population Statements activity. Although there is no right or wrong side to the statements the students ability to support why they feel the way they do tells the teacher a lot about their grasp of the material.	

12/16/13-12/20/13

LESSON TITLE: Mid-term Review	**TIME ALLOCATION: 50 minutes** *Note if the class time was shortened due to any event.
GEORGIA PERFORMANCE SCIENCE STANDARDS ADDRESSED: • All standards covered up to this point.	
MATERIALS: *Notes	**PRIOR KNOWLEDGE NEEDED:** **MODIFICATIONS MADE FOR SPECIAL NEEDS:** Students tested in small group setting consistent with their IEP.
PROCEDURE AND ACTIVITIES **Monday 12/16**- Worked on mid-term study guide **Tuesday 12/17**- Worked on mid-term study guide **Wednesday 12/18**- Due to testing schedule, did not see either class **Thursday 12/19**- Due to testing schedule, did not see either class **Friday 12/20**- Both **CT** and **SG** took their mid-term/posttest	
EVALUATION AND ASSESSMENT: Students were evaluated on the mid-term over all information covered this semester. This mid-term counted 20% of their final grade.	