HISD SciPack Deployment

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Report on Outcomes from the Study of a SciPack Deployment in the Houston Independent School District during School Year 2009-2010

by

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CONTENTS

CONTENTS (CONTINUED)

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

Edvantia, a not-for-profit research firm with offices in Charleston (WV) and Nashville (TN), conducted a study of the National Science Teachers Association's (NSTA's) Learning Center SciPack online professional development courses. SciPacks are based on the national science standards and contain three to five Science Objects, each with embedded simulations and related questions. Each SciPack, which takes approximately 10 hours to complete, describes and illustrates pedagogical strategies, includes virtual support via e-mail, begins with a pre-assessment, and concludes with an embedded final assessment. This study examined the extent to which middle school teachers in the Houston Independent School District (HISD) used two of the Learning Center's SciPacks (Earth's Changing Surface; Force and Motion), and the SciPacks' impact on teacher science teaching efficacy, teacher and student content knowledge in earth science and force and motion, and teacher instructional practices.

The research was based on a two pretest-posttest delayed-treatment control group design involving random assignment. Several measures were used to answer the research questions, including teacher and student assessments, teacher surveys, and web use statistics. Findings related to outcomes are presented below.

Teacher Use of Learning Center SciPack Professional Development Resources. Teacher use of the SciPacks and other NSTA resources was moderate over the course of the study. More than half (62%) of participants accessed at least two SciPacks during the study time frame. Most logins to the SciPack site occurred during October, November, and January, which aligned with the SciPack schedule of times that teachers were expected to complete each SciPack. Low frequency of logins at the beginning of the year may suggest that teachers did not find the time in August or early September to focus on the SciPacks, particularly the new teachers in the Abrazo program.

Science Teaching Efficacy. Teachers' self-efficacy toward teaching science was examined through data from teacher surveys. Survey results indicate that teachers' sense of efficacy for teaching science increased over the course of the study, which suggests positive effects of the professional development experience, especially given the short time frame of the study. Further, teachers who completed at least two SciPacks *significantly* increased their perceived preparedness to teach earth science over the course of the study.

Teacher and Student Content Knowledge. Teachers' content knowledge of earth science and force and motion was examined by embedded SciPack final assessments, and pre- and post-assessments. Assessment scores indicated that teachers significantly increased their content knowledge in both content areas. Teachers improved their scores over time almost equally for both earth science and force and motion. Further, treatment teachers achieved higher gain scores than control teachers in both content areas.

Students of participating teachers did, indeed, improve their performance in earth science or force and motion. Fifth-grade students in the treatment teachers' classrooms scored significantly higher on an earth science assessment than did those in control teachers' classrooms, suggesting that the SciPacks had a positive impact on student performance in earth science. In addition, 6th- and 8th-grade students of treatment group teachers had gain scores that were significantly larger than the gain scores of students in control teachers' classrooms, again suggesting that teacher SciPack completion had a positive influence on their students' knowledge of force and motion.

Changes in Teaching Practices. Teacher reports of their science instructional strategies and student practices in the classroom generally did not change over the course of the study; lack of change may have been influenced by the study timeline where some teachers had instructed content before being provided access to the SciPacks.

Areas for Future Research

Although the findings are conclusive for the participating school district, the following recommendations are provided as suggestions for future research studies conducted on SciPacks or other NSTA resources.

- The research should be replicated in multiple school districts and in a broader set of instructional contexts (e.g., student demographics, social environment, geographic diversity) to achieve even wider generalizability.
- Teachers in this study were recruited out of availability. This may have influenced their motivation and willingness to complete SciPack modules. Future studies should include various types of recruitment strategies; for instance, the next study might include recruiting teachers who volunteer and then randomly assigning them to treatment and control conditions.
- Futures studies should include from the initial design incentives for all data collection activities to increase completion rates. Low rates affect external validity and may mask effects that are truly there.
- The study should be replicated with a larger sample size so even if there is attenuation over time, researchers will have a sample that is needed to enable statistical judgments that are accurate and reliable.
- In order to see the impact of SciPacks on teachers' instructional strategies, future studies could incorporate a sufficient time frame (e.g., a school year) to examine potential changes in instructional practice. Researchers would have an opportunity triangulate data collected from surveys, lesson plans, instructional logs, and/or classroom observations to increase credibility and validity of the results.
- The current study explored the use of two specific SciPack modules at the elementary and middle school levels. The study could be replicated using other SciPacks that are relevant for those grades (e.g., Solar System, Ocean's Effect on Weather and Climate, or Earth, Sun, and Moon) to determine the efficacy of these modules.

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INTRODUCTION

The National Science Teachers Association's (NSTA's) Learning Center contains a wealth of resources, both free and for fee, for science teaching. The resources in the Learning Center include Science Objects, Web Seminars, journal articles, NSTA symposia, SciGuides, and NSTA Press book chapters. In addition, NSTA has SciPacks, which are online learning experiences that take approximately 10 hours to complete, based on the national science standards. All SciPacks contain three to five Science Objects, each with embedded simulations and related questions. Each SciPack describes and illustrates pedagogical strategies and has e-mail support. Every SciPack begins with a pre-assessment and concludes with an embedded final assessment. Whether or not teachers register for a SciPack course, they have access to most content on the Learning Center Web site. Edvantia, a not-for-profit research firm in Charleston (WV) and Nashville (TN) conducted an efficacy study of its SciPack online professional development courses.

Online Learning

Research on science courses and professional development offered through online or distance learning has uncovered many benefits for learners. First, the independent style of online courses/professional development provides the learner flexibility to work whenever and wherever most convenient, a plus for many teachers who lack time away from class to attend traditional trainings. Online learning also provides opportunities to learners who may not be located near traditional learning environments; this is particularly the case for rural learners who can access online courses when geography prohibits them from attending on-site classes at postsecondary institutions (Krall et al., 2009). Further, many online learning courses offer asynchronous discussion boards as instructional methods that serve as learning communities for peer reflections. These discussion boards offer a social construction of knowledge, "when students take time to articulate their thoughts and questions, gain perspective from the ideas and questions of others, and reflect upon their previous ideas" (Asbell-Clarke & Rowe, 2007, p. 118). Aside from the benefits offered by the format of an online learning environment, research indicates that learners using this format do improve their content knowledge, in some cases, significantly greater than on-campus learners (Krall et. al., 2009; Harlen & Doubler, 2004). Based on this research, an online format to professional development can be considered an effective alternative to traditional avenues of training. Although this is a very brief introduction to the potential benefits of online professional development for teachers, it highlights both the rationale for continued development and testing of high-quality online opportunities for teachers.

Houston Independent School District

With funding from the ExxonMobil Foundation, the efficacy study took place in the Houston Independent School District (HISD). One of the 10 largest school systems in the nation, HISD serves approximately 200,000 students in 293 schools. The 183 elementary schools in the district enroll more than 107,000 students annually. These students are in the classrooms of 6,545 elementary teachers. The 41 middle schools in the system enroll more than 35,000 students annually. These students are in the classrooms of approximately 2,560 middle school teachers, 305 of whom are science teachers. Approximately 75 teachers in Grades 6-8 are new to the district each year and participate in the Abrazo program. These teachers include those new to the profession and experienced teachers who are new to the district. A similar program for elementary school teachers, Science Learning and Leadership Collaborative (SLLC), typically includes approximately 20-30 fifth-grade teachers annually. Participants for this study were recruited from the Abrazo and SLLC teacher programs.

SciPacks

Based on content alignment with the Texas Essential Knowledge and Skills for Science, the HISD staff selected the following two SciPacks for use with the Abrazo and SLLC teachers: Earth's Changing Surface and Force and Motion.

The Earth's Changing Surface SciPack explores how Earth's ever-changing surface is due to continuous natural processes such as tectonic activity, earthquakes, volcanic activities, weathering and erosion, and sedimentation and the reformation of rock. The focus is on topics related to how and why these processes occur, and how elements cycle through the land, oceans, and atmosphere as a result of these processes. This SciPack looks at Earth as a system that exists in dynamic equilibrium. Earth's Changing Surface SciPack contains the following three Science Objects: Changing Earth from Within, Sculpting the Landscape, and Humans as Agents of Change.

The Force and Motion SciPack explores the effects of forces on the motion of objects. The focus is on topics related to concepts such as constant motion, acceleration, speed and direction as well as a discussion of Newton's Laws of Motion. Force and Motion SciPack contains the following four Science Objects: Position and Motion, Newton's First Law, Newton's Second Law, and Newton's Third Law.

Figure 1 presents a screen capture of one of the Science Objects from Earth's Changing Surface SciPack. Links to Science Objects and embedded content are displayed on the left side of the screen. An audio feature that reads text aloud is offered to users at the top of the screen.

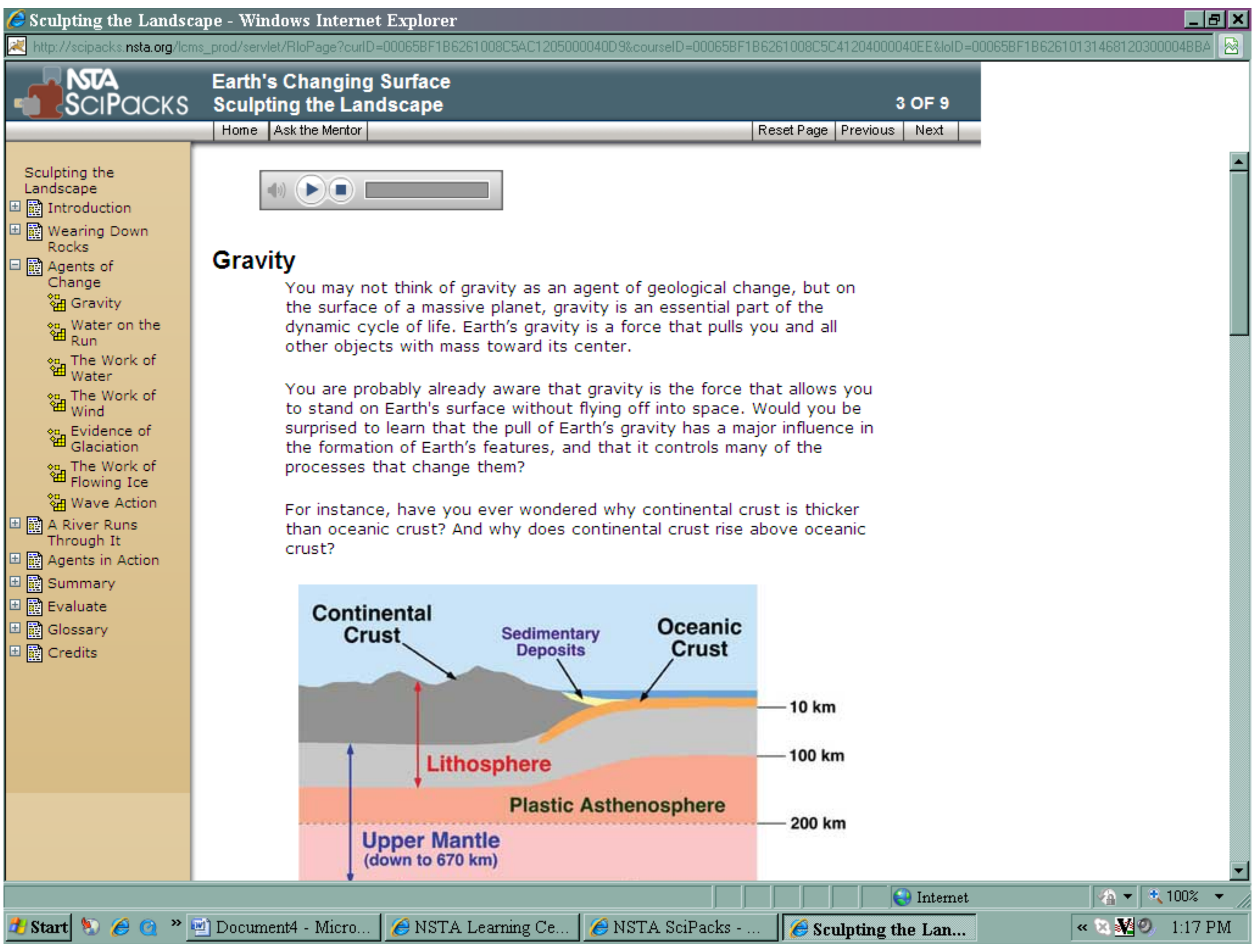

Figure 1. Earth's Changing Surface embedded Science Object.

Participant Recruitment

Abrazo teacher participants included first year middle school teachers in the Houston Independent School District (HISD). They were provided pre-service days (e.g., summer orientation) before the start of school, and monthly after-school professional development opportunities; attendance at these monthly trainings was not mandatory. The Abrazo team leader primarily assisted new teachers in becoming acclimated to the HISD and its curriculum by providing mentoring, coaching, and training.

SLLC teacher participants were fifth-grade teachers who had a least one year of teaching experience. A two-week intensive training was held in the summer for SLLC teachers; mandatory monthly training events were held throughout the year. The SLLC team leader provided program oversight, recruited participants, coordinated curriculum, and was engaged in program planning and development.

Abrazo and SLLC participants were selected for this study for a number of reasons. First, participants were selected for logistical purposes: (1) leaders could monitor and track teacher participation; (2) the timeline of the study was aligned with program timelines; (3) program orientation provided opportunity for NSTA staff to introduce the study and train participants on use of the SciPacks; and (4) accessing teachers in these programs saved staff from the timely process of recruiting other teachers throughout the district. Second, Abrazo and SLLC participants were also considered by district staff to be highly appropriate recipients of the SciPack professional development.

Houston SciPack Training

Teachers from Abrazo and SLLC programs received training on the use of the Learning Center and study processes during the summer prior to the 2009-2010 school year. The SciPack study was not presented as a mandatory or voluntary aspect of the Abrazo program; however, teachers were strongly encouraged to participate in the study by program leaders. Each group of teachers were trained during a 3-hour workshop held at one of the HISD schools. SLLC teachers were trained by the Learning Center Senior Director on July 23, 2009; the training was incorporated into a larger SLLC program meeting that teachers were already scheduled to attend. Abrazo teachers were trained by the Eduvate and another NSTA consultant on August 6, 2009; the training was one element during a week of all-day trainings to provide new hire teachers with orientation to the district. Thirty SLLC and 31 Abrazo teachers completed the training.

As part of both trainings, NSTA provided HISD team leaders with information packets about the Learning Center opportunities and about the SciPack efficacy study. Information about NSTA's online and telephone Help Desk resources was also provided during trainings and in print materials distributed to all participating teachers. Once the project was underway, the Learning Center Senior Director supplied HISD with a slide presentation to refresh teachers' familiarity with how to access and navigate the Learning Center. The Director also offered a Web conference in January 2010 to answer teachers' questions about using the Learning Center platform. The Web seminar was recorded and its archive's URL was shared with all of the HISD teachers participating in the program for their on-demand review.

Purpose of the Report

This report details information and findings regarding the 2009-2010 Houston SciPack study. The report summarizes the evaluation activities conducted during the year and provides formative evaluation of the project by examining the extent to which project outcomes were met.

METHODS

The research was based on a two pretest-posttest delayed-treatment control group design involving random assignment. The research questions for this study are as follows:

- Are teachers using the Learning Center SciPack professional development resources?
- Are the SciPacks effective at increasing teacher content knowledge?
- Does completion of the SciPacks increase teachers' science teaching efficacy?
- Are teachers reporting changes in practice as a result of the professional development?
- How do teachers plan to use their new knowledge and resources to positively affect student science learning (e.g., pedagogical changes, use of different classroom resources, more or less frequent use of specific instructional practices, etc.)?
- How do the students of participating teachers perform on assessments in earth science and force and motion?

This research study examined the efficacy of the two SciPacks among teachers in Grades 5-8. The study includes a partial replication substudy, which involved a delayed treatment model for the initial control teachers. The SciPacks were selected based on the alignment between SciPack content and the Texas Essential Knowledge and Skills for Science.

Stratified on pre-assessment and self-efficacy results, participants were randomly assigned to one of two groups, wherein randomly assigned Group A is the treatment group for the Force and Motion SciPack, and randomly assigned Group B is the treatment group for the Earth's Changing Surface SciPack. The stratified randomization procedure took the teacher pre-assessment and pre-survey (self-efficacy) scores into account. A single combination score from the pre-assessment and self-efficacy scale was calculated for each participant. These scores were rank ordered and the sample divided into two groups: relatively higher scorers and relatively lower scorers. From within each stratum, participants were randomly assigned to either Group A or Group B. The study began with 60 participants; 4 of these dropped out of the study in the early stages. Of the 56 remaining teachers, 29 had been assigned to Group A and 27 to Group B. Table 1 identifies the assignment of treatment and control groups to each SciPack.

Table 1. Assignment of Treatment and Control Groups to SciPacks

Group	Treatment	Control
A	Force and Motion	Earth's Changing Surface
B	Earth's Changing Surface	Force and Motion

Based on HISD staff's knowledge of when content would be taught in the classrooms, evaluators developed a schedule of implementation for each SciPack; thus, study design was intended to measure change in practice. The following table displays the SciPack schedule. When serving as a control group, participants were expected to explore NSTA Learning Center free resources (including the Solar System SciPack), create collections, and develop a professional development plan. A design that provided treatment and control group teachers access to both SciPacks and Learning Center resources is illustrated in Table 2. NSTA staff members traveled to Houston the summer of 2009 to train teachers on the use of the SciPacks during their orientation program.

Table 2. SciPack Schedule

Group	July 23 - Sept 30 (Elementary) Aug 6 - Sept 30 (Middle School)	Oct 1 – Nov 30	Beginning Nov 16	Nov 16 – Jan 31
A	Take *Force & Motion* SciPack	Explore Learning Center free resources, create collections, develop PD plan	Full access to all Learning Center resources after completing first SciPack	Take *Earth's Changing Surface* SciPack
B	Explore Learning Center free resources, create collections, develop PD plan	Take *Earth's Changing Surface* SciPack	Full access to all Learning Center resources after completing first SciPack	Take *Force & Motion* SciPack

Instruments

Several measures were used to answer the research questions, including teacher and student assessments, teacher surveys, and web use statistics. Table 3 illustrates the relationships between data collection methods and research questions.

Table 3. Efficacy Study Data Collection Methods by Research Question

Data Collection Methods	Research Question				
	Use of Resources	Teaching Efficacy	Content Knowledge	Teaching Practice	Student Knowledge
Teacher Pre- and Post-Assessments			X		
SciPack Final Assessments			X		
Teacher Survey	X	X		X	
Web Use Statistics	X				
Student Pre and Posttests					X

Teacher Assessments

The measurement of teacher content knowledge was gathered via the e-learning platform's pre-assessment and post-assessment, and the SciPacks' embedded final assessment. The pre- and post-assessment consisted of 34 multiple-choice items (21 Earth Science items and 13 Force and Motion items); items remained the same for both assessments. All 60 participants completed the pre-assessment at their individual 2009 summer program orientation/training; 4 teachers withdrew from the SciPack study and, thus, their assessment data were not included in the analysis. Twenty-four (42.9%) of the remaining 56 teachers completed Earth's Changing Surface post-assessment; 26 (46.4%) completed Force and Motion post-assessment. Post-assessments were completed in January 2010.

The Earth's Changing Surface embedded final assessment consisted of 22 multiple-choice items; Force and Motion final assessment had 15 multiple-choice items. Teachers completed the SciPack embedded final assessments as they completed each SciPack. Twenty-four (42.9%) teachers completed the Earth's Changing Surface final assessment and 26 (46.4%) completed the Force and Motion final assessment. Table 4 presents the schedule of teacher assessments; it should be noted that due to low completion rates, the timeline of activities was adjusted from the original timeline to provide teachers more time to complete assessments. To increase response rates,

teachers were provided a $30 Visa gift card for completing each SciPack (including embedded SciPack final assessment; $60 total) and $20 for completing each post-assessment ($40 total).

Teacher Survey

Throughout the implementation of the Houston SciPack Study, teachers completed an online survey measuring their (a) self-efficacy for teaching science, (b) awareness and use of NSTA Learning Center and other Web-based science resources to enhance their own pedagogy and content knowledge, and (c) use of instructional practices in their science classes. Instructional practice items were drawn from the Local Systemic Change for Teacher Enhancement 2006 Teacher Questionnaire, developed by Horizon Research. Teachers' self-efficacy was measured using the 16-item Self-Efficacy Teaching and Knowledge Instrument for Science Teachers (SETAKIST; Roberts & Henson, 2000); analyses on this study's collected survey data generated high reliability among the 16 items: alpha = 0.904, 0.864, and 0.810 for the first, second, and third administrations of the survey, respectively. The teacher survey was administered to participants at the beginning of the study during summer program orientation (pre-survey; Survey #1), October 2009 (first post-survey; Survey #2), and January 2010 (second post-survey; Survey #3). All 56 participants completed the pre-survey, 25 (44.6%) completed the first post-survey, and 35 (62.5%) completed the second post-survey; 23 (41.1%) teachers completed all three surveys. To increase response rates, teachers were provided a $25 Visa gift card as an incentive for completing the Survey #3. Table 4 presents the schedule of teacher assessments and surveys.

Table 4. Teacher Assessment / Survey Schedule

Group	July 23/Aug 6	Nov 15	Dec 3	Jan 6-31
Group A	Teacher Practices Survey #1 Teacher Content Pre-Assessment	Teacher Practices Survey #2 and *Force & Motion* Final Assessment and Post-Assessment	Teacher Content *(Earth's Changing Surface)* Post-Assessment	Teacher Practices Survey #3 and *Earth's Changing Surface* Final Assessment and Post-Assessment
Group B	Teacher Practices Survey #1 Teacher Content Pre-Assessment	Teacher Practices Survey #2 and *Force & Motion* Post-Assessment	Teacher Content *(Earth's Changing Surface)* Final Assessment and Post-Assessment	Teacher Practices Survey #3 and *Force & Motion* Final Assessment and Post-Assessment

Web Use Statistics

Frequencies of teacher logins to the SciPack site were recorded within the NSTA Learning Center. At the conclusion of the study, evaluators downloaded login history for each teacher from the site to determine the frequency with which teachers accessed the two required SciPacks, as well as other SciPacks.

Student Assessment

Students of Abrazo and SLLC teachers involved in this study were administered a pretest and posttest to measure their knowledge of Earth Science and/or Force and Motion. The student assessments—aligned with SciPack content and HISD content standards—were created by the evaluation team in consultation with HISD and NSTA staff. The student pretest that measured both content areas was administered during the first two weeks of school; posttests were administered in October (Force and Motion) and December (Earth Science). Timing of the posttests was determined in consultation with HISD staff to acknowledge when the topics were taught in the curriculum. The fifth grade assessment had a total of 18 Earth Science items; sixth-, seventh-, and

eighth-grade assessments had 15 items each of Earth Science and Force and Motion. The schedule for student assessments is provided below.

Table 5. Student Assessment Schedule

Teacher Pool	Late August / Early September	By Oct 31	By Dec 18
SLLC (Elementary) Groups A and B	Student Content Pre-Test – Earth Science	N/A	Student Content Post-Test – Earth Science
Abrazo (Middle School) Groups A and B	Student Content Pre-Test – Earth Science Student Content Pre-Test –Force & Motion	Student Content Post-Test –Force & Motion	Student Content Post-Test – Earth Science

Only students in Grade 5 (SLLC participants) completed both the Earth Science pretest and posttest. As originally designed, students in Grades 6-8 were expected to complete the pretest and posttest for both content areas; however, in addition to the pretest, evaluators received only the posttest for Force and Motion for these grades. No posttests for Earth Science were received from Abrazo participants (Grades 6-8). The number of students completing each pretest and posttest are presented in Table 6, by grade level.

Table 6. Student Assessment Completion by Grade Level

Grade	Earth Science				Force & Motion			
	Pretest		*Posttest*		*Pretest*		*Posttest*	
	N Teacher	N Student	N Teacher	N Student	N Teacher	N Student	N Teacher	N Student
5	18	372	14	291	N/A	N/A	N/A	N/A
6	6	159	--	--	6	158	3	50
7	5	103	--	--	5	103	--	--
8	8	161	--	--	8	156	3	122
Total	*37*	*795*	*14*	*291*	*19*	*417*	*6*	*172*

Analyses

Study analyses involved the examination of teacher and student knowledge in earth science and force and motion, instructional practices, and Web use. Survey and assessment data were primarily examined three ways: change over time for all participants; change in treatment versus control groups; and change by SciPack completion (i.e., number of SciPacks completed). Quantitative survey and assessment data were imported into the Statistical Package for the Social Sciences (SPSS) and cleaned before analyses were conducted. Analyses for presented methods are discussed in more detail below.

Teacher survey data were analyzed three ways. Data from Survey #1 and Survey #3 of all participants were analyzed to determine changes over time; frequencies (e.g., percentages), paired samples *t* tests (of participants who completed both surveys), and effect sizes (when appropriate), were calculated to compare participants' change in preparedness to teach science, science instruction practices, student practices in the classroom, and teachers' Internet use. For the experimental component of the study, data from Survey #1 and Survey #2 were examined to determine differences between treatment and control groups of teachers' self efficacy, and preparedness to teach science—called the *intent-to-treat* analyses; a 2 x 2 mixed-design analysis of variance (ANOVA) was calculated to examine the effects between subjects (treatment and control), within-subjects (Survey #1 and Survey #2), and the interaction of group and time. *Treatment-on-treated* analyses examined differences between teachers who completed 1 or fewer SciPacks and

those who completed 2 or more SciPacks throughout the study period; a 2 x 2 mixed-design ANOVA examined the effects between subjects (the number of SciPacks completed), within-subjects (Survey #1 and Survey #3), and the interaction of group and time.

Comparative analyses including *t* tests and repeated measures analyses of variance (ANOVAs) were conducted on SciPack final assessment, teacher pre- and post-assessment, and student assessment data. Repeated measures ANOVAs examined the effects of group and time on assessment scores, and the interaction. Examination of student knowledge data was limited due to the return of student assessments. Data from 5th-grade student assessments was analyzed to examine student knowledge of earth science; data from 6th- and 8th-grade student assessments were analyzed to examine knowledge of force and motion (see Table 6 for rates of assessment return).

Teacher logins to the SciPack site were downloaded and entered into SPSS. Logins were counted by teacher and SciPack. Descriptive statistics (e.g., means, standard deviations) were performed to determine the average number of times teachers' accessed each SciPack.

FINDINGS

Findings for this report are organized by data collection measure. A discussion of findings that examines research questions is presented following this section.

Teacher SciPack Use Statistics

To determine SciPack usage by all study participants, evaluators downloaded and analyzed users' history reports from the NSTA Learning Center site. These reports provided the number of times in which participants accessed (or logged into) each SciPack. It should be noted that 5 of the 56 teachers did not access any SciPacks during the duration of the study.

Eight different SciPacks were accessed by teachers a total of 1,657 times throughout the course of the study. At the conclusion of the study, 13 of the total teacher participants (SLLC = 11; Abrazo = 2) completed Earth's Changing Surface SciPack; 15 teachers (SLLC = 13; Abrazo = 2) completed Force and Motion SciPack. In addition to the required study SciPacks, teachers accessed six others, including the following: (1) Solar System; (2) Ocean's Effect on Weather and Climate; (3) Earth, Sun, and Moon; (4) Cell Structure and Function; (5) Resources and Human Impact; and (6) Energy. Figure 2 presents the percentage of times each SciPack was accessed; it should be noted that the Solar System SciPack was used as an example/demonstration during the summer training session.

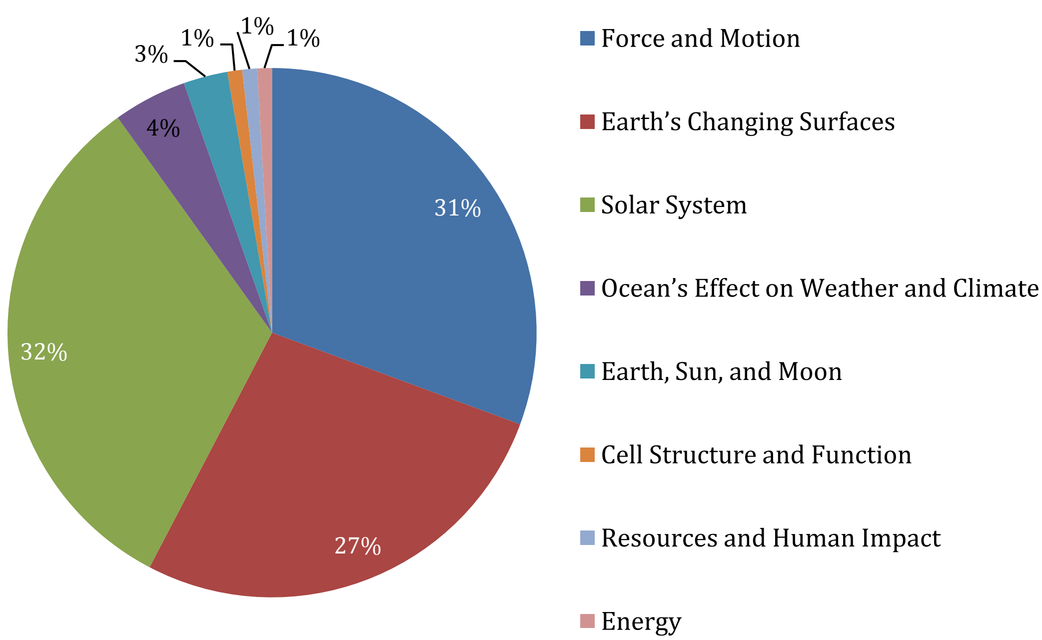

Figure 2. Percentage of times teachers accessed each SciPack.

On average, teachers accessed 2.17 (SD = 1.11) SciPacks, with a range of 1 to 5 SciPacks accessed per teacher. Figure 3 displays the number of SciPacks accessed by teachers. More than one third accessed only 1 SciPack, and 22-30% accessed 2 or 3 SciPacks. The 21 teachers who accessed more than 2 SciPacks had completed the 2 required study SciPacks.

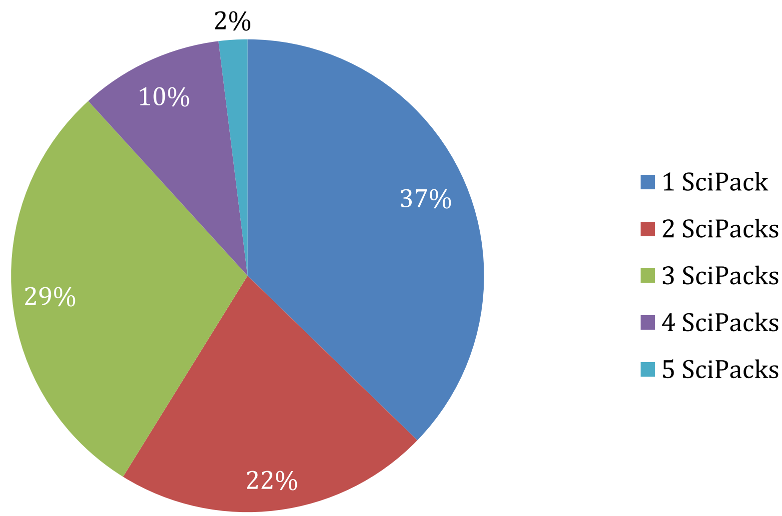

Figure 3. Number of SciPacks accessed by teachers.

Teachers logged into each SciPack an average of 11.2 times (*SD* = 8.24), with a range of 1 to 32 logins. One fourth of logins occurred during the month of January; other high frequency months included October (17.5%) and November (16.6%); these findings reverberate teachers' earlier comments that they completed the SciPacks in numerous sessions across time. Teachers accessed SciPacks an equal number of times (10%) the months of August, September, and December. Approximately 6% of teachers accessed the SciPacks during the month of July.

On average, teachers logged into the two required SciPacks almost equal number of times. One teacher logged into the Force and Motion SciPack a total of 137 times and two teachers logged into Earth's Changing Surface a total of 82 and 146 times; because these data were not representative of all teacher logins, they were considered outliers and excluded from the descriptive analyses presented in Table 7.

Table 7. Teacher SciPack Use

SciPack	*N* Teachers	Total Logins	Mean[a]	*SD*[a]	Minimum[a]	Maximum[a]
Force and Motion	34	626	14.82	8.20	1	32
Earth's Changing Surface	30	654	15.21	6.51	1	29
Solar System[b]	36	300	5.91	6.53	1	32
Ocean's Effect on Weather and Climate	5	35	7.00	8.69	1	22
Earth, Sun, and Moon	3	23	7.67	3.79	5	12
Cell Structure and Function	1	13	--	--	--	--
Resources and Human Impact	1	4	--	--	--	--
Energy	1	2	--	--	--	--

[a] Outliers were excluded from descriptive statistics.
[b] Solar System SciPack was used as an example/demonstration during the summer training session.

Teacher Survey

The teacher survey was administered to participants three times: the pre-survey (Survey #1) before any professional development had taken place, the first post-survey (Survey #2) after just one group of teachers (Group A; treatment group) had completed a SciPack, and the second post-survey (Survey #3) after both groups had completed the SciPacks. Responses to the three surveys were matched for each participant. See Appendix B for data summaries of the three surveys.

Teacher Practices Survey #1, which had the most respondents of the three surveys, was completed by 56 teachers. Seventy-three percent (73%) of the respondents were female. Thirty-eight percent (38%) had a bachelor's degree, 27% had a bachelor's plus 15 or 30 credits, and 35% had a master's degree or a master's plus 15 credits. Thirty-six percent (36%) had a degree in a science field such as biology or chemistry, and 20% had a degree in science education. Eighty percent (80%) of the respondents were regular classroom teachers, 19% were lab teachers, and 2% taught bilingual education. Respondents had taught school from 0 to 28 years (mean 6.2, standard deviation [*SD*] 7.00) and had taught their current subject from 0 to 17 years (mean 2.9, *SD* 4.05). Seventy percent (70%) were teachers of science only; about half (48%) taught fifth grade, while the rest were about evenly distributed across Grades 3, 4, 6, 7, and 8.

For the total analysis, paired-samples *t* tests or frequencies compared Survey #1 results to those of Survey #3 to determine whether all participants (i.e., those who answered both surveys) had changed over the course of the project in their feelings of preparedness to teach science topics, self-efficacy for teaching science, frequency of own use of instructional strategies, frequency of students' classroom practices, and frequency of own use of Web resources.

Feeling Prepared to Teach Science

Teachers were asked how well prepared they felt with regard to teaching two broad science topics: Earth's features and physical processes, and forces and motion. Table 8 shows that, for both topics, teachers significantly increased their feelings of being prepared to teach over time and felt "fairly well prepared" to teach both topics by the end of the project. Effect sizes (Cohen's *d*) suggest a movement of the group of more than half a standard deviation. The effect size can be interpreted as the degree to which the group's mean score moved in the desired direction over time. The effect size (Cohen's *d*) reported with each significant difference indicates the percentile change in the mean score from pre to second post-survey: $d < .25$ = change of less than 10 percentile points; $d = .25\text{-}.50$ = change of 10-20 percentile points; $d = .50\text{-}.80$ = change of 20-30 percentile points; $d > .80$ = change of more than 30 percentile points (Becker, 2000).

Table 8: Teachers' Survey #1 and #3 Feelings of Preparedness to Teach Science Topics

How well prepared do you feel to teach each of these topics?	*n*	Survey #1		Survey #3		Paired Comparisons			
		Mean	*SD*	Mean	*SD*	Diff.	*t*	*df*	*d*
Earth's features and physical processes	32	2.75	0.67	3.19	0.64	0.44	3.70**	31	0.67
Forces and motion	28	2.64	0.68	3.00	0.67	0.36	2.17*	27	0.53

Note. Response options: 1 = *not adequately prepared*; 2 = *somewhat prepared*; 3 = *fairly well prepared*; 4 = *very well prepared*.
$^*p < .05$. $^{**}p < .01$.

Self-Efficacy for Teaching Science

Teachers answered 16 items concerning their self-efficacy for teaching science. A total self-efficacy score was computed for those who responded to all items; negative items were reverse-coded in computing the total. As shown in Table 9, the teachers improved their self-efficacy over

the course of the project for 13 of the 16 items, with the greatest change occurring for "*I wish I had a better understanding of the science concepts I teach.*" Additionally, there was a significant difference in the total self-efficacy scores (range of 16-80) between administrations, $t(31) = 3.16$, $p < .05$, indicating that teachers had higher self-efficacy after participating in the project.

Table 9: Teachers' Survey #1 and #3 Self-Efficacy for Teaching Science

		Survey #1		Survey #3	
Self-Efficacy Items	***n***	**Mean**	***SD***	**Mean**	***SD***
When teaching science, I usually welcome student questions	34	4.76	0.50	4.62	0.78
I do not feel I have the necessary skills to teach science	35	1.77	1.09	1.54	0.89
I am typically able to answer students' science questions	35	3.94	0.91	4.29	0.89
Given a choice, I would not invite the principal to evaluate my science teaching	35	1.91	1.20	1.83	1.18
I feel comfortable improvising during science lab experiments	34	3.88	1.04	4.18	1.06
Even when I try very hard, I do not teach science as well as I teach most other subjects	35	1.74	1.15	1.66	0.84
After I have taught a science concept once, I feel confident teaching it again	34	4.44	0.61	4.47	0.79
I find science a difficult topic to teach	35	1.91	1.20	1.57	0.92
I know the steps necessary to teach science concepts effectively	35	3.80	0.93	4.09	0.74
I find it difficult to explain to students why science experiments work	35	2.26	1.09	1.89	0.96
I am continually finding better ways to teach science	35	4.69	0.53	4.51	0.78
I generally teach science ineffectively	35	1.57	0.82	1.74	1.04
I understand science concepts well enough to teach science effectively	35	4.17	1.07	4.40	0.74
I know how to make students interested in science	34	4.12	0.81	4.35	0.54
I feel anxious when teaching science content that I have not taught before	35	3.14	1.06	2.80	1.18
I wish I had a better understanding of the science concepts I teach	35	3.40	1.24	2.91	1.20
Total Self-Efficacy Score[a] (for respondents who answered all items)	32	63.47	10.25	66.63	7.67

Note. Response options: 1 = *strongly disagree*; 2 = *disagree*; 3 = *uncertain*; 4 = *agree*; 5 = *strongly agree*.
[a]Items in italics were reverse-coded when computing the total self-efficacy score; range of 16-80.

Science Instruction

Teachers were asked to indicate how frequently they used 14 strategies/practices as part of their science instruction. The changes in frequency from the pre-survey to the second post-survey were generally small; usage for 10 of the 14 practices increased slightly over the surveys. The largest change occurred for "*Demonstrate a science related principle or phenomenon,*" indicating that teachers were more likely to use this strategy at Survey #3 administration than at Survey #1 administration. Table 10 presents statistical details.

Table 10: Survey #1 and #3 Frequency of Teachers' Use of Instructional Practices/Strategies

About how often do you do the following as part of your science instruction?	*n*	Survey #1			Survey #3		
		Never/ Rarely	Sometimes	Often/All the Time	Never/ Rarely	Sometimes	Often/All the Time
Use assessments to find out what students know before or during a unit	31	16.1%	22.6%	61.3%	8.6%	28.6%	62.9%
Introduce content through formal presentations	31	12.9%	29.0%	58.1%	5.7%	31.4%	62.9%
Use science instructional materials	30	6.7%	6.7%	86.7%	2.9%	8.6%	88.6%
Demonstrate a science related principle or phenomenon	31	3.2%	19.4%	77.4%	2.9%	5.7%	91.4%
Teach science using real-world contexts	31	3.2%	6.5%	90.3%	2.9%	5.7%	91.4%
Help students see connections between science and other disciplines	31	--	19.4%	80.6%	2.9%	8.8%	88.2%
Use open-ended questions	31	9.7%	6.5%	83.9%	--	20.0%	80.0%
Facilitate student discussion	30	3.3%	16.7%	80.0%	2.9%	8.6%	88.6%
Encourage students to consider alternative explanations	31	--	22.6%	77. 4%	--	17.1%	82.9%
Encourage students to explain concepts to one another	31	3.2%	16.1%	80.6%	5.7%	20.0%	74.3%
Assign science homework	30	10.0%	16.7%	73.3%	21.2%	18.2%	60.6%
Embed assessments in regular class activities	31	12.9%	16.1%	71.0%	8.8%	29.4%	61.8%
Allow students to work at their own pace	31	12.9%	29.0%	58.1%	11.4%	25.7%	62.9%
Read and comment on the reflections students have written in notebooks or journals	29	10.3%	34.5%	55.2%	11.4%	28.6%	60.0%

Note. N/A responses were not included in these analyses.

Student Practices in the Science Classroom

Teachers also indicated how often they had students carry out certain practices in the classroom. Again, the changes in frequency from the pre-survey to the second post-survey were small; usage of 7 of the 12 practices increased slightly across the surveys. The largest change occurred for "*Design or implement their own investigations*"; teachers were more likely to use this strategy at post-survey (2nd) administration than at the time of pre-survey. See Table 11 for statistical details.

Table 11: Survey #1 and #3 Frequency of Student Practices

About how often do you have students do the following as part of your science instruction?	*n*	Survey #1			Survey #3		
		Never/ Rarely	Sometimes	Often/All the Time	Never/ Rarely	Sometimes	Often/All the Time
Participate in cooperative learning groups	31	3.2%	6.5%	90.3%	--	8.6%	91.4%
Engage in hands-on science activities	31	3.2%	6.5%	90.3%	--	8.6%	91.4%
Work on models or simulations	31	3.2%	22.6%	74.2%	2.9%	14.3%	82.9%
Design or implement their own investigations	31	29.0%	38.7%	32.3%	28.6%	20.0%	51.4%
Record, represent, and/or analyze data	31	3.2%	16.1%	80.6%	--	34.3%	65.7%
Supply evidence to support their claims	31	16.1%	22.6%	61.3%	5.7%	28.6%	65.7%
Write reflections in a notebook or journal	30	13.3%	23.3%	63.3%	2.9%	28.6%	68.6%
Prepare written science reports	30	43.3%	20.0%	36.7%	34.3%	22.9%	42.9%
Read science-related materials in class	31	6.5%	12.9%	80.6%	5.7%	22.9%	71.4%
Use mathematics as a tool in problem solving	30	6.7%	16.7%	76.7%	5.7%	22.9%	71.4%
Use calculators	29	44.8%	20.7%	34.5%	58.8%	23.5%	17.6%
Use computers	30	23.3%	23.3%	53.3%	26.5%	26.5%	47.1%

Note. N/A responses were not included in these analyses.

Teachers' Internet Use

On the pre-survey, 98% of respondents indicated that they had a computer at home, 89% had Internet access at home, and 84% had taken an online course; only 18% were maintaining a classroom-based webpage. The teachers also indicated their frequency of use of various Internet resources. As shown in Table 12, their responses did not change significantly from Survey #1 to Survey #3; however, the largest change was observed for "*Use the Internet for professional development (e.g., accessing research and best practices for teaching).*"

Table 12: Survey #1 and #3 Frequency of Teachers' Use of Web Resources

About how often do you . . .	*n*	Survey #1			Survey #3		
		Never/ Rarely	Some-times	Often/All the Time	Never/ Rarely	Some-times	Often/All the Time
Visit the school's website	32	18.8%	28.1%	53.1%	25.7%	22.9%	51.4%
Use the Internet for personal use	33	15.2%	9.1%	75.8%	14.3%	8.6%	77.1%
Use the Internet for professional development (e.g., accessing research and best practices for teaching)	33	6.1%	15.2%	78.8%	--	11.4%	88.6%
Use the Internet for researching scientific content before a lesson	33	6.1%	3.0%	90.9%	2.9%	8.6%	88.6%

About how often do you . . .	*n*	Survey #1			Survey #3		
		Never/ Rarely	Some-times	Often/All the Time	Never/ Rarely	Some-times	Often/All the Time
Use the Internet for developing lesson plans/ideas	33	6.1%	9.1%	84.8%	5.7%	11.4%	82.9%
Use the Internet for creating instructional materials	33	12.1%	9.1%	78.8%	8.8%	14.7%	76.5%
Use the Internet to communicate with others	33	6.1%	6.1%	87.9%	2.9%	8.6%	88.6%
Use social networking websites or online professional discussion groups for discussing science–based content	35	24.2%	18.2%	57.6%	22.9%	20.0%	57.1%

Note. N/A responses were not included in these analyses.

Teachers were asked to list three websites that they visited most frequently to improve their own science content knowledge or instructional practice. On Survey #1, 23% of the 56 respondents did not list any websites. The most popular sites were BrainPOP, Discovery Education, and Google (each listed by 21-23% of respondents). On Survey #3, only 6% of the 35 respondents did not list any websites, and the most popular sites were NSTA and Bio Ed Online K8 Science, each listed by 40-46% of respondents.

Experimental Analyses

Intent-to-treat analyses. Between the administrations of Survey #1 and Survey #2, one group (A) of teachers completed a SciPack, while the other group (B) of teachers served as a control group. A 2 x 2 mixed-design ANOVA was calculated to examine the effects on survey responses of group (treatment and control—between subjects), time (Survey #1 and Survey #2—within-subjects or repeated measures), and the interaction of group and time. This calculation was carried out for three items/scores: preparedness to teach Earth's features and physical processes, preparedness to teach forces and motion, and self-efficacy for teaching science.

For each of the three items, the treatment group had higher scores than the control group at both administrations of the survey, but there was no significant difference between the treatment group's change from Survey #1 to Survey #2 and the control group's change. Though not statistically significant, all differences in gains between groups were in the predicted direction, with treatment group higher than control group. The low number of control respondents on Survey #2 may have contributed to the lack of statistically significant differences, given the very large score differentials that would have been required to approach a statistically significant difference. See Table 13 for details.

Table 13: Mean Survey Scores for Treatment and Control Groups on Three Items

Item	Group	*n*	Time	Mean	*SD*	Change from Survey #1 to #2
Prepared to teach: Earth's features & physical processes	Treatment	17	Survey #1	2.88	0.49	0.12
			Survey #2	3.00	0.79	
	Control	6	Survey #1	2.00	0.63	0.00
			Survey #2	2.00	0.63	
Prepared to teach: Forces and motion	Treatment	15	Survey #1	2.73	0.59	0.34
			Survey #2	3.07	0.80	
	Control	6	Survey #1	2.17	0.75	0.16
			Survey #2	2.33	0.82	
Self-efficacy for teaching science: Total score	Treatment	16	Survey #1	64.75	7.22	3.06
			Survey #2	67.81	5.71	
	Control	7	Survey #1	54.57	14.50	4.00
			Survey #2	58.57	8.72	

Note. Response options for "Prepared" items: 1 = *not adequately prepared*; 2 = *somewhat prepared*; 3 = *fairly well prepared*; 4 = *very well prepared*.

Treatment-on-treated analyses. Between the administrations of Survey #1 and Survey #3, teachers were asked to complete at least two pre-specified SciPacks; however, not all teachers did. A 2 x 2 mixed-design ANOVA was calculated to examine the effects on survey responses of number of SciPacks completed (those who completed 0-1[1] SciPacks and those who completed 2 or more SciPacks—between subjects), time (Survey #1 and Survey #3—within-subjects or repeated measures), and the interaction of group and time. This calculation was carried out for three items: preparedness to teach Earth's features and physical processes, preparedness to teach forces and motion, and total score for self-efficacy for teaching science.

Teachers who completed two or more SciPacks reported *significantly* higher pre- to post-survey gains regarding their preparedness to teach Earth's features and physical processes than teachers who completed one or fewer SciPacks, t (30) = -2.257, $p < .05$. Although teachers who completed two or more SciPacks showed larger pre- to post-survey changes regarding their preparedness to teach forces and motion and their self-efficacy for teaching science than teachers who completed one or fewer SciPacks, no significant differences were found. See Table 14 for details.

[1] Due to small sample sizes, data were categorized into two groups: teachers who completed *less than* two SciPacks, and those who completed *at least* two SciPacks.

[2] Teachers who pass the SciPack final assessment with a score of 70% or higher are not able to take the assessment again.

Table 14: Mean Survey Scores for Treatment Groups (0-1 SciPacks vs. 2+ SciPacks) on Three Items

Item	Group	*n*	Time	Mean	*SD*	Change from Survey #1 to #3
Prepared to teach: Earth's features & physical processes	0-1 SciPacks	11	Survey #1	2.91	0.539	0.09
			Survey #3	3.00	0.730	
	2+ SciPacks	21	Survey #1	2.67	0.632	0.62
			Survey #3	3.29	0.644	
Prepared to teach: Forces and motion	0-1 SciPacks	8	Survey #1	3.13	0.354	0.12
			Survey #3	3.25	0.707	
	2+ SciPacks	20	Survey #1	2.45	0.686	0.45
			Survey #3	2.90	0.641	
Self-Efficacy for teaching science: Total score	0-1 SciPacks	13	Survey #1	68.69	5.692	-0.46
			Survey #3	68.23	8.738	
	2+ SciPacks	22	Survey #1	60.82	10.755	5.18
			Survey #3	66.00	6.683	

Note. Response options for "Prepared" items: 1 = *not adequately prepared*; 2 = *somewhat prepared*; 3 = *fairly well prepared*; 4 = *very well prepared*.

Teacher Reactions to the Resources

The teachers were asked how the NSTA Force and Motion SciPack affected their content knowledge in force and motion; 34 responded to this question. Among the 26 respondents who indicated that they had accessed this SciPack, 81% made positive comments. Eight percent (8%) made neutral comments ("review" or "refresher" of content knowledge), and 12% replied negatively ("did not affect my content knowledge" or "affected it very little"). Among the positive responses were comments that the SciPack *"clarified some of the terms and concepts that I misunderstood before"; "gave me much more confidence to teach forces and motion in my class . . . especially Newton's Third Law of Motion"; "helped me understand how these concepts physically show up in our environment"; and "enabled me to answer many of the tough questions that students want answers to."*

Next, the teachers were asked how the NSTA Earth's Changing Surface SciPack affected their content knowledge in earth science; 34 responded to this question. Among the 24 respondents who indicated that they had accessed this SciPack, 83% made positive comments. Thirteen percent (13%) made neutral comments (already "familiar with most of the content" or "refresher"), and 4% responded negatively *("It confused some beliefs I had about weathering, erosion, and deposition")*. Among the positive responses were comments that this SciPack *"played a huge role in my understanding the recent earthquake in Haiti"; "gave me more creative ideas to introduce the material to my students"; "helped me to understand and explain the process of convection"; "gave me basic knowledge that I did not have"; and "[revealed] a few flaws in my thinking."*

The teachers were then asked how they plan to incorporate what they learned from the SciPacks in their classroom instruction; 33 responded to this question. Among the 28 respondents who had accessed at least one SciPack, 93% intended to incorporate their learning in their instruction, and 7% saw the experience as primarily for their own knowledge or were unsure. Most of the positive comments were general statements that the teachers would use their learning in

future instruction; specific intentions included lesson planning; providing a basis for student discussion; giving students the opportunity to explore NSTA resources; and incorporating illustrations, demonstrations, and simulations.

Teacher Assessments

Two types of assessments were selected to serve as outcome measures for teacher content knowledge: the embedded final assessment for each SciPack and the e-learning platform's pre- and post-assessments. Findings from these assessments are presented below.

SciPack Final Assessments

After completing each SciPack, teachers completed the SciPack's embedded final assessment. Twenty-four teachers (Group A = 14; Group B = 10) completed the Earth's Changing Surface final assessment and 26 (Group A = 19; Group B = 7) completed the Force and Motion final assessment. For teachers who took the final assessment more than once, their highest score was selected for analysis[2]. Between the two assessments, teachers received an overall higher score (approximately 8 percentile points) on the Earth's Changing Surface assessment. The average percentage score for Earth's Changing Surface was 78.87, and ranged from 62.20 to 92.40. For Force and Motion final assessment, participants' average score was 70.73, ranging from 26.70 to 87.80. Although no significant differences existed between groups, Group A scored slightly higher on Earth's Changing Surface final assessment than Group B, and Group B scored slightly higher than Group A on Force and Motion final assessment. Interestingly, each group scored higher on the second SciPack they were assigned, suggestive of a practice effect. Table 15 displays descriptive statistics for each group.

Table 15. SciPack Final Assessment Descriptive Statistics

Group	*N*	Mean	*SD*	Minimum	Maximum
			Earth's Changing Surface		
A	14	81.23	8.38	62.20	92.40
B	10	75.57	6.08	63.30	85.20
Total	*24*	*78.87*	*7.89*	*62.20*	*92.40*
			Force and Motion		
A	19	68.84	22.03	26.70	87.80
B	7	75.87	3.33	70.00	80.00
Total	*26*	*70.73*	*19.03*	*26.70*	*87.80*

Teacher Pre/Post Assessment

Assessments measuring teachers' knowledge of Earth Science and Force and Motion were administered at the beginning of the study and after completion of each SciPack. The pre-assessment contained both earth science and force and motion items; post-assessment items were split between the two content areas, but contained the same items as the pre-assessment. Twenty-

[2] Teachers who pass the SciPack final assessment with a score of 70% or higher are not able to take the assessment again. If NSTA staff provided opportunities to re-take the assessment, teachers' highest score after the threshold of 70% was recorded.

four teachers completed both assessments for Earth's Changing Surface; 26 completed both assessments for Force and Motion. Findings are discussed below by SciPack.

Earth's Changing Surface. Group B served as the treatment group for Earth's Changing Surface SciPack and Group A served as the control. Gain scores were calculated by comparing the difference between post-assessment and pre-assessment scores for teachers who completed both assessments. Though not significant, treatment group teachers achieved higher gain scores, on average, than control group teachers. Treatment teachers scored approximately 16 percentile points (Mean = 16.60; *SD* = 14.36) higher on the post-assessment than the pre-assessment, compared to control teachers who scored 8 points higher (Mean = 8.07; *SD* = 12.16). Table 16 presents descriptive statistics for each group's assessment scores and their gain scores from pre- to post-assessment. Figure 4 displays the average pre- and post-assessment scores for each group and total participants.

Table 16. Earth's Changing Surface Teacher Assessment Scores

Group	*n*	Pre-Assessment		Post-Assessment		Gain Scores	
		Mean	*SD*	Mean	*SD*	Mean	*SD*
Treatment	10	54.30	17.72	70.90	17.48	16.60	14.36
Control	14	59.14	19.00	67.21	20.03	8.07	12.16
Total	*24*	*57.12*	*18.24*	*68.75*	*18.70*	*11.62*	*13.51*

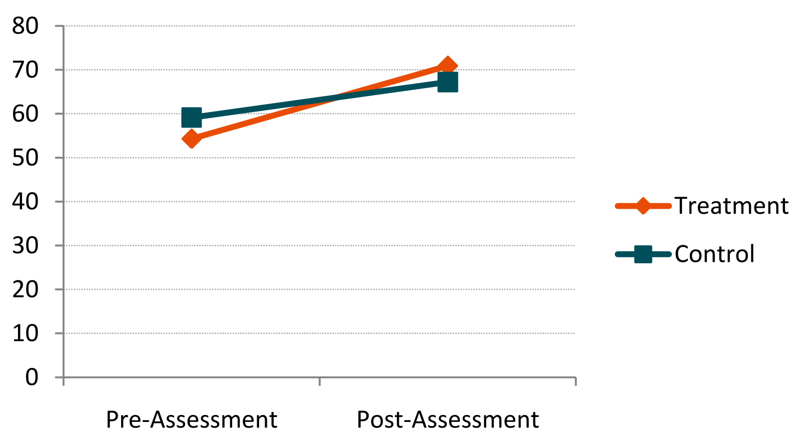

Figure 4. Teachers' knowledge of earth science concepts relevant to the Earth's Changing Surface SciPack.

As shown in Table 17, a repeated measures ANOVA was conducted to explore the effects of group and time on assessment scores, while also testing for interactions. A significant difference was found between pre- and post-assessment scores for earth science, $F(1, 24) = 20.680$, $p < .01$, partial $\eta^2 = 0.485$. For the 24 teachers with data at both time points, assessment scores significantly increased over time by nearly 12 percentile points (Mean = 11.62; SD = 13.51). This finding indicates that participants did, indeed, increase their knowledge of earth science over the course of the SciPack study. The results indicated no significant interactions between time and group.

Table 17. Earth's Changing Surface Teacher Assessment Repeated Measures Analysis of Variance

	df	SS	MS	F	Partial η^2
Time	1	1775.315	1775.315	20.680**	0.485
Time X Group	1	212.148	212.148	2.471	.101
Error	22	1888.664	85.848		

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

Force and Motion. Group A served as the treatment group for Force and Motion SciPack and Group B served as the control. Though not significant, treatment teachers achieved higher gain scores, on average, than control teachers. For the group of teachers with data at both time points, teachers in Group A scored approximately 16 percentile points (Mean gain = 16.50; *SD* = 20.63) higher on the post-assessment than the pre-assessment, compared to Group B teachers who scored 5 points higher (Mean gain = 5.40; *SD* = 25.63). Table 18 presents descriptive statistics for each group's assessment scores. Figure 5 displays the average pre- and post-assessment scores for each group and total participants.

Table 18. Force and Motion Teacher Assessment Scores

Group		Pre-Assessment		Post-Assessment		Gain Scores	
	n	Mean	*SD*	Mean	*SD*	Mean	*SD*
Treatment	16	48.00	17.451	64.50	17.297	16.50	20.63
Control	10	56.20	15.901	61.60	18.246	5.40	25.63
Total	*26*	*51.15*	*17.038*	*63.38*	*17.362*	*12.23*	*22.64*

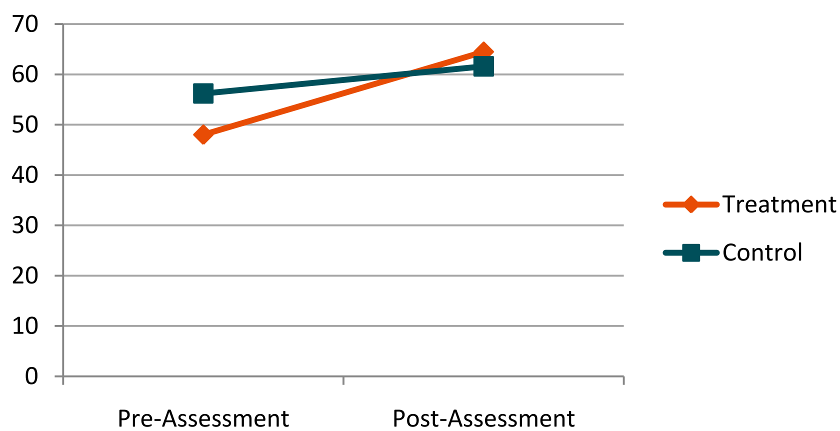

Figure 5. Teachers' knowledge of force and motion concepts relevant to the Force and Motion SciPack.

When teachers' scores were examined as a whole, a significant difference was found between pre- and post-assessment scores for Force and Motion, as shown in Table 19. For the 26 teachers with data at both time points, a repeated measures ANOVA revealed that assessment scores significantly increased over time, ($F(1, 26) = 5.877$, $p < .05$, partial $\eta^2 = 0.197$), by approximately 12 percentile points (Mean = 12.23; SD = 22.64). This finding indicates that

participants increased their knowledge of Force and Motion over the course of the SciPack study timeline. No significant interactions between time and group were found.

Table 19. Force and Motion Teacher Assessment Repeated Measures Analysis of Variance

	df	SS	MS	F	Partial η^2
Time	1	1475.723	1475.723	5.877*	0.197
Time X Group	1	379.108	379.108	1.510	0.059
Error	24	6026.200	251.092		

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

Student Assessments

Students of participating teachers completed pre- and post-assessments to measure their knowledge of earth science and force and motion; 5th grade students were required to complete only the earth science pre- and post-assessments. See Table 5 in the Methods section for response rates of student assessment. Pre-assessments were collected on all grade levels; force and motion post-assessment data were collected for 6th and 8th grades. Therefore, earth science knowledge was examined of 5th grade students only, and Force and Motion knowledge was measured of 6th and 8th grade students.

Student Earth Science Knowledge

On average, 5th grade students scored approximately 50% (Mean = 49.79; *SD* = 18.05) on the pre-assessment and 63% (63.29; *SD* = 18.36) on the post-assessment. Students of treatment teachers scored nearly 17 percentile points (Mean = 16.83; SD = 15.74) higher on the post-assessment than the pre-assessment, compared to students of control teachers who scored nearly 12 percentile points higher (Mean = 11.92; SD = 16.17). Table 20 presents descriptive statistics for each group's assessment scores. When treatment and control groups were compared, they each significantly improved scores between assessments. Further, treatment and control groups were significantly different; the treatment group, which started out with lower knowledge scores than the control group students, made greater gains in earth science content knowledge ($t[210] = 2.080$, $p < .05$, $d = 0.31$).

Table 20. Student Earth Science Knowledge

Group		Pre-Assessment		Post-Assessment		Gain Scores	
	n	**Mean**	***SD***	**Mean**	***SD***	**Mean**	***SD***
Treatment	68	45.51	15.33	62.33	16.87	16.83	15.74
Control	144	51.81	18.92	63.73	19.06	11.92	16.17
Total	*212*	*49.79*	*18.05*	*63.29*	*18.36*	*13.50*	*16.16*

*$p < .01$

Figure 6 depicts 5th grade students' scores from pre-assessment to post-assessment. As shown, the students assigned to control group teachers scored higher than the students of treatment teachers at both administrations; however, the treatment group achieved higher gain scores between assessments than the control group. Post-assessment scores ranged within 1.4 percentile points for both groups and total participants.

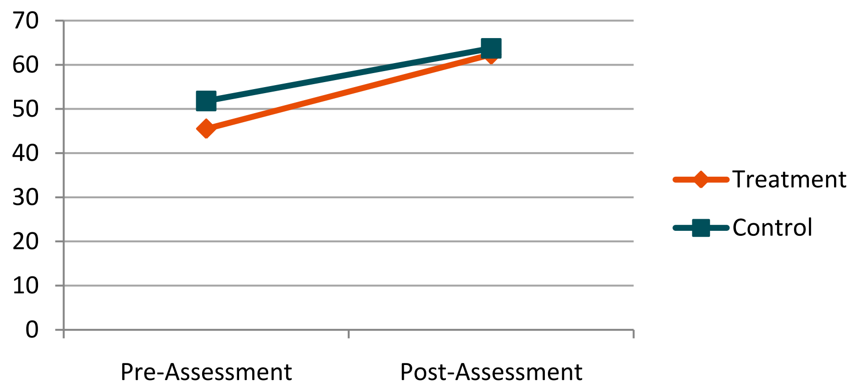

Figure 6. Students' knowledge scores on assessments of earth science.

When treatment and control groups were compared using a repeated measures ANOVA, they each significantly improved scores between assessments, $F(1, 212) = 148.460$, $p < .01$, partial $\eta^2 = 0.414$. Table 21 displays scores for each group. Further, a significant interaction between time and group was found, $F(1, 212) = 4.328$, $p < .05$, partial $\eta^2 = 0.020$. Specifically, the students of treatment group teachers, which started out with lower knowledge scores than the students of control group teachers, made greater gains in earth science content knowledge.

Table 21. Earth Science Student Assessment Repeated Measures Analysis of Variance

	df	SS	MS	F	Partial η^2
Time	1	19090.723	19090.723	148.460**	0.414
Time X Group	1	556.482	556.482	4.328*	0.020
Error	210	27004.301	128.592		

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

Student Force and Motion Knowledge

Sixth and eighth grade students' knowledge of force and motion was examined over time for all students and by their teachers' experimental group assignment. Post-assessments for seventh grade students were not returned and thus, not included in analyses. On average, 6th grade students scored approximately 39% (Mean = 38.94; *SD* = 18.96) on the pre-assessment and 48% (Mean = 48.33; *SD* = 12.29) on the post-assessment. Force and motion knowledge changed significantly for the 44 students who completed both assessments ($t[43] = 3.402$, $p < .01$, $d = 0.59$). These students scored significantly higher on the post-assessment (Mean = 48.33, *SD* = 12.29) than the pre-assessment (Mean = 38.94, *SD* = 18.96).

On average, 8th grade students scored approximately 33% (Mean = 33.33; *SD* = 9.18) on the pre-assessment and 36% (Mean = 36.07; *SD* = 12.11) on the post-assessment. Pre- and post-assessment scores were not significantly different for the 39 students with data at both time points. Table 22 presents descriptive statistics for each group's assessment scores.

Table 22. Student Force and Motion Knowledge

Grade	Group		Pre-Assessment		Post-Assessment		Gain Scores	
		n	Mean	*SD*	Mean	*SD*	Mean	*SD*
6	Treatment	25	30.13	18.96	42.93	10.01	12.80	21.42
	Control	19	50.52	11.40	55.44	11.56	4.91	12.34
	Total	44	38.94	18.96	48.33	12.29	9.39	18.32
8	Treatment	16	35.00	7.50	40.83	11.89	5.83	17.19
	Control	23	32.17	10.18	32.75	11.35	0.58	13.62
	Total	39	33.33	9.18	36.07	12.11	2.74	15.20
6 & 8	Treatment	41	32.03	15.58	42.11	10.69	10.08	19.95
	Control	42	40.47	14.07	43.01	16.07	2.54	13.08
	Total	83	36.31	15.35	42.57	13.61	6.27	17.15

Figure 7 depicts the change of each group's scores from pre-assessment to post-assessment for Grades 6 and 8. Although the control group scored higher than the treatment group at both administrations, the treatment group achieved higher gain scores than the control group. Post-assessment scores ranged within 1 percentile point for both experimental groups and total participants.

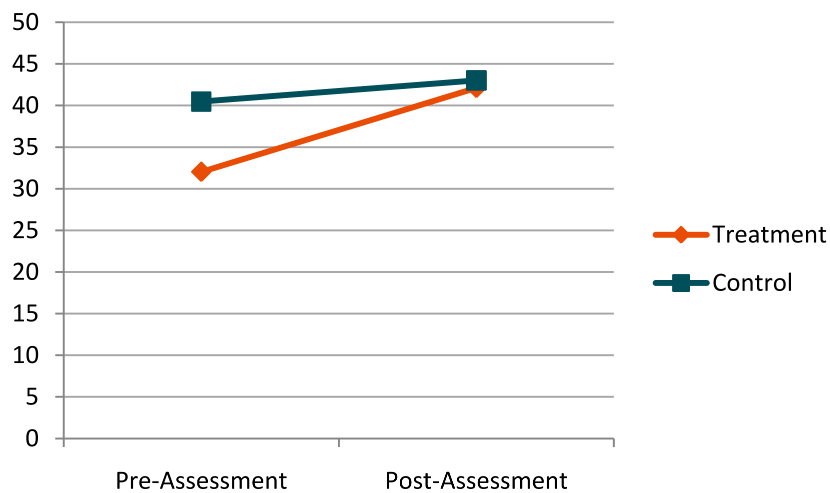

Figure 7. Students' knowledge scores on assessments of force and motion

Scores of Grades 6 and 8 were combined, thereby increasing the sample size. As shown in Table 23, a repeated measures ANOVA suggests a significant difference between pre- and post-assessment scores for force and motion, $F(1, 83) = 11.669$, $p < .01$, partial $\eta^2 = 0.126$. Further, a significant interaction between time and group was found, $F(1, 83) = 4.167$, $p < .05$, partial $\eta^2 = 0.049$. As was shown with the earth science data, the students of treatment group teachers, which started out with lower knowledge scores than the students of control group teachers, made greater gains in force and motion content knowledge, even though they still scored lower than the control group students on the post-assessment.

Table 23. Force and Motion Student Assessment Repeated Measures Analysis of Variance

	df	SS	MS	F	Partial η^2
Time	1	1652.386	1652.386	11.669**	0.126
Time X Group	1	590.003	590.003	4.167*	0.049
Error	81	11469.970	141.605		

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

DISCUSSION

The following discussion is organized by research question; findings from methods supporting each question were triangulated to determine the overall impact of the SciPacks on study participants.

SciPack Completion

Over the course of the study, 13 and 15 of the total teacher participants completed Earth's Changing Surface and Force and Motion SciPacks, respectively. Completion rates were higher for SLLC teachers compared to Abrazo teachers. However, the majority of teachers (91%) accessed at least one SciPack over the course of the study. Early on in the study, 4 teachers withdrew and chose not to participate in the SciPacks; these teachers had not accessed any SciPacks at the time of withdrawal. No other teachers elected to end their participation throughout the remainder of the study.

To determine teacher use of NSTA resources, evaluators examined Web use statistics, Teacher Survey data, and teacher focus group data. Teacher use of the SciPacks and other NSTA resources was moderate over the course of the study. As evidenced by history reports of SciPack logins, 62% of participants accessed at least 2 SciPacks over the course of the study; 7 teachers who accessed 2 SciPacks selected only one of the required SciPacks; teachers accessing at least 3 SciPacks had accessed both required study SciPacks. Most logins to the SciPack site occurred during October, November, and January, which aligned with the SciPack schedule of times that teachers were expected to complete each SciPack. Low frequency of logins at the beginning of the year may be attributed to one study group's lack of access to the study SciPacks, or may suggest that teachers did not possess time to focus on the SciPacks, particularly new teachers. Teacher survey results indicated that the NSTA website was one of the sites frequently visited by teachers. Aside from their use of SciPacks, teacher use of the Internet or other Web resources did not change significantly across time.

Science Teaching Efficacy

Teachers' self-efficacy toward teaching science was examined through data from teacher surveys. Survey results indicate that teachers increased their self-efficacy for teaching science over the course of the study, which is a very positive finding given the short time frame of the study. Further, teachers who completed at least two SciPacks significantly increased their preparedness to teach earth science over the course of the study; teachers also increased their preparedness to teach force and motion, though not significantly.

Teacher Content Knowledge

Teachers' content knowledge of earth science and force and motion was examined by embedded SciPack final assessments, and pre- and post-assessments. Assessment scores indicated that teachers significantly increased their content knowledge in both content areas. In fact, teachers improved their scores over time almost equally for both earth science and force and motion. Pre-assessment scores indicate that teachers scored about half (51-57%) of items correct for each content area; post-assessment scores increased by about 12 points to 63-68%, indicating a moderate increase, though still room for improvement. Although interactions between time and group were not significant, the trend was positive with treatment teachers achieving higher gain scores than control teachers in both content areas. The teacher survey supported this finding as teachers reported that the SciPacks enhanced their knowledge of the content.

Instructional Practice

Effects of the SciPacks on teaching practice were assessed via teacher surveys. Teacher reports of their science instructional strategies and student practices in the classroom generally did not change over the course of the study. Reports of little to no change in teaching practices as a result of the SciPacks may have been influenced by the study timeline.

Student Content Knowledge

Student knowledge in earth science and force and motion was assessed through pre and posttests. Assessment results indicate that students of participating teachers did, indeed, improve their performance in earth science or force and motion. Students in fifth-grade classrooms of treatment teachers significantly increased their knowledge of earth science over the period of the study. Although students of control teachers also increased their knowledge over time, treatment students gained significantly more knowledge than control students, suggesting that the SciPacks had a positive impact on student performance in earth science. Student performance in force and motion showed positive changes as well. Sixth-grade students in treatment groups significantly increased their knowledge over time, unlike control students. And sixth- and eighth-grade treatment student gain scores were significantly greater than control student gain scores, again suggesting that teacher SciPack completion had a positive influence on their students' knowledge of force and motion.

AREAS FOR FUTURE RESEARCH

Although the findings are conclusive for the participating school district, the following recommendations are provided as suggestions for future research studies conducted on SciPacks or other NSTA resources.

- The research should be replicated in multiple school districts and in a broader set of instructional contexts (e.g., student demographics, social environment, geographic diversity) to achieve even wider generalizability.
- Teachers in this study were recruited out of availability. This may have influenced their motivation and willingness to complete SciPack modules. Future studies should include various types of recruitment strategies; for instance, the next study might include recruiting teachers who volunteer and then randomly assigning them to treatment and control conditions.
- Futures studies should include from the initial design incentives for all data collection activities to increase completion rates. Low rates affect external validity and may mask effects that are truly there.
- The study should be replicated with a larger sample size so even if there is attenuation over time, researchers will have a sample that is needed to enable statistical judgments that are accurate and reliable.
- In order to see the impact of SciPacks on teachers' instructional strategies, future studies could incorporate a sufficient time frame (e.g., a school year) to examine potential changes in instructional practice. Researchers would have an opportunity triangulate data collected from surveys, lesson plans, instructional logs, and/or classroom observations to increase credibility and validity of the results.
- The current study explored the use of two specific SciPack modules at the elementary and middle school levels. The study could be replicated using other SciPacks that are relevant for those grades (e.g., Solar System, Ocean's Effect on Weather and Climate, or Earth, Sun, and Moon) to determine the efficacy of these modules.

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Appendices

Appendix A:

SciPacks and Assessment Completion Data

SciPacks and Assessments Completion Data

Group A HISD teachers:

Total number of teachers: 28 teachers

3 teachers opt-out of the program after it started

Completed SciPack Force and Motion pre-assessment test: 28 teachers

Completed SciPack Force and Motion: 19 teachers

Completed SciPack Force and Motion post-assessment test: 16 teachers

Completed SciPack Earth’s Changing Surface pre-assessment test: 28 teachers

Completed SciPack Earth’s Changing Surface: 15 teachers

Completed SciPack Earth’s Changing Surface post-assessment: 14 teachers

Group B HISD teachers:

Total number of teachers: 28 teachers

1 teacher opt-out of the program after it started

Completed SciPack Earth’s Changing Surface pre-assessment test: 28 teachers

Completed SciPack Earth’s Changing Surface: 10 teachers

Completed SciPack Earth’s Changing Surface post-assessment test: 8 teachers

Completed SciPack Force and Motion pre-assessment test: 28 teachers

Completed SciPack Force and Motion: 6 teachers

Completed SciPack Force and Motion post-assessment test: 4 teachers

Appendix B:

Teacher Survey Summaries

Houston SciPack Study Teacher Survey: Pre

Number of Respondents: 56

Descriptive Information

1. What is your role in the school? (Select only one.)

80% Regular Classroom Teacher
0% Special Education Teacher
19% Lab Teacher
2% Other Bilingual Education

2. Which category best describes the degree and credits you have now? (Select only one.)

38% Bachelor's
16% Bachelor's + 15
11% Bachelor's + 30 or more
26% Master's
9% Master's + 15
0% Master's + 30 or more
0% Education Specialist
0% Doctorate
2% Other: ESL Certification

3. Gender (Select one.)

73% Female
27% Male

4. Do you have a degree in a science field or science education?

36% Science field (e.g., biology, physics)
20% Science education
48% Neither

5. Counting this year, how many years have you taught in any school?

Range	Mean	Std. Dev.
0-28	6.2 Years	7.00

6. Counting this year, how many years have you taught your current subject(s)?

Range	Mean	Std. Dev.
0-17	2.9 Years	4.05

7. Please select each subject you currently teach. Choose all that apply:

9% Not Applicable (I have not yet taught)
16% I teach all subjects
70% Science only
7% Other: Elementary, Math & Science, Science & Social Studies

8. **(A)** Please select each grade you currently teach. **(B)** Indicate the grade(s) you are certified to teach. Choose all that apply.

(A) Grade(s) I Currently teach		(B) I am certified to teach
16%	3	43%
21%	4	82%
48%	5	71%
16%	6	73%
20%	7	70%
25%	8	70%

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Confidence in Science Teaching

	Not Adequately Prepared (1)	Somewhat Prepared (2)	Fairly Well Prepared (3)	Very Well Prepared (4)	Mean	Std. Dev.
9. How well prepared do you feel to teach each of the following topics?						
a. Earth's features and physical process	6%	33%	52%	10%	2.70	0.74
b. Forces and motion	6%	30%	60%	4%	2.60	0.67

Self-Efficacy

10.	Strongly Disagree (1)	Disagree (2)	Uncertain (3)	Agree (4)	Strongly Agree (5)
When teaching science, I usually welcome student questions	0%	0%	5%	20%	75%
I do not feel I have the necessary skills to teach science	44%	35%	11%	7%	4%
I am typically able to answer students' science questions	2%	6%	13%	60%	20%
Given a choice, I would not invite the principal to evaluate my science teaching	43%	36%	5%	13%	4%
I feel comfortable improvising during science lab experiments	4%	6%	22%	42%	27%
Even when I am try very hard, I do not teach science as well as I teach most other subjects	46%	39%	7%	4%	4%
After I have taught a science concept once, I feel confident teaching it again	0%	0%	11%	44%	46%
I find science a difficult topic to teach	41%	41%	9%	4%	5%
I know the steps necessary to teach science concepts effectively	2%	5%	25%	50%	18%
I find it difficult to explain to students why science experiments work	21%	50%	14%	13%	2%
I am continually finding better ways to teach science	0%	0%	7%	27%	66%
I generally teach science ineffectively	45%	39%	11%	4%	2%
I understand science concepts well enough to teach science effectively	2%	5%	11%	46%	36%
I know how to make students interested in science	2%	2%	15%	56%	26%
I feel anxious when teaching science content that I have not taught before	9%	21%	25%	41%	4%
I wish I had a better understanding of the science concepts I teach	7%	21%	18%	39%	14%

	Range	Mean	Std. Dev.
Self Efficacy Score (for respondents who answered all items; possible score 16-80)	33-80	63.2	9.56

PLEASE CONTINUE

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Instructional Practices

11. ABOUT HOW OFTEN DO YOU DO EACH OF THE FOLLOWING AS A PART OF YOUR SCIENCE INSTRUCTION?	N/A Haven't taught	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
a. Use assessments to find out what students know before or during a unit	18%	0%	14%	21%	23%	23%
b. Introduce content through formal presentations	18%	2%	7%	25%	34%	14%
c. Use science instructional materials	19%	2%	4%	7%	37%	32%
d. Demonstrate a science related principle or phenomenon	18%	0%	4%	20%	32%	27%
e. Teach science using real-world contexts	18%	0%	2%	9%	34%	38%
f. Help students see connections between science and other disciplines	18%	0%	0%	21%	29%	32%
g. Use open-ended questions	18%	0%	5%	11%	25%	41%
h. Facilitate student discussion	18%	0%	2%	13%	29%	38%
i. Encourage students to consider alternative explanations	18%	0%	0%	21%	30%	30%
j. Encourage students to explain concepts to one another	18%	0%	4%	14%	32%	32%
k. Assign science homework	20%	4%	13%	9%	38%	18%
l. Embed assessments in regular class activities	18%	4%	7%	18%	29%	25%
m. Allow students to work at their own pace	18%	0%	11%	27%	30%	14%
n. Read and comment on the reflections students have written in notebooks or journals	23%	4%	9%	25%	21%	18%

12. About how often do **you have students do** each of the following as a part of your science instruction?	N/A Haven't taught	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
a. Participate in cooperative learning groups	18%	0%	4%	9%	27%	43%
b. Engage in hands-on science activities	18%	0%	4%	7%	41%	30%
c. Work on models and assimilations	17%	0%	4%	22%	37%	20%
D. DESIGN OR IMPLEMENT THEIR OWN INVESTIGATIONS	18%	2%	21%	32%	16%	11%
E. Record, represent, and/or analyze data	18%	0%	5%	11%	34%	32%
f. Supply evidence to support their claims	18%	2%	9%	16%	25%	30%
g. Write reflections in a notebook or journal	21%	4%	7%	20%	27%	21%
h. Prepare written science reports	20%	9%	21%	23%	14%	13%
i. Read science-related materials in class	18%	2%	9%	13%	36%	23%
j. Use mathematics as a tool in problem solving	18%	0%	4%	15%	36%	27%
k. Use calculators	21%	11%	16%	25%	16%	11%
L. USE COMPUTERS	18%	2%	16%	20%	27%	16%

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Web Resources

13.	About how often do **you**:	N/A	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
a.	Visit the school's Web site	9%	4%	14%	20%	21%	32%
b.	Use the Internet for personal use	7%	5%	5%	9%	23%	50%
c.	Use the Internet for professional development (e.g., accessing research and best practices for teaching)	7%	2%	4%	14%	34%	39%
d.	Use the Internet for researching scientific content before a lesson	9%	2%	4%	4%	29%	54%
e.	Use the Internet for developing lesson plans/ideas	9%	2%	4%	9%	25%	52%
f.	Use the Internet for creating instructional materials	9%	2%	6%	7%	26%	51%
g.	Use the Internet to communicate with others	7%	4%	2%	7%	23%	57%
h.	Use social networking Web sites or online professional discussion groups for discussing science–based content	7%	18%	9%	13%	21%	32%

		Yes	No
14.	Do you maintain your own classroom-based Web page?	18%	82%
15.	Do you have a computer at home?	98%	2%
16.	Do you have Internet access at home?	89%	11%
17.	Have you ever taken a course that was conducted either completely or partially online?	84%	16%

18. What are the 3 websites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit websites for these purposes, please write N/A)

Websites listed & number of respondents

N/A or blank	13	Discovery	7	Houston ISD	4	enchantedlearning	2
brainpop	13	NSTA	6	Ask.com	3	science spot	2
unitedstreaming	13	Wikipedia	4	edhelper	2	science daily	2
Google	12	National Geographic	4	K8science	2	tfanet	2

Listed once: lesson planet, bbcschools, school board, learner.org, NASA, TEA, project clear, NSF, fossweb, science-class.net, PBS, webccat.org, coreknowledge.org, sciencemag.org, Nature, teacher tube, Scholastic, Yahoo science, TEKS objectives, takscope, NDL, sci.net

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Houston SciPack Study Teacher Survey: Post(1)

Number of Respondents: 26

Confidence in Science Teaching

1. How well prepared to you feel to teach each of these topics?	Not Adequately Prepared (1)	Somewhat Prepared (2)	Fairly Well Prepared (3)	Very Well Prepared (4)	Mean	Std. Dev.
Earth's features and physical processes	4%	40%	36%	20%	2.70	0.84
Forces and motion	4%	33%	42%	21%	2.80	0.83

Self-Efficacy

2.	Strongly Disagree (1)	Disagree (2)	Uncertain (3)	Agree (4)	Strongly Agree (5)
When teaching science I usually welcome student questions.	4%	4%	0%	27%	65%
I do not feel I have the necessary skills to teach science.	42%	35%	4%	15%	4%
I am typically able to answer students' science questions.	0%	8%	0%	62%	31%
Given a choice, I would not invite the principal to evaluate my science teaching.	46%	31%	12%	12%	0%
I feel comfortable improvising during science lab experiments.	15%	15%	0%	35%	35%
Even when I try very hard, I do not teach science as well as I teach most other subjects.	46%	35%	8%	8%	4%
After I have taught a science concept once, I feel confident teaching it again.	4%	0%	0%	39%	58%
I find science a difficult topic to teach.	65%	15%	4%	15%	0%
I know the steps necessary to teach science concepts effectively.	0%	4%	12%	69%	15%
I find it difficult to explain to students why science experiments work.	42%	42%	8%	4%	4%
I am continually finding better ways to teach science.	0%	0%	0%	39%	62%
I generally teach science ineffectively.	54%	35%	8%	4%	0%
I understand science concepts well enough to teach science effectively.	0%	4%	8%	58%	31%
I know how to make students interested in science.	0%	4%	4%	46%	46%
I feel anxious when teaching science content that I have not taught before.	12%	42%	19%	15%	12%
I wish I had a better understanding of the science concepts I teach.	8%	19%	19%	35%	19%

	Range	Mean	Std. Dev.
Self Efficacy Score (for respondents who answered all items; possible score 16-80)	40-78	64.7	9.19

Instructional Practices

3. About how often do you do each of the following as a part of your science instruction?	N/A (haven't taught)	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
Use assessments to find out what students know before or during a unit.	0%	0%	12%	48%	18%	12%
Introduce content through formal presentations.	0%	0%	12%	24%	52%	12%
Use science instructional materials.	0%	0%	0%	4%	44%	52%
Demonstrate a science-related principle or phenomenon.	0%	0%	0%	8%	60%	32%
Teach science using real-world contexts.	0%	0%	0%	16%	32%	52%
Help students see connections between science and other disciplines.	0%	0%	4%	16%	40%	40%
Use open-ended questions.	0%	0%	0%	20%	44%	36%
Facilitate student discussion.	0%	0%	0%	24%	36%	40%
Encourage students to consider alternative explanations.	0%	0%	4%	32%	24%	40%
Encourage students to explain concepts to one another.	0%	0%	0%	24%	28%	48%
Assign science homework.	0%	12%	8%	12%	44%	24%
Embed assessments in regular class activities.	8%	0%	4%	28%	40%	20%
Allow students to work at their own pace.	4%	4%	4%	32%	32%	24%
Read and comment on the reflections students have written in notebooks or journals.	0%	0%	12%	40%	28%	20%

Instructional Practices

4. About how often do you have students do each of the following as a part of your science instruction?	N/A (haven't taught)	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
Participate in cooperative learning groups.	4%	0%	0%	4%	32%	60%
Engage in hands-on science activities.	0%	0%	0%	8%	36%	56%
Work on models or simulations.	0%	0%	0%	28%	36%	36%
Design or implement their own investigations.	4%	8%	20%	36%	8%	24%
Record, represent, and/or analyze data.	0%	0%	4%	20%	32%	44%
Supply evidence to support their claims.	0%	0%	8%	25%	33%	33%
Write reflections in a notebook or journal.	0%	0%	4%	28%	36%	32%
Prepare written science reports.	0%	21%	25%	25%	17%	13%
Read science-related materials in class.	0%	8%	0%	40%	28%	24%
Use mathematics as a tool in problem solving.	0%	0%	4%	24%	44%	28%
Use calculators.	0%	28%	20%	36%	12%	4%
Use computers.	0%	12%	24%	28%	28%	8%

Web Resources

5. About how often do you:	N/A (haven't taught)	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
Visit the school's website.	0%	8%	12%	36%	12%	32%
Use the Internet for personal use.	0%	4%	8%	8%	8%	71%
Use the Internet for professional development (e.g., accessing research and best practices for teaching).	0%	0%	4%	16%	36%	44%
Use the Internet for researching scientific content before a lesson.	0%	0%	4%	20%	24%	52%
Use the Internet for developing lesson plans/ideas.	0%	0%	05	24%	16%	60%
Use the Internet for creating instructional materials.	0%	0%	4%	20%	16%	60%
Use the Internet to communicate with others.	0%	0%	0%	8%	17%	75%
Use social networking and/or professional community websites for discussing science content and instruction.	0%	12%	12%	16%	24%	36%

NSTA Resources

6. How satisfied are you with…	N/A (have yet to access)	Very Dissatisfied	Somewhat Dissatisfied	No Opinion	Somewhat Satisfied	Very Satisfied
NSTA Force & Motion SciPack……………………….	33%	8%	4%	4%	21%	29%
NSTA Earth's Changing Surface SciPack…………	74%	0%	0%	9%	4%	13%
NSTA Learning Center Free Resources. …………	29%	0%	5%	5%	29%	33%

7. How, if at all, has working through the NSTA Force & Motion SciPack affected your content knowledge in Force and Motion? (If you have yet to access this SciPack, please write N/A).

*It has not affected my content knowledge.

*Greatly! I feel very confident and I am find it easier to facilitate inquiry as I visit students at their forces and motion discovery stations

*I learned by experiencing the virtual activities and trying some with the pack at home.

*It has helped me to have a better understanding on the subject.

*I am now fairly confident about teaching Force & Motion, Newton's first 3 laws and I have a lot of resources and ideas for activities to teach the concept.

*Refresher

*A bit more knowledgeable of Newton's law

*It gave me background information.

*Deeper understanding and more confidence teaching the subject.

*I just had a class at university with that but the SciPack cleared up some things I didn't understand.

*The SciPack focused on areas that are above what I teach on a day to day basis. I did not assist me at all for the physical science force and motion objective.

*Did not help at all. Horrible; boring, slow paced, and too much unnecessary information.

*Clarified some details on the topic.

*Increased my knowledge greatly.

*I now have a better understanding of motion graphs.

**N/A = 9*

8. How, if at all, has working through the NSTA Earth's Changing Surface SciPack affected your content knowledge in Earth Science? (If you have yet to access this SciPack, please write N/A).

**N/A = 21*

*Have not yet completed.

*It has helped me understand different concepts that I was confused about.

*YES

*It is very informative and useful. The technical terms are a lot, and the explanations are not that simple.

9. In what ways, if any, do you plan to incorporate what you have learned from the NSTA SciPacks in your classroom instruction?

*I plan to use some of the examples in my classroom instruction.

*Discuss and reflect on activities in forces and motions discovery stations in journals and as a class.

*Incorporate hands on activities to explore before explaining concepts.

*I would use some of the demonstrations and questions related to the topic to substantiate my lessons.

*I have already started sharing the activities for Force& Motion with students.

*Unsure

*The activities

*Use it as background knowledge.

*I am still thinking about that.

*More hands on things to get them excited and then follow up with computer sims.

*I use the visual aids. The vocabulary and level of the questions are above what fifth graders need at this point

*Don't know

*Show some of the animation clips to explain concepts to students;

*Not sure

*I am beginning a roller coaster activity

*Possibly showing them some of the pictures or videos.

*I hope to use the resources to gain knowledge and ideas for the classroom.

*It will make me more comfortable and give me more opportunity to provide hand-on activities with my students.

*I will incorporate the information as a strategy to implement the 5E Model

*I will make it easier for them to understand the concept and principles about the Earth's Changing Surface.

**N/A = 4*

10. What specific Learning Center resources, if any, have you found helpful? How have these resources been helpful?

*Haven't had time to search.

*www.renzullilearning.com

*SciPacks

*The only Learning Center resources that I've used are the ones from the Force & Motion SciPack. The little Hands-on Activities.

*none

*I can implement more science experiments

*None

*I haven't really explored yet.

*Edusmart is very helpful in explaining concepts and building vocabulary. I am impressed with their visual aids.
*Brainpop is somewhat helpful. I'm not impressed with their level of questions.

*Don't know

*Articles on specific topics I searched for;

*The articles on NSTA

*I like the articles and have been exposed to some of the ideas on formative assessments by our new grading system

*The SciPacks are good

*I've found the Hollingsworth Center very resourceful.

*Science Objects

**N/A = 5*

Web Resources

		Yes	No
11.	Do you maintain your own classroom-based Web pages?	8%	92%
12.	Do you have a computer at home?	100%	0%
13.	Do you have Internet access at home?	100%	0%

14. What are the 3 websites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit websites for these purposes, please write N/A.)

Websites listed & number of respondents

N/A or blank	3	NSTA	9	Middle school science	2
K8science	11	Houston ISD	3	Discovery	2
brainpop	10	unitedstreaming	8	NASA	2

Listed once: Google, enchantedlearning, tfanet, fossweb, learningscience, xtreemscience,Internet4classrooms, renzullilearning, edheads, Jefferson County Schools, coreworks, nclearn, sciencemag

Houston SciPack Study Teacher Survey: Post(2)

Number of Respondents: 35

Confidence in Science Teaching

1. How well prepared to you feel to teach each of these topics?	Not Adequately Prepared (1)	Somewhat Prepared (2)	Fairly Well Prepared (3)	Very Well Prepared (4)	Mean	Std. Dev.
Earth's features and physical processes	0%	11%	54%	34%	3.20	0.65
Forces and motion	0%	18%	56%	27%	3.10	0.67

Self-Efficacy

2.	Strongly Disagree (1)	Disagree (2)	Uncertain (3)	Agree (4)	Strongly Agree (5)
When teaching science I usually welcome student questions.	3%	0%	0%	27%	71%
I do not feel I have the necessary skills to teach science.	60%	34%	0%	3%	3%
I am typically able to answer students' science questions.	3%	3%	3%	46%	46%
Given a choice, I would not invite the principal to evaluate my science teaching.	51%	34%	0%	9%	6%
I feel comfortable improvising during science lab experiments.	6%	3%	3%	46%	43%
Even when I try very hard, I do not teach science as well as I teach most other subjects.	51%	37%	6%	6%	0%
After I have taught a science concept once, I feel confident teaching it again.	3%	0%	0%	43%	54%
I find science a difficult topic to teach.	66%	17%	11%	6%	0%
I know the steps necessary to teach science concepts effectively.	0%	6%	6%	63%	26%
I find it difficult to explain to students why science experiments work.	37%	59%	6%	6%	3%
I am continually finding better ways to teach science.	3%	0%	0%	37%	60%
I generally teach science ineffectively.	49%	43%	0%	3%	6%
I understand science concepts well enough to teach science effectively.	0%	3%	6%	40%	51%
I know how to make students interested in science.	0%	0%	3%	57%	40%
I feel anxious when teaching science content that I have not taught before.	17%	26%	20%	34%	3%
I wish I had a better understanding of the science concepts I teach.	14%	26%	20%	34%	6%

	Range	Mean	Std. Dev.
Self Efficacy Score (for respondents who answered all items; possible score 16-80)	48-80	66.9	7.55

Instructional Practices

3. About how often do you do each of the following as a part of your science instruction?	**N/A** (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Use assessments to find out what students know before or during a unit.	0%	0%	9%	29%	46%	17%
Introduce content through formal presentations.	0%	0%	6%	31%	43%	20%
Use science instructional materials.	0%	0%	3%	9%	46%	43%
Demonstrate a science-related principle or phenomenon.	0%	0%	3%	6%	51%	40%
Teach science using real-world contexts.	0%	0%	3%	6%	39%	63%
Help students see connections between science and other disciplines.	0%	0%	3%	9%	35%	53%
Use open-ended questions.	0%	0%	0%	20%	36%	54%
Facilitate student discussion.	0%	0%	3%	9%	43%	46%
Encourage students to consider alternative explanations.	0%	0%	0%	17%	34%	49%
Encourage students to explain concepts to one another.	0%	0%	6%	20%	23%	51%
Assign science homework.	3%	12%	9%	18%	32%	26%
Embed assessments in regular class activities.	3%	3%	6%	29%	26%	34%
Allow students to work at their own pace.	0%	0%	11%	26%	40%	23%
Read and comment on the reflections students have written in notebooks or journals.	0%	3%	9%	29%	49%	11%

Instructional Practices

4. About how often do you have students do each of the following as a part of your science instruction?

	N/A (haven't taught)	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
Participate in cooperative learning groups.	0%	0%	0%	9%	34%	57%
Engage in hands-on science activities.	0%	0%	0%	9%	46%	46%
Work on models or simulations.	0%	0%	3%	14%	51%	31%
Design or implement their own investigations.	0%	0%	29%	20%	23%	29%
Record, represent, and/or analyze data.	0%	0%	0%	34%	26%	40%
Supply evidence to support their claims.	0%	0%	6%	29%	29%	37%
Write reflections in a notebook or journal.	0%	0%	3%	29%	29%	40%
Prepare written science reports.	0%	9%	26%	23%	29%	14%
Read science-related materials in class.	0%	6%	0%	23%	37%	34%
Use mathematics as a tool in problem solving.	0%	0%	6%	23%	49%	23%
Use calculators.	3%	23%	34%	23%	17%	0%
Use computers.	3%	6%	20%	26%	37%	9%

Web Resources

5. About how often do you:

	N/A (haven't taught)	Never	Rarely (few times a year)	Sometimes (once or twice a month)	Often (once or twice a week)	All or almost all the time
Visit the school's Web site.	0%	0%	26%	23%	20%	31%
Use the Internet for personal use.	0%	9%	6%	9%	17%	60%
Use the Internet for professional development (e.g., accessing research and best practices for teaching).	0%	0%	0%	11%	34%	54%
Use the Internet for researching scientific content before a lesson.	0%	0%	3%	9%	34%	54%
Use the Internet for developing lesson plans/ideas.	0%	0%	6%	11%	20%	63%
Use the Internet for creating instructional materials.	0%	3%	6%	15%	21%	56%
Use the Internet to communicate with others.	0%	3%	0%	9%	14%	74%
Use social networking and/or professional community Web sites for discussing science content and instruction.	0%	17%	6%	20%	14%	43%

Web Resources

		Yes	No
6.	Do you maintain your own classroom-based Web page?	11%	89%
7.	Do you have a computer at home?	97%	3%
8.	Do you have Internet access at home?	94%	6%

9. What are the 3 Web sites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit Web sites for these purposes, please write N/A.)

Web sites listed & number of respondents

N/A or blank	2	unitedstreaming	5	Houston ISD	3	science-class.net	3
NSTA	16	Google	5	tfanet	3		
K8science	14	Discovery	3	NASA	3		
brainpop	6	Science spot	3	fossweb	3		

Listed twice: Wikipedia, Ask.com, edhelper, enchantedlearning, middle school science

Listed once: TEA, Scholastic, learningscience, learn.rice, Chem4kids, Biology corner, xtreemscience, Yahoo, Internet4classrooms, ted.com, Bill Nye the science guy, education.com, study island, learning.com

NSTA Resources

10. How satisfied are you with…	N/A (have yet to access)	Very Dissatis-fied	Somewhat Dissatis-fied	No Opinion	Somewhat Satisfied	Very Satisfied
Force & Motion SciPack	9%	6%	9%	15%	29%	32%
Earth's Changing Surface SciPack	12%	0%	6%	15%	27%	41%
SciGuides (lesson plans)	44%	0%	0%	21%	24%	12%
Journal Articles	9%	6%	9%	15%	29%	32%
Podcasts	12%	0%	6%	15%	27%	41%
Web Seminar Archives	44%	0%	0%	21%	24%	12%
e-Book Chapters	29%	0%	0%	21%	27%	24%

11. How, if at all, has working through the NSTA Force & Motion SciPack affected your content knowledge in Force and Motion? (If you have yet to access this SciPack, please write N/A).

*This has not affected my content knowledge.
*Forces and Motion SciPack gave me much more confidence to teach forces and motion in my class. I especially got a lot out of the explanation of Newton's Third Law of Motion. It was made very clear to me when before, I just didn't get it.
*It was difficult because of time constraints but I feel I learned enough to teach this objective better.
*The Force and Motion SciPack has given me a greater depth to understanding physics and physical science. I can now answer many of the tough questions that students want answers to.
*It has increased, and I have a better understanding of certain concepts
*Yes, I am somewhat more knowledgeable in this subject area.
*I have not used any of the knowledge because I taught forces and motion before using the SciPack.
*It was a good review of physics
*The animations help me see it better, and if I understand better, I can teach better.
*I gained more personal knowledge. The content is too high to apply in the classroom.
*Affected it very little.

*Refresher on the content
*Clarified some of the terms and concepts that I have misunderstood before.
*A lot
*I gained more knowledge.
*I have yet to access this information, therefore I cannot comment on it.
*It has broadened my knowledge of the subject.
*It did help me clarify motion graphs
*I am prepared and very refreshed
*It has made me wonder, especially the videos.
*Increased
*It made me more confident in teaching the content
*The Force and Motion SciPack helped me to understand how these concepts physically show up in our environment. Having this information has made it extremely important that I convey these thoughts to my students.
*It helped me brush up on my Physics, I hadn't taken the course in a few years.
*The simulations were beneficial in supporting the learning of the concepts.
*Understanding clearly and comprehensively the concepts had increased my confidence in teaching the subject.
*It has increased my knowledge base.
**N/A = 7*

12. How, if at all, has working through the NSTA Earth's Changing Surface SciPack affected your content knowledge in Earth Science? (If you have yet to access this SciPack, please write N/A).

*Earth's Changing Surface SciPack was very helpful. A few misconceptions were cleared up. I enjoyed this SciPack.
*I think I was pretty strong in earth science before I did this SciPack because of a great historical geology professor that I studied with in college. However, it was interesting and I learned a lot about seismic waves and how we know what the inside of the earth is like.
*It helped me to corroborate the knowledge I had about this topic.
*Earth's Changing Surface has really helped me to understand and explain the process of convection. I am able to tell students how this process drives many of Earth's cycles.
*It has increased, and I have a better understanding of certain concepts
*Yes, I am somewhat more knowledgeable in this subject area.
*I have not used any of the knowledge because i taught Earth Science before using the SciPack
*It gave me a lot of new information. I felt I was taking a class in college.
*I saw a few flaws in my thinking.
*I gained more personal knowledge. The content is too high to apply in the classroom.
*Reinforced some good concepts, it strengthened my knowledge.
*Refresher on the content
*I gained more in-depth knowledge about the structure and the different layers of earth that I did not know before.
*I gained more knowledge.
*I have yet to access this information, therefore I cannot comment on it.
*I was familiar with most of that content before I accessed the SciPack
*It has been a treat and a privilege.
*I enjoyed it! It gave me basic knowledge that I did not have.
*Increased... difficult vocabulary
*It made me more confident in teaching the content
*The Changing Surface SciPack played a huge role in my understanding the recent earthquake in Haiti. This SciPack made it easier for me to give my students real world experiences in order to understand these concepts.
*It confused some of the beliefs I had about weathering, erosion, and deposition. The pictures were very difficult to me.
*Already knew much of what was taught, but the visuals provided helped support further learning.
*Understanding clearly and comprehensively the concepts had increased my confidence in teaching the

subject.
*It has given me more creative ideas to introduce the material to my students.
**N/A = 9*

13. In what ways, if any, do you plan to incorporate what you have learned from the NSTA SciPacks in your classroom instruction?

*The SciPacks will help me in preparing lessons.
*The Force and Motion SciPack will help me to facilitate more in-depth discussion with my students after they participate in force and motion discovery stations.
*I am already using it. For example, I used a module to illustrate Inertia during my lesson.
*I will definitely use the demonstration ideas to teach the students these concepts.
*Discussion
*Yes, I do. I am excited.
*It has enriched my knowledge in both areas.
*I will use some of the example given.
*The pictures and illustrations are helpful. The online quiz will be used as a pre and post.
*Background info.
*Very little. More for my knowledge.
*I am not sure yet
*I am more prepared to answer questions and know about misconceptions that I may need to clarify with students.
*I have gained more knowledge.
*I have not accessed the SciPack and am not able to comment on how to incorporate it.
*To help me to better prepare my lessons.
*I will be using motion graphs much more next year
*I plan to continue my memberships
*I plan to use it for back up while I am teaching it to the children.
*I have gt vanguard so they can go further with content... the more I know the better
*I plan to use some of the simulations presented in the SciPacks.
*I plan to incorporate these NSTA SciPacks into the learning environment when possible to make learning more real to my students.
*I will use things learned as an extension in lessons or as a tool to help the kids understand the concept better.
*I plan to incorporate what I have learned in every aspect of my teaching.
*I will use it for support in content.
*By giving students opportunity to explore resources from the NSTA library and other students materials.
*Through hands-on activities.
*I plan to use lesson plans and animations
*I share the information and use the techniques in the classroom.
**N/A = 4*

14. What other comments would you like to provide about your experience with the NSTA SciPack Study?

*I've started studying other SciPacks like the moon and earth revolution pack. It is very interesting and should be helpful. I tried the space pack and it was way over my head.
*I had great learning experience using the content from the NSTA SciPack Study.
*Earth's Changing Surface had a few errors, i.e. "step instead of steep" and there was one question that had no correct answer (I think it was a T/F question and I tried it both ways.)
*It was extremely long and time consuming!
*Yes, I do. I am excited.
*The forces and motion SciPack is too difficult and it makes the learning experience not so pleasant.
*None
*The SciPacks are waaaaaaaaaay too long!
*Force & motion was very, dull, boring, and long. More than a little disorganized and not appropriate for

the grade levels I teach. Earths changing surface was more engaging and relevant to my classroom.
*None
*I wish all members of the NSTA have free access to the SciPack. It is very valuable but I might not have paid to have access to them. Teachers and schools are ready to pay for students' materials but not so much for teacher knowledge enrichment.
*I have gained more knowledge.
*Due to my "non-access" to the SciPack, I am not able to comment on any experience with it.
*Thank you SO much for allowing me to be able to use these resources!
*I think the tests were a bit detailed when asked a question and the Earth SciPack you had more than one answer correct. I think that made it difficult.
*All in all, even though it was time consuming, it was a positive experience for me. If I could change one thing, it would be the amount of time it takes to complete everything.
*These SciPacks have really been mentally challenging to me. I have really enjoyed this journey. It has left me with a greater thirst for more knowledge about my world.
*I had a bit of trouble locating the links for the pre/post tests combined with the SciPacks, I'm not certain if it's located only in email or if it is on the site.
*I had very strong feelings initially regarding how I did not get to select which SciPack I was able to access to help me before I taught force and motion which is a weakness for me. I also did not feel that HISD should have volunteered new teachers without asking permission because as new teachers we already have huge amounts of training and more time we have to invest in our first year in a new district. The Earth's Changing surface SciPack was nicely written and was beneficial.
*None so far.
*I have really enjoyed the tabs on the website.
*I think this study would be best for second year or more experienced teachers. As a first year teacher, I found the study virtually impossible to participate in because of all my other commitments (ACP, professional development, university courses.)
*A more direct timeline of what is expected when. Also I would like explanations/things that will specifically benefit my students.
**N/A = 6*

Appendix C:

Teacher Surveys

Houston SciPack Study Teacher Survey

Houston SciPack Study Teacher Survey

With funding from ExxonMobil Foundation, the National Science Teachers Association (NSTA) is offering online professional development ("SciPacks") to new math and science teachers in the Houston Independent School District (HISD). Edvantia, a nonprofit research firm with offices in Charleston (WV) and Nashville (TN), is conducting a study of this effort to explore the effects of this type of online professional development. Dr. Kristine Chadwick at Edvantia is the lead research project manager; Chandra O'Connor is the researcher for the project.

To understand the effectiveness of the SciPacks, we are asking you to complete this survey, which asks about your confidence teaching science, instructional practices (e.g., use of hands-on activities, student grouping, assessment), and awareness and use of Web resources. Results from the survey also will be used to randomly assign you to one of two groups, though both groups will be able to complete the SciPacks. The survey should take about 20 minutes to complete.

Completed surveys will not be shared with staff or administrators from your school or HISD, or with NSTA staff. Information gathered from the surveys will be reported only at an aggregated level. Data from this study will be stored in secure electronic files accessible only by appropriate Edvantia research staff.

While there will be no direct benefits to individuals for participating in this data collection activity and no direct compensation for doing so, these data are critical for fully documenting the processes and effects of the NSTA SciPacks. Please note that participation is voluntary, and you may cease participation at any time without reprisal or penalty. There are no known risks associated with this project that are greater than those ordinarily encountered in daily life.

If you have any questions about this study, please contact Chandra O'Connor by phone (800.624.9120, ext. 5404) or e-mail (chandra.o'connor@edvantia.org). For information on protection of research participants' rights, contact Karen Bradley (800.624.9120, ext. 5841, karen.bradley@edvantia.org).

Data collected for research purposes are stored in compliance with International Standards Organization (ISO) 17799 requirements for access, security, and redundancy. Data are stored in an encrypted format in a centralized, electronically and physically secure server at Edvantia for a period not to exceed 5 years following the final audit of the project. All electronic data of a personal nature are safeguarded and available only to those project leaders, staff, and technologists having a need to know within the specific criteria as set forth in the approved project plan. Names will not be associated with any of the findings. The Edvantia IRB has the authority to inspect consent records and data files only to assure compliance with approved procedures.

Houston SciPack Study Teacher Survey

Descriptive Information

1. What is your role in the school? (Select only one.)

- ○ Regular Classroom Teacher
- ○ Special Education Teacher
- ○ Lab Teacher
- ○ Other

Other (please specify)

____

2. Which category best describes the degree and credits you have now? (Select only one.)

- ○ Bachelor's
- ○ Bachelor's + 15
- ○ Bachelor's + 30 or more
- ○ Master's
- ○ Master's + 15
- ○ Master's + 30 or more
- ○ Education Specialist
- ○ Doctorate
- ○ Other

Other (please specify)

____

3. Gender (Select one.)

- ○ Female
- ○ Male

4. Do you have a degree in a science field or science education?

- ☐ Science field (for instance, biology, physics, chemistry)
- ☐ Science education
- ☐ Neither

Houston SciPack Study Teacher Survey

Descriptive Information

5. How many years have you taught in any school?

6. How many years have you taught your current subject(s)?

7. Please select each subject you currently teach. Choose all that apply:

- ☐ Not Applicable (I have not yet taught)
- ☐ I teach all subjects
- ☐ I teach science only
- ☐ Other

Other (please specify)

8. (A) Please select each grade you currently teach, and (B) Indicate the grade(s) you are certified to teach. Choose all that apply.

	Grade(s) I currently teach	Grade(s) I am certified to teach
3	☐	☐
4	☐	☐
5	☐	☐
6	☐	☐
7	☐	☐
8	☐	☐

Confidence in Science Teaching

9. How well prepared do you feel to teach each of these topics?

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
Earth's features and physical processes	◯	◯	◯	◯
Forces and motion	◯	◯	◯	◯

10. Please respond to the following items on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree).

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
When teaching science, I usually welcome student questions.	◯	◯	◯	◯	◯
I do not feel I have the necessary skills to teach science.	◯	◯	◯	◯	◯
I am typically able to answer students' science questions.	◯	◯	◯	◯	◯
Given a choice, I would not invite the principal to evaluate my science teaching.	◯	◯	◯	◯	◯
I feel comfortable improvising during science lab experiments.	◯	◯	◯	◯	◯
Even when I try very hard, I do not teach science as well as I teach most other subjects.	◯	◯	◯	◯	◯
After I have taught a science concept once, I feel confident teaching it again.	◯	◯	◯	◯	◯
I find science a difficult topic to teach.	◯	◯	◯	◯	◯
I know the steps necessary to teach science concepts effectively.	◯	◯	◯	◯	◯
I find it difficult to explain to students why science experiments work.	◯	◯	◯	◯	◯
I am continually finding better ways to teach science.	◯	◯	◯	◯	◯
I generally teach science ineffectively.	◯	◯	◯	◯	◯
I understand science concepts well enough to teach science effectively.	◯	◯	◯	◯	◯
I know how to make students interested in science.	◯	◯	◯	◯	◯
I feel anxious when teaching science content that I have not taught before.	◯	◯	◯	◯	◯
I wish I had a better understanding of the science concepts I teach.	◯	◯	◯	◯	◯

Houston SciPack Study Teacher Survey

Instructional Practices

11. About how often do you do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Use assessments to find out what students know before or during a unit.	○	○	○	○	○	○
Introduce content through formal presentations.	○	○	○	○	○	○
Use science instructional materials.	○	○	○	○	○	○
Demonstrate a science-related principle or phenomenon.	○	○	○	○	○	○
Teach science using real-world contexts.	○	○	○	○	○	○
Help students see connections between science and other disciplines.	○	○	○	○	○	○
Use open-ended questions.	○	○	○	○	○	○
Facilitate student discussion.	○	○	○	○	○	○
Encourage students to consider alternative explanations.	○	○	○	○	○	○
Encourage students to explain concepts to one another.	○	○	○	○	○	○
Assign science homework.	○	○	○	○	○	○
Embed assessments in regular class activities.	○	○	○	○	○	○
Allow students to work at their own pace.	○	○	○	○	○	○
Read and comment on the reflections students have written in notebooks or journals.	○	○	○	○	○	○

Instructional Practices

12. About how often do you have students do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Participate in cooperative learning groups.	○	○	○	○	○	○
Engage in hands-on science activities.	○	○	○	○	○	○
Work on models or simulations.	○	○	○	○	○	○
Design or implement their own investigations.	○	○	○	○	○	○
Record, represent, and/or analyze data.	○	○	○	○	○	○
Supply evidence to support their claims.	○	○	○	○	○	○
Write reflections in a notebook or journal.	○	○	○	○	○	○
Prepare written science reports.	○	○	○	○	○	○
Read science-related materials in class.	○	○	○	○	○	○
Use mathematics as a tool in problem solving.	○	○	○	○	○	○
Use calculators.	○	○	○	○	○	○
Use computers.	○	○	○	○	○	○

Houston SciPack Study Teacher Survey

Web Resources

13. About how often do you:

	N/A (don't teach)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Visit the school's Web site.	◯	◯	◯	◯	◯	◯
Use the Internet for personal use.	◯	◯	◯	◯	◯	◯
Use the Internet for professional development (e.g., accessing research and best practices for teaching).	◯	◯	◯	◯	◯	◯
Use the Internet for researching scientific content before a lesson.	◯	◯	◯	◯	◯	◯
Use the Internet for developing lesson plans/ideas.	◯	◯	◯	◯	◯	◯
Use the Internet for creating instructional materials.	◯	◯	◯	◯	◯	◯
Use the Internet to communicate with others.	◯	◯	◯	◯	◯	◯
Use social networking and/or professional community Web sites for discussing science content and instruction.	◯	◯	◯	◯	◯	◯

Houston SciPack Study Teacher Survey

Web Resources

14. Do you maintain your own classroom-based Web page?

○ Yes ○ No

15. Do you have a computer at home?

○ Yes ○ No

16. Do you have Internet access at home?

○ Yes ○ No

17. Have you ever taken a course that was conducted either completely or partially online?

○ No

○ Yes

18. What are the 3 Web sites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit Web sites for these purposes, please write N/A.)

a. ____________________

b. ____________________

c. ____________________

Thank you for your feedback!

Houston SciPack Study Teacher Survey #2

With funding from ExxonMobil Foundation, the National Science Teachers Association (NSTA) is offering online professional development ("SciPacks") to new math and science teachers in the Houston Independent School District (HISD). Edvantia, a nonprofit research firm with offices in Charleston (WV) and Nashville (TN), is conducting a study of this effort to explore the effects of this type of online professional development. Dr. Kristine Chadwick at Edvantia is the lead research project manager; Chandra O'Connor is the researcher for the project.

To understand the effectiveness of the SciPacks, we are asking you to complete this survey, which asks about your confidence teaching science, instructional practices (e.g., use of hands-on activities, student grouping, assessment), and awareness and use of Web resources. The survey should take about 20 minutes to complete.

Completed surveys will not be shared with staff or administrators from your school or HISD, or with NSTA staff. Information gathered from the surveys will be reported only at an aggregated level. Data from this study will be stored in secure electronic files accessible only by appropriate Edvantia research staff.

While there will be no direct benefits to individuals for participating in this data collection activity and no direct compensation for doing so, these data are critical for fully documenting the processes and effects of the NSTA SciPacks. Please note that participation is voluntary, and you may cease participation at any time without reprisal or penalty. There are no known risks associated with this project that are greater than those ordinarily encountered in daily life.

If you have any questions about this study, please contact Chandra O'Connor by phone (800.624.9120, ext. 5404) or e-mail (chandra.o'connor@edvantia.org). For information on protection of research participants' rights, contact Karen Bradley (800.624.9120, ext. 5841, karen.bradley@edvantia.org).

Data collected for research purposes are stored in compliance with International Standards Organization (ISO) 17799 requirements for access, security, and redundancy. Data are stored in an encrypted format in a centralized, electronically and physically secure server at Edvantia for a period not to exceed 5 years following the final audit of the project. All electronic data of a personal nature are safeguarded and available only to those project leaders, staff, and technologists having a need to know within the specific criteria as set forth in the approved project plan. Names will not be associated with any of the findings. The Edvantia IRB has the authority to inspect consent records and data files only to assure compliance with approved procedures.

Confidence in Science Teaching

1. How well prepared do you feel to teach each of these topics?

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
Earth's features and physical processes	○	○	○	○
Forces and motion	○	○	○	○

2. Please respond to the following items on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree).

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
When teaching science, I usually welcome student questions.	○	○	○	○	○
I do not feel I have the necessary skills to teach science.	○	○	○	○	○
I am typically able to answer students' science questions.	○	○	○	○	○
Given a choice, I would not invite the principal to evaluate my science teaching.	○	○	○	○	○
I feel comfortable improvising during science lab experiments.	○	○	○	○	○
Even when I try very hard, I do not teach science as well as I teach most other subjects.	○	○	○	○	○
After I have taught a science concept once, I feel confident teaching it again.	○	○	○	○	○
I find science a difficult topic to teach.	○	○	○	○	○
I know the steps necessary to teach science concepts effectively.	○	○	○	○	○
I find it difficult to explain to students why science experiments work.	○	○	○	○	○
I am continually finding better ways to teach science.	○	○	○	○	○
I generally teach science ineffectively.	○	○	○	○	○
I understand science concepts well enough to teach science effectively.	○	○	○	○	○
I know how to make students interested in science.	○	○	○	○	○
I feel anxious when teaching science content that I have not taught before.	○	○	○	○	○
I wish I had a better understanding of the science concepts I teach.	○	○	○	○	○

Instructional Practices

3. About how often do you do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Use assessments to find out what students know before or during a unit	○	○	○	○	○	○
Introduce content through formal presentations	○	○	○	○	○	○
Use science instructional materials	○	○	○	○	○	○
Demonstrate a science-related principle or phenomenon	○	○	○	○	○	○
Teach science using real-world contexts	○	○	○	○	○	○
Help students see connections between science and other disciplines	○	○	○	○	○	○
Use open-ended questions	○	○	○	○	○	○
Facilitate student discussion	○	○	○	○	○	○
Encourage students to consider alternative explanations	○	○	○	○	○	○
Encourage students to explain concepts to one another	○	○	○	○	○	○
Assign science homework	○	○	○	○	○	○
Embed assessments in regular class activities	○	○	○	○	○	○
Allow students to work at their own pace	○	○	○	○	○	○
Read and comment on the reflections students have written in notebooks or journals	○	○	○	○	○	○

Instructional Practices

4. About how often do you have students do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Participate in cooperative learning groups	○	○	○	○	○	○
Engage in hands-on science activities	○	○	○	○	○	○
Work on models or simulations	○	○	○	○	○	○
Design or implement their own investigations	○	○	○	○	○	○
Record, represent, and/or analyze data	○	○	○	○	○	○
Supply evidence to support their claims	○	○	○	○	○	○
Write reflections in a notebook or journal	○	○	○	○	○	○
Prepare written science reports	○	○	○	○	○	○
Read science-related materials in class	○	○	○	○	○	○
Use mathematics as a tool in problem solving	○	○	○	○	○	○
Use calculators	○	○	○	○	○	○
Use computers	○	○	○	○	○	○

Web Resources

5. About how often do you:

	N/A (don't teach)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or Almost All the Time**
Visit the school's Web site.	○	○	○	○	○	○
Use the Internet for personal use.	○	○	○	○	○	○
Use the Internet for professional development (e.g., accessing research and best practices for teaching).	○	○	○	○	○	○
Use the Internet for researching scientific content before a lesson.	○	○	○	○	○	○
Use the Internet for developing lesson plans/ideas.	○	○	○	○	○	○
Use the Internet for creating instructional materials.	○	○	○	○	○	○
Use the Internet to communicate with others.	○	○	○	○	○	○
Use social networking and/or professional community Web sites for discussing science content and instruction.	○	○	○	○	○	○

NSTA Resources

6. How satisfied are you with . . .

	N/A (have yet to access)	Very Dissatisfied	Somewhat Dissatisfied	No Opinion	Somewhat Satisfied	Very Satisfied
NSTA Force & Motion SciPack	○	○	○	○	○	○
NSTA Earth's Changing Surface SciPack	○	○	○	○	○	○
NSTA Learning Center Free Resources	○	○	○	○	○	○

7. How, if at all, has working through the NSTA Force & Motion SciPack affected your content knowledge in Force and Motion? (If you have yet to access this SciPack, please write N/A).

8. How, if at all, has working through the NSTA Earth's Changing Surface SciPack affected your content knowledge in Earth Science? (If you have yet to access this SciPack, please write N/A).

9. In what ways, if any, do you plan to incorporate what you have learned from the NSTA SciPacks in your classroom instruction?

10. What specific Learning Center resources, if any, have you found helpful? How have these resources been helpful?

Web Resources

11. Do you maintain your own classroom-based Web page?

◯ Yes ◯ No

12. Do you have a computer at home?

◯ Yes ◯ No

13. Do you have Internet access at home?

◯ Yes ◯ No

14. What are the 3 Web sites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit Web sites for these purposes, please write N/A.)

a. ____________________

b. ____________________

c. ____________________

Thank you for your feedback!

Houston SciPack Study Teacher Survey #3

With funding from ExxonMobil Foundation, the National Science Teachers Association (NSTA) is offering online professional development ("SciPacks") to new math and science teachers in the Houston Independent School District (HISD). Edvantia, a nonprofit research firm with offices in Charleston (WV) and Nashville (TN), is conducting a study of this effort to explore the effects of this type of online professional development. Dr. Kristine Chadwick at Edvantia is the lead research project manager; Chandra O'Connor is the researcher for the project.

To understand the effectiveness of the SciPacks, we are asking you to complete this survey, which asks about your confidence teaching science, instructional practices (e.g., use of hands-on activities, student grouping, assessment), and awareness and use of Web resources. The survey should take about 20 minutes to complete.

Completed surveys will not be shared with staff or administrators from your school or HISD, or with NSTA staff. Information gathered from the surveys will be reported only at an aggregated level. Data from this study will be stored in secure electronic files accessible only by appropriate Edvantia research staff.

As a thank you for your time and completion of this survey, you will receive a $25 Visa gift card from Edvantia. Please note that participation is voluntary, and you may cease participation at any time without reprisal or penalty. There are no known risks associated with this project that are greater than those ordinarily encountered in daily life.

If you have any questions about this study, please contact Chandra O'Connor by phone (800.624.9120, ext. 5404) or e-mail (chandra.o'connor@edvantia.org). For information on protection of research participants' rights, contact Karen Bradley (800.624.9120, ext. 5841, karen.bradley@edvantia.org).

Data collected for research purposes are stored in compliance with International Standards Organization (ISO) 17799 requirements for access, security, and redundancy. Data are stored in an encrypted format in a centralized, electronically and physically secure server at Edvantia for a period not to exceed 5 years following the final audit of the project. All electronic data of a personal nature are safeguarded and available only to those project leaders, staff, and technologists having a need to know within the specific criteria as set forth in the approved project plan. Names will not be associated with any of the findings. The Edvantia IRB has the authority to inspect consent records and data files only to assure compliance with approved procedures.

Confidence in Science Teaching

1. How well prepared do you feel to teach each of these topics?

	Not Adequately Prepared	Somewhat Prepared	Fairly Well Prepared	Very Well Prepared
Earth's features and physical processes	○	○	○	○
Forces and motion	○	○	○	○

2. Please respond to the following items on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree).

	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
When teaching science, I usually welcome student questions.	○	○	○	○	○
I do not feel I have the necessary skills to teach science.	○	○	○	○	○
I am typically able to answer students' science questions.	○	○	○	○	○
Given a choice, I would not invite the principal to evaluate my science teaching.	○	○	○	○	○
I feel comfortable improvising during science lab experiments.	○	○	○	○	○
Even when I try very hard, I do not teach science as well as I teach most other subjects.	○	○	○	○	○
After I have taught a science concept once, I feel confident teaching it again.	○	○	○	○	○
I find science a difficult topic to teach.	○	○	○	○	○
I know the steps necessary to teach science concepts effectively.	○	○	○	○	○
I find it difficult to explain to students why science experiments work.	○	○	○	○	○
I am continually finding better ways to teach science.	○	○	○	○	○
I generally teach science ineffectively.	○	○	○	○	○
I understand science concepts well enough to teach science effectively.	○	○	○	○	○
I know how to make students interested in science.	○	○	○	○	○
I feel anxious when teaching science content that I have not taught before.	○	○	○	○	○
I wish I had a better understanding of the science concepts I teach.	○	○	○	○	○

Instructional Practices

3. About how often do you do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Use assessments to find out what students know before or during a unit	○	○	○	○	○	○
Introduce content through formal presentations	○	○	○	○	○	○
Use science instructional materials	○	○	○	○	○	○
Demonstrate a science-related principle or phenomenon	○	○	○	○	○	○
Teach science using real-world contexts	○	○	○	○	○	○
Help students see connections between science and other disciplines	○	○	○	○	○	○
Use open-ended questions	○	○	○	○	○	○
Facilitate student discussion	○	○	○	○	○	○
Encourage students to consider alternative explanations	○	○	○	○	○	○
Encourage students to explain concepts to one another	○	○	○	○	○	○
Assign science homework	○	○	○	○	○	○
Embed assessments in regular class activities	○	○	○	○	○	○
Allow students to work at their own pace	○	○	○	○	○	○
Read and comment on the reflections students have written in notebooks or journals	○	○	○	○	○	○

Instructional Practices

4. About how often do you have students do each of the following as a part of your science instruction?

	N/A (haven't taught)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or almost all the time**
Participate in cooperative learning groups	○	○	○	○	○	○
Engage in hands-on science activities	○	○	○	○	○	○
Work on models or simulations	○	○	○	○	○	○
Design or implement their own investigations	○	○	○	○	○	○
Record, represent, and/or analyze data	○	○	○	○	○	○
Supply evidence to support their claims	○	○	○	○	○	○
Write reflections in a notebook or journal	○	○	○	○	○	○
Prepare written science reports	○	○	○	○	○	○
Read science-related materials in class	○	○	○	○	○	○
Use mathematics as a tool in problem solving	○	○	○	○	○	○
Use calculators	○	○	○	○	○	○
Use computers	○	○	○	○	○	○

Web Resources

5. About how often do you:

	N/A (don't teach)	**Never**	**Rarely** (few times a year)	**Sometimes** (once or twice a month)	**Often** (once or twice a week)	**All or Almost All the Time**
Visit the school's Web site.	○	○	○	○	○	○
Use the Internet for personal use.	○	○	○	○	○	○
Use the Internet for professional development (e.g., accessing research and best practices for teaching).	○	○	○	○	○	○
Use the Internet for researching scientific content before a lesson.	○	○	○	○	○	○
Use the Internet for developing lesson plans/ideas.	○	○	○	○	○	○
Use the Internet for creating instructional materials.	○	○	○	○	○	○
Use the Internet to communicate with others.	○	○	○	○	○	○
Use social networking and/or professional community Web sites for discussing science content and instruction.	○	○	○	○	○	○

Web Resources

6. Do you maintain your own classroom-based Web page?

◯ Yes ◯ No

7. Do you have a computer at home?

◯ Yes ◯ No

8. Do you have Internet access at home?

◯ Yes ◯ No

9. What are the 3 Web sites you visit most frequently to improve your own science content knowledge or instructional practices? (If you do not visit Web sites for these purposes, please write N/A.)

a. __________

b. __________

c. __________

NSTA Resources

10. How satisfied are you with the following NSTA Learning Center resources?

	N/A (did not access)	Very Dissatisfied	Somewhat Dissatisfied	No Opinion	Somewhat Satisfied	Very Satisfied
Force & Motion SciPack	○	○	○	○	○	○
Earth's Changing Surface SciPack	○	○	○	○	○	○
SciGuides (lesson plans)	○	○	○	○	○	○
Journal Articles	○	○	○	○	○	○
Podcasts	○	○	○	○	○	○
Web Seminar Archives	○	○	○	○	○	○
e-Book Chapters	○	○	○	○	○	○

11. How, if at all, has working through the NSTA Force & Motion SciPack affected your content knowledge in Force and Motion? (If you have yet to access this SciPack, please write N/A).

12. How, if at all, has working through the NSTA Earth's Changing Surface SciPack affected your content knowledge in Earth Science? (If you have yet to access this SciPack, please write N/A).

13. In what ways, if any, do you plan to incorporate what you have learned from the NSTA SciPacks in your classroom instruction?

14. What other comments would you like to provide about your experience with the NSTA SciPack Study?

Thank you for your feedback!

Appendix D:

Student Pre/Posttests

STUDENT INFORMATION SHEET

Houston SciPack Study

A company called Edvantia is conducting a study to look at how teachers in your school district teach science. Some teachers are getting training in different ways of teaching science. We at Edvantia are trying to find out whether this training helps teachers.

One part of our study involves giving students like yourself a short 20-minute science test to see how science students learn over time. This test is not part of your science grade—we just want to get an idea about how teachers in the school district teach science. We won't know what student filled out the tests because we won't have your name. We ask for your ID number only because we want to match the test you take now with a test you will take later in the year.

You may not know how to answer some of the questions. That's ok. You can either make your best guess or skip to the next question. When you have completed your test, place it in the envelope provided by your teacher. Your teacher will send all the tests to Edvantia; your teacher will not grade your test.

Thank you very much for your assistance!

Houston SciPack Study
Student Grade 5 Pretest

Student ID #: | | | | | |

(*Your teacher will provide your Student ID Number*)

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

Like this: ● Not this: ⊗ ✓

1. Some processes that shape Earth's surface are slow. Other processes are rapid.

   Which statement describes a rapid change?

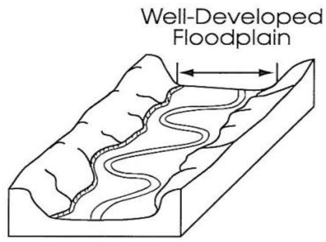
   ____ Glaciers melt and form rivers.
   ____ Wind weathers rocks into sand.
   ____ Earthquakes move land and rocks.
   ____ Rivers carry sediment and build deltas.

2. The prairie is ideal for the growth of grasses because it has rich topsoil. All of these processes help form topsoil **EXCEPT —**

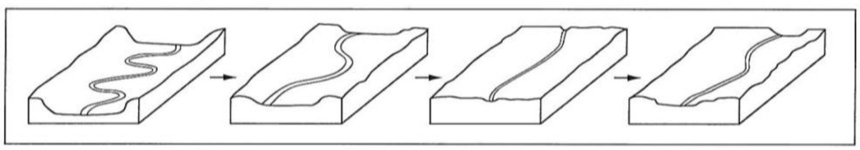
   ____ decay of trees
   ____ weathering of rocks
   ____ erosion of hills
   ____ movement of oceans

Continue to Next Page ➡

3. Over many years, a river changes how it flows. A young river flows rapidly down a shallow bed because it has not developed a floodplain. An old river has a large floodplain and flows slowly around many bends.



Which series shows a river from its youngest age to its oldest?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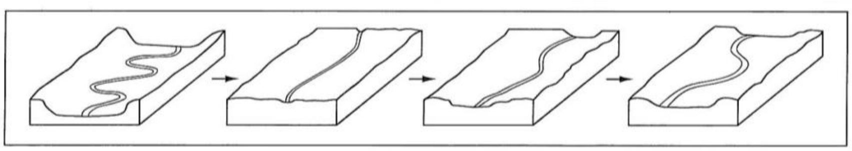
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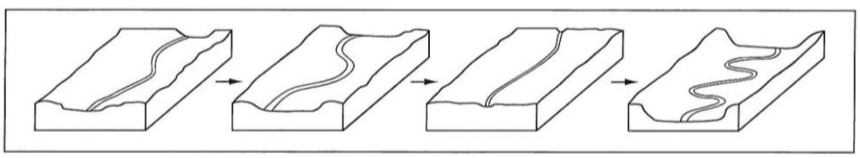
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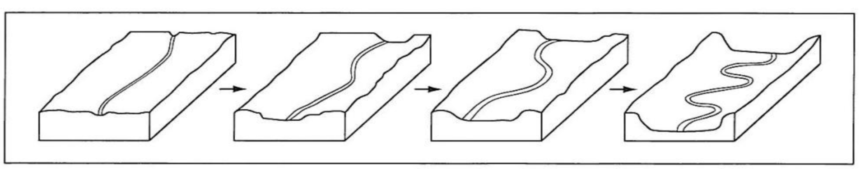

____

4. The energy that causes seawater to form water vapor comes from —

____ the clouds
____ underwater mountains
____ chemical reactions in the sea
____ the sun

Continue to Next Page ➡

____

5. Similar containers were filled with different types of soil. Holes were poked into the bottom of each container, and 300 milliliters of water were added. The water that dripped out was collected and measured. According to the information in the table, which type of soil retained water best?

Types of Soil	Amount of Water Collected (mL)
Potting soil	220
Sandy soil	250
Gravel	295
Clay	225

____ Potting soil
____ Sandy soil
____ Gravel
____ Clay

6. Which gas in the air would increase if a large number of trees were cut down?

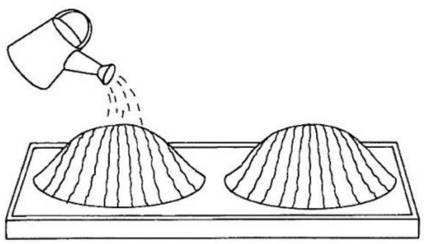
____ Carbon dioxide
____ Nitrogen
____ Oxygen
____ Water vapor

7. Tides on the Texas coast usually occur twice

____ daily
____ weekly
____ monthly
____ yearly

Continue to Next Page ➡

8. Which experiment would best show how different methods of plowing fields on a hill affect erosion?



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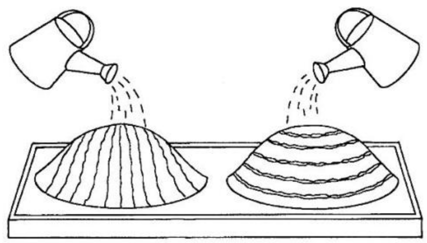

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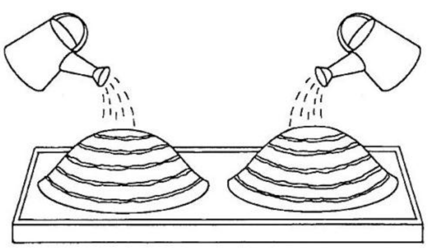

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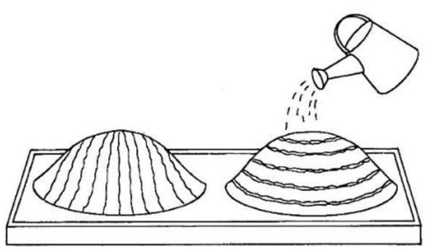

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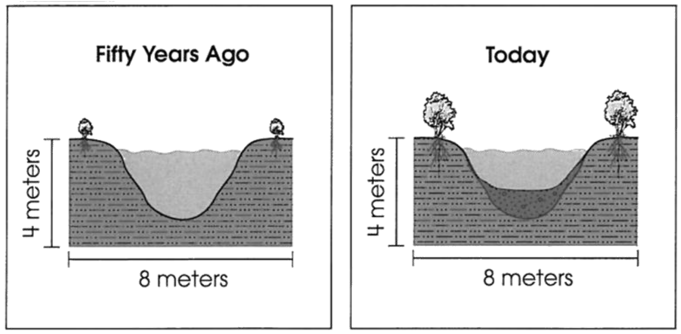
9. The diagrams below show what a river looked like fifty years ago and what it looks like today.



Which statement describes how a process acting slowly could have caused the river to become shallow over time?

____ A heavy rainfall raised the water level and flooded the river.
____ A glacier melted upstream and the water flowed into the river.
____ A large amount of soil was moved into the river during an earthquake.
____ A small amount of soil was deposited each time the river current slowed down.

10. Which of these best completes this chart?

Fossil Fuels	Alternative Energy Sources
Oil	Wood
Natural gas	Wind
?	Sun

____ Water
____ Soil
____ Coal
____ Sand

Continue to Next Page ➡

11. Which of these is a renewable resource?

____ Tree
____ Coal
____ Oil
____ Natural gas

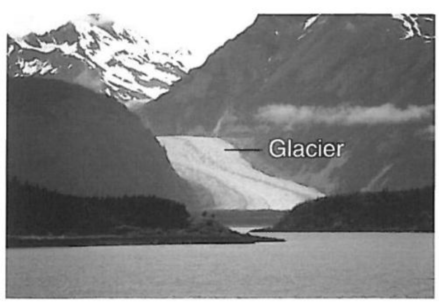
12. In which of these ways can volcanoes help build up new land?

____ By adding heat to Earth's surface
____ By adding gases to the atmosphere
____ By adding lava to Earth's surface
____ By adding water vapor to the atmosphere

13. Why are most fossils found in sedimentary rock?

____ Sedimentary rocks are not very old
____ Organisms live only in areas with sedimentary rock
____ Organisms can be preserved in sedimentary rock
____ Sedimentary rock are only found at the surface of the ground

14. The picture shows a kind of glacier that can be many meters thick. In this landscape, which of the following is most directly affected by this kind of glacier?



____ The average height of plants on the mountainside
____ The shape of clouds that form above the glacier
____ The average mass of trees near the lake
____ The shape of the valley between the mountains

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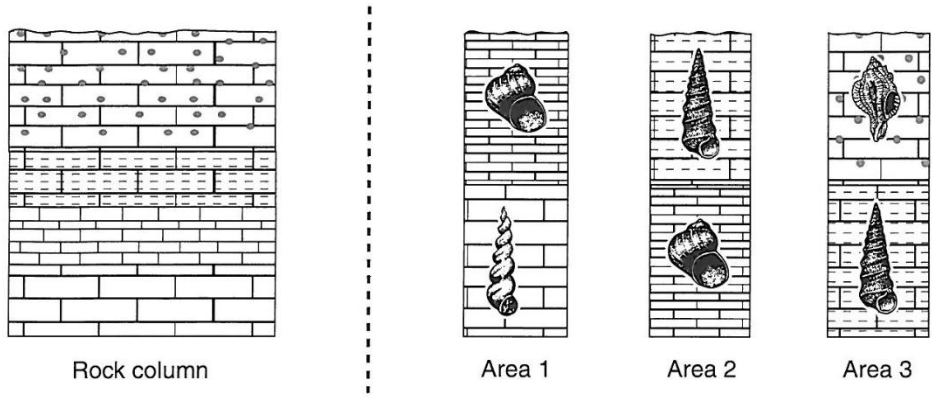
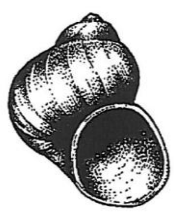


15. The rock column above shows the layers in a rock formation. The three diagrams above show the positions of fossils in different rock layers. According to this information, which fossil is the youngest?


____


____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____

16. Which of these can cause sharp, rough mountains to become rounded and smooth over time?

____ Wind and rain
____ The sun’s rays
____ Light and darkness
____ Earth’s magnetic field

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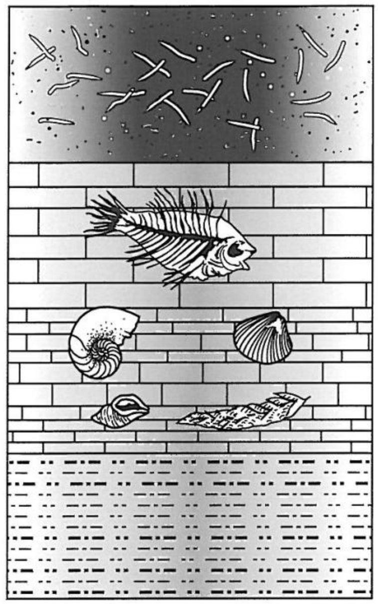
17. This diagram shows layers of soil and rock from below a forest floor. Which of these conclusions is best supported by the information found in this diagram?



____ A body of water once covered the area.
____ The forest was made up of oak trees.
____ Fish were the first animals in the area.
____ The area was planted with trees one year ago.

18. Rocks in the stream that the students were studying were smoother than rocks found in a nearby stream. The smoother rocks were most likely found in a stream where, over a long period of time, the water —

____ was deeper
____ appeared cloudy
____ was cold
____ moved faster

Thank you for your participation! Please place your completed assessment in the envelope provided by your teacher.

Adapted from CA State Standards Released Test Items Science 2009; TX Assessment of Knowledge and Skills Science Grade 5 2003, 2004, 2006, and 2008 Released Items; OH Achievement Tests Grade 5 Science Student Test Booklet May 2007, 2008, and 2009

STUDENT INFORMATION SHEET

Houston SciPack Study

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One part of our study involves giving students like yourself a short 30-minute science test to see how science students learn over time. This test is not part of your science grade—we just want to get an idea about how teachers in the school district teach science. We won't know what student filled out the tests because we won't have your name. We ask for your ID number only because we want to match the test you take now with a test you will take later in the year.

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Thank you very much for your assistance!

Houston SciPack Study

Student Grade 6 Pretest

Student ID #: | | | | | |

(***Your teacher will provide your Student ID Number***)

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

Like this: ● Not this: ⊗ ✓

1. Where is *most* of Earth's water located?

____ glaciers
____ lakes
____ oceans
____ rivers

2. Which of the following processes is responsible for changing liquid water into water vapor?

____ photosynthesis
____ condensation
____ evaporation
____ precipitation

3. The freezing and thawing action of water affects a rock by

____ transforming the rock into igneous rock
____ chemically changing the rock
____ gradually breaking down the rock into smaller pieces
____ leaving behind sedimentary particles from evaporated solutions

Continue to Next Page ➡

4. Moving water was the *most* important factor in forming which of these?

____ the Grand Canyon
____ San Andreas Fault
____ the Rocky Mountains
____ Mount St. Helens Volcano

5. What does a scientist *most likely* consider when studying the relative ages of rock layers in a canyon wall?

____ chemical weathering
____ current climate
____ amount of daily rainfall
____ Law of Superposition

6. In an area where a river has cut deep into Earth, there are several layers of very different rock exposed. The oldest rock layer is *most* likely to be the layer that is

____ below the other layers
____ the thickest layer
____ the most rich in fossils
____ igneous intrusive rock

7. The youngest rocks on the ocean floor are typically located near what feature?

____ a mid-ocean ridge
____ a continental shelf
____ an abyssal plain
____ a subduction trench

8. Which of the following areas is most likely to form metamorphic rocks such as gneiss and schist?

____ a sea floor
____ a windblown desert
____ a site deep underground
____ a site covered by a glacier

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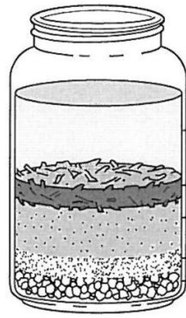

9. In the jar shown above, a sample of soil was mixed with water and then allowed to settle for 24 hours. The jar serves as a model for what process?

____ Evaporation of water from a muddy pond
____ Formation of soil from parent material
____ Deposition of sediment in a lake bed
____ Erosion of rock particles by water

10. Rivers, springs, and aquifers are all —

____ frozen in winter
____ human-made structures
____ located above ground
____ sources of fresh water

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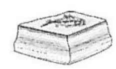
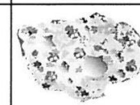
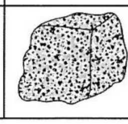
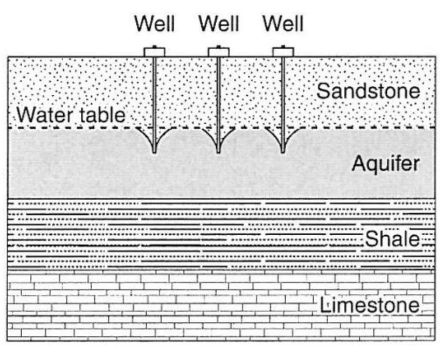
Rock Samples

Sample	Observations	Sketch
Limestone	• tiny grains arranged in layers • feels gritty • reddish tan or gray • has a fish fossil	
Conglomerate	• small rocks and pebbles of different colors stuck together • feels lumpy	
Obsidian	• looks like black glass • cannot see parts of other things • feels smooth	
Pumice	• light gray • has tiny holes like a sponge • very lightweight • feels very rough	
Granite	• tiny specks that are black, white and gray • specks are about the same size • feels rough	

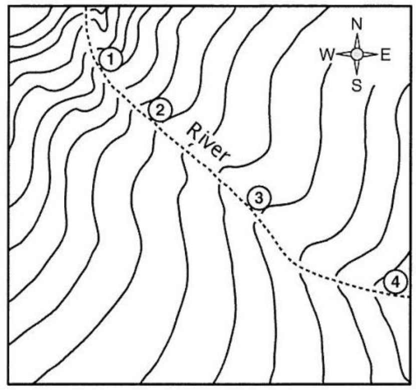
11. Sedimentary rocks have visible layers of small pieces of other rocks. Based on the information in the rock sample table, which is a sedimentary rock?

____ pumice
____ granite
____ obsidian
____ limestone



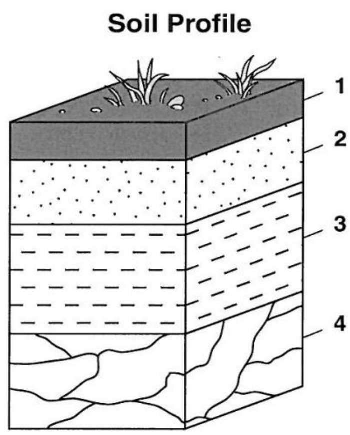
12. The three wells shown provide water for a growing city. What is the most likely effect on the system if six new wells are brought into production as the population increases?

____ The limestone layer will collapse.
____ The shale layer will shrink.
____ The aquifer will increase in volume.
____ The water table will drop.



13. The river shown on the topographic map flows fastest at point —

____ 1
____ 2
____ 3
____ 4



14. Which layer of soil profile would be affected the most by weathering and erosion?

____ 1
____ 2
____ 3
____ 4

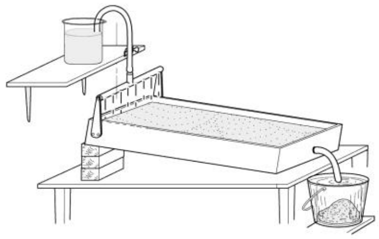


Table 1

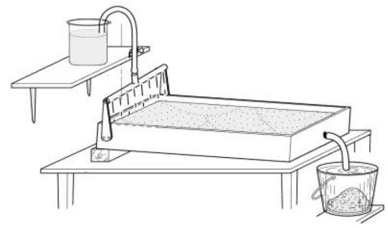


Table 3

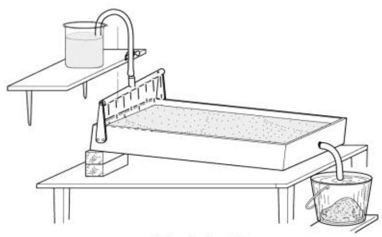


Table 2

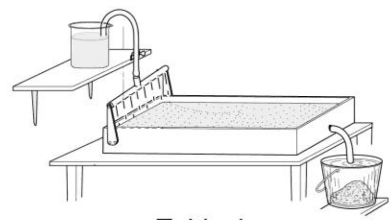


Table 4

Procedure

1. Construct 4 identical stream tables, using the same amount of sand in each table.
2. Angle each stream table as shown above.
3. Pour 1 liter of water from the same height onto each stream table.
4. Collect water and sand eroded from the table into the buckets.
5. Dry the eroded sand.
6. Measure the mass of the sand eroded from each table.
7. Record results.

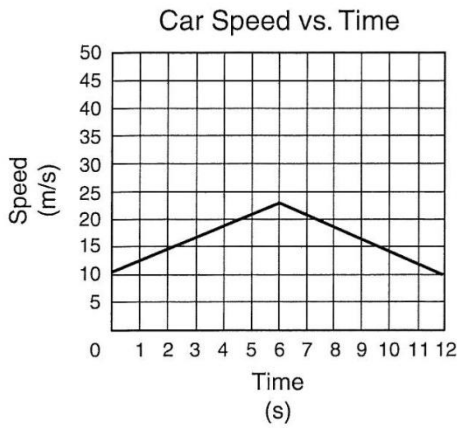
15. Students performed this experiment to test the effects of the slope of the stream table on the amount of sand eroded. What is the independent variable in this experiment?

____ slope of the tables

____ amount of sand eroded

____ volume of water collected in buckets

____ volume of water poured on the tables



16. The graph shows the speed of a car traveling east over a 12-second period on a flat surface. In the first 6 seconds shown on the graph, the car is —

____ increasing its speed
____ changing direction
____ heading northeast
____ gaining potential energy

17. To calculate an object's acceleration, you need to know

____ distance traveled and total time
____ starting point, end point, and the object's mass
____ starting velocity, final velocity, and time it takes to change velocity
____ average speed and distance traveled

18. Acceleration is a change in

____ speed
____ velocity
____ direction
____ All of the above

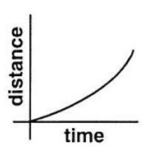
19. An example of acceleration is

____ a hovering helicopter
____ a car turning a corner
____ jogging at the same pace
____ bicycling at 40 m/s

20. The moving blades of a windmill are an example of

____ centripetal acceleration
____ positive acceleration
____ negative acceleration
____ deceleration

21. An object moves away from a motion detector with a constant speed. Which graph *best* represents the motion of the object?



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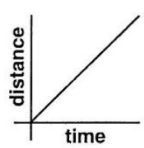

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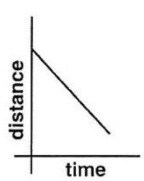

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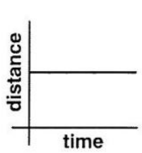
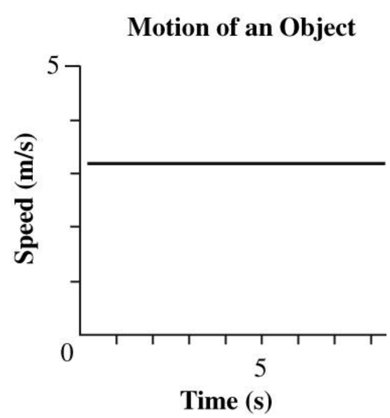


____

22. Friction is a force that

____ opposes an object’s motion
____ does not exist when surfaces are very smooth
____ decreases with larger mass
____ All of the above

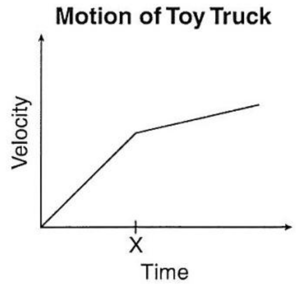
23. The motion of an object moving at a constant velocity was measured during a lab activity and is graphed below.



Which statement describes the forces most likely acting on the object?

____ Two opposite forces are unequal
____ The total of all forces equals zero
____ The forward force changes at a constant rate
____ The horizontal force is greater than the vertical force

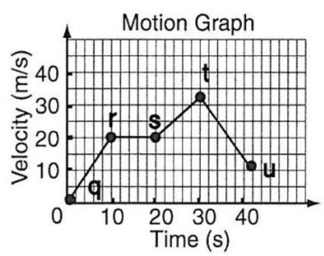
24. A student applied a constant force to a toy truck. A graph of the truck's movement is shown below.



Which of the following could *best* explain the change in velocity at time X?

____ The truck's momentum became greater than its inertia.
____ The truck went from moving in a straight path to moving in a curved path.
____ The truck began traveling up a slight sloped surface.
____ The truck went from rolling on a rough surface to rolling on a polished surface.

25. The graph below shows the velocity of a car that is moving in a straight line.



During which of the following intervals are forces on the car balanced?

____ q to r
____ r to s
____ s to t
____ t to u

26. A force

____ is expressed in newtons
____ can cause an object to speed up, slow down, or change direction
____ is a push or a pull
____ All of the above

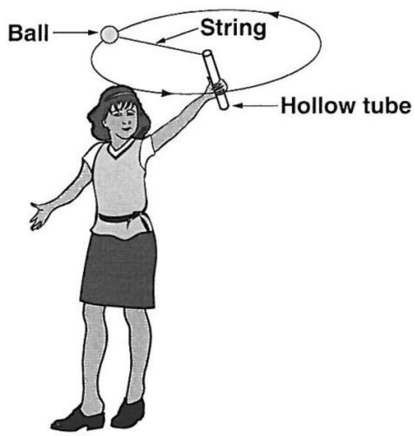
27. The planets are held in their orbits by _____ forces.

____ balanced
____ unbalanced
____ centrifugal
____ centripetal

28. Newton's law of universal gravitation describes the relationships between all of the following EXCEPT

____ Distance
____ Mass
____ Heat
____ Gravitational force

29. Using a string, a ball, and a hollow tube for a handle, Latanya makes the model shown below. Holding the handle's center, she swings the ball in a circle to show how a planet orbits a star. She knows that the orbit of a planet depends upon the gravitational pull of the star.



Which model component illustrates the effect of gravity?

____ the ball
____ the string
____ the handle
____ the rotation direction

30. A student places a ball on the ground and kicks it. The ball moves along the ground. Why does the ball move?

____ The kick decreases the weight of the ball.
____ The kick applies a contact force to the ball.
____ The kick decreases the force of gravity acting on the ball.
____ The kick removes friction between the ball and the ground.

Thank you for your participation! Please place your completed assessment in the envelope provided by your teacher.

Adapted from CA State Standards Released Test Items (Earth Science/Physics/Science); NC Testing Program EOG Grade 8 Sample Items 2007; Grade 8 Science and Technology/Engineering Test 2006-2007 Released Items; OH Achievement Tests Grade 5 Science Student Test Booklet May 2007; VA Standards of Learning End of Course Earth Science Spring 2007 Released Test; OK School Testing program Sample Assessment Items for Grade 8 Science, 2006; TX Assessment of Knowledge and Skills Science Grade 8 2008 Released Items; FL Comprehensive Assessment Test Grade 8 Science Sunshine State Standards; Holt Science and Technology

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Houston SciPack Study

Student Grade 7 Pretest

Student ID #: | | | | | |

(***Your teacher will provide your Student ID Number***)

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

Like this: ● Not this: ⦻ ✓

1. Which process is *most* responsible for the formation of the Grand Canyon?

____ scouring by continental glaciers
____ erosion by wind and water
____ eruptions by explosive volcanoes
____ cracking of Earth's crust by earthquakes

2. Some processes that shape Earth's surface are slow. Other processes are rapid. Which statement describes a rapid change?

____ Glaciers melt and form rivers.
____ Wind weathers rocks into sand.
____ Earthquakes move land and rocks.
____ Rivers carry sediment and build deltas.

3. What best explains how soil is built up in a flood plain?

____ farmers add fertilizer which add new soil
____ plants break down into compost which makes soil
____ sediment is deposited by rivers during floods
____ soil gets used up and the land becomes a desert

Continue to Next Page ➡

4. In what location along the river is erosion most likely to be the greatest?

____ widest part
____ flattest part
____ place with the fastest flow
____ place with the fewest rocks

5. What is responsible for shaping this arch?

____ plate tectonics
____ earthquakes
____ deposition
____ erosion

6. Earthquake vibrations are detected, measured, and recorded by instruments called

____ sonargraphs
____ seismographs
____ Richter scales
____ magnetometers

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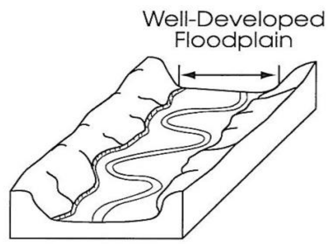
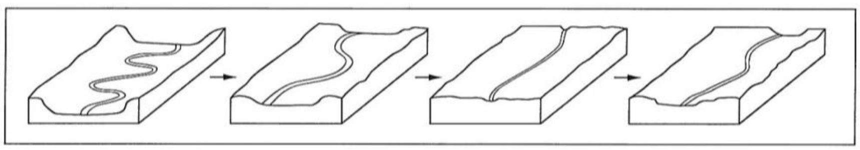
7. Over many years, a river changes how it flows. A young river flows rapidly down a shallow bed because it has not developed a floodplain. An old river has a large floodplain and flows slowly around many bends.



Which series shows a river from its youngest age to its oldest?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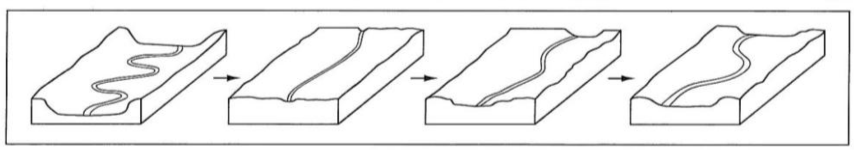
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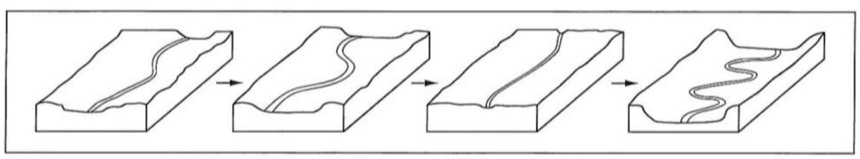
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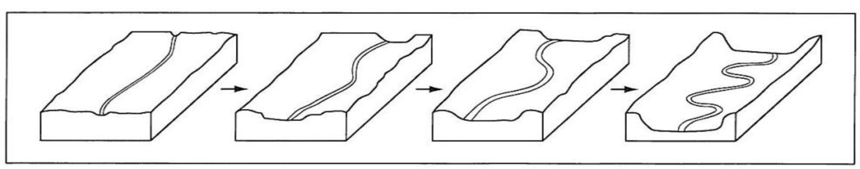
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8. Which provides the best evidence for the theory that some faults and volcanoes are results of tectonic plate interactions?

____ Faults on tectonic plates are in constant motion, but volcanoes may not erupt for many years.
____ Faults and volcanoes existed long before there were tectonic plates.
____ Tectonic plates that have many faults do not usually have volcanoes.
____ Faults and volcanoes are often found at tectonic plate boundaries.

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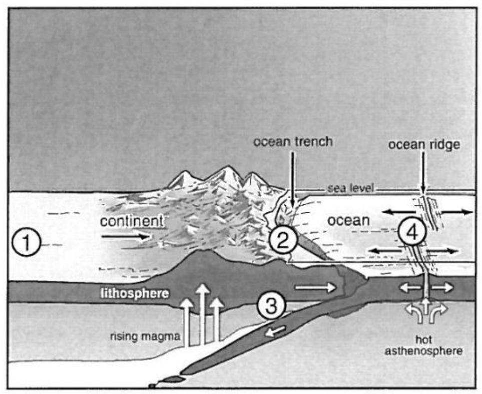
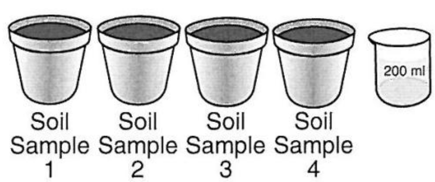
9. Dramatic variations in the polar ice caps most likely suggest changes in —

____ the Moon's orbit
____ Earth's climate
____ ebb and flow of tides
____ global water consumption



10. At which location would earthquakes be *least* likely to occur?

____ 1
____ 2
____ 3
____ 4



11. To find out which soil absorbs (holds) moisture best, each container shown must —

____ be made of a different material
____ have soil from the same place
____ be tested by the same person
____ contain the same amount of soil

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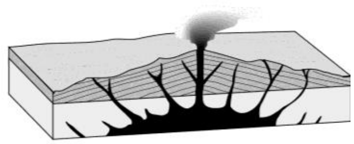
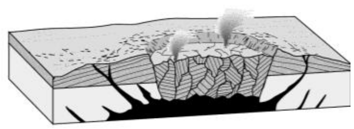
A.



B.



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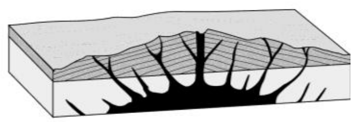

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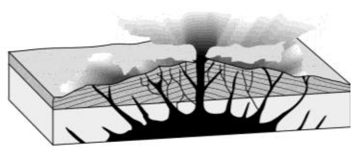

12. Which list identifies the order of events that formed a volcanic crater?

____ C B D A
____ B A C D
____ C A D B
____ D B A C

13. The Richter scale measures which of the following earthquake characteristics?

____ intensity
____ magnitude
____ frequency
____ probability

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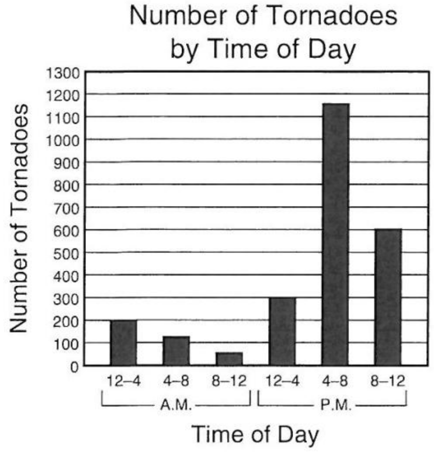
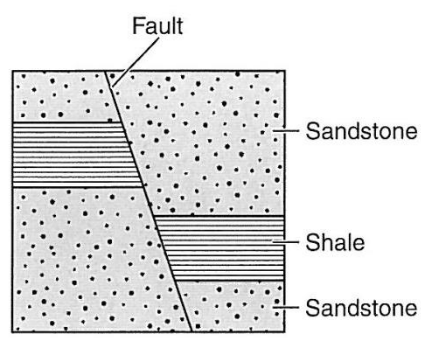


14. A student prepared this graph of tornadoes reported over a 50-year period in a midwestern state. Which statement is supported by these data?

____ Tornadoes are less frequent in the morning.
____ Darkness increases the strength of tornadoes.
____ Tornadoes occurring at night are brief.
____ The probability of a tornado is the same throughout the day.



15. The shale layers in the drawing were broken and separated by movement along the fault. What also most likely occurred as these rock layers moved along the fault?

____ Formation of deep caves
____ Erosion of lower layers
____ Volcanic eruption
____ Earthquake

Continue to Next Page ➡

16. A student riding her bicycle on a straight, flat road covers one block every 7 seconds. If each block is 100 m long, she is traveling at

____ constant speed
____ constant velocity
____ 10 m/s
____ Both A and B

17. How much time will it take for a person to walk the length of a football field (100 yards) at a constant speed of 5 ft/s?

____ 20 seconds
____ 33 seconds
____ 60 seconds
____ 166 seconds

18. The figure shows a block that is being pulled along the floor. According to the figure, what is the acceleration of the block?

____ $2 \frac{m}{s^2}$
____ $3 \frac{m}{s^2}$
____ $4 \frac{m}{s^2}$
____ $6 \frac{m}{s^2}$

Continue to Next Page ➡

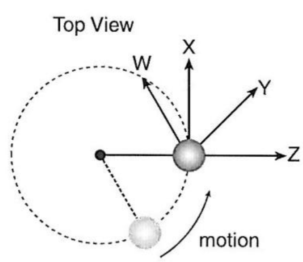
19. A satellite that is moving in a circular orbit around Earth and maintaining a constant speed will experience a

____ changing gravitational force toward Earth
____ net gravitational force toward Earth
____ changing acceleration away from Earth
____ net acceleration away from Earth

20. Objects on the surface of Earth experience a large downward force although the universal gravitational constant is very small. Which of the following best explains this phenomenon?

____ Objects on Earth's surface exert a gravitational pull as strong as Earth's, regardless of the gravitational constant.
____ The universal gravitational constant only describes relationships between small objects in outer space.
____ Earth's mass is large enough that its gravity remains strong even when multiplied by a small constant.
____ The universal gravitational constant increases in proportion with the mass of an object.

21. A ball on a rope swings around a vertical pole.



In which direction will the ball fly if released at the location shown?

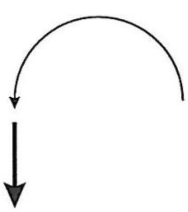
____ W
____ X
____ Y
____ Z

Continue to Next Page ➡

22. The gravitational force of the Earth in relation to the gravitational force of everything else on Earth represents a(n) ____ that causes everything to fall toward the center of the Earth.

____ unbalanced force
____ balanced force
____ centrifugal force
____ centripetal force

23. The picture shows the circular path of a toy plane being swung around on a string. What path would the toy take if the string broke?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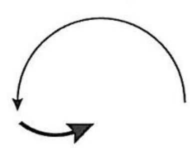
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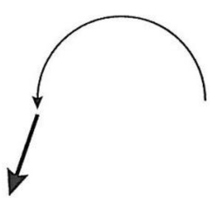
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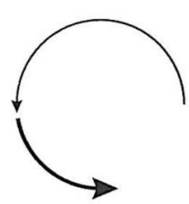
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24. If three balls of different materials were dropped at the same time from the same height, which would hit the ground first? (Assume there is no air resistance.)

____ a tennis ball
____ a solid rubber ball
____ a solid steel ball
____ they would all hit at the same time

25. According to Newton's first law of motion, a moving object that is not acted on by an unbalanced force will

____ remain in motion
____ eventually come to a stop
____ transfer its energy to another object
____ accelerate in the absence of friction

26. The principal's chair has wheels. It sits on her office floor next to her desk. She pulls the chair away from her desk.

What makes the chair move?

____ the force of gravity on the chair
____ the force of her pull on the chair
____ friction between her hand and the chair
____ friction between the wheels and the floor

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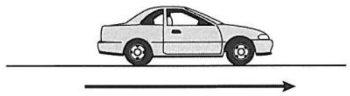
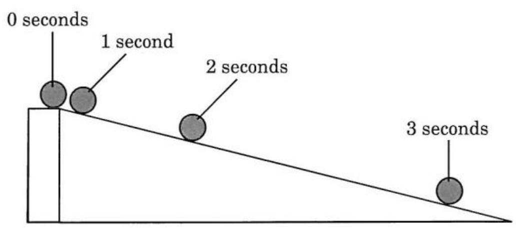


27. To describe this car's motion, a student should use its ___

___ direction and speed
___ mass and volume
___ speed and color
___ volume and direction

28. This diagram shows a ball rolling down an inclined plane. The position of the ball is labeled for each second it travels.



Which *best* describes the motion of the ball?

___ getting faster each second
___ getting slower each second
___ maintaining the same motion
___ constantly changing direction

29. Which *best* describes how forces must interact for a kite to sail up into the air?

___ The force of gravity must be equal to the force of the wind.
___ The force of gravity must be greater than the force of the wind.
___ The force of the wind must be greater than the force of gravity.
___ The force of the person flying the kite must be equal to the force of the wind.

Continue to Next Page ➡

30. Which force causes a moving object to slow and then stop?

___ acceleration
___ inertia
___ friction
___ lift

Thank you for your participation! Please place your completed assessment in the envelope provided by your teacher.

STUDENT INFORMATION SHEET

Houston SciPack Study

A company called Edvantia is conducting a study to look at how teachers in your school district teach science. Some teachers are getting training in different ways of teaching science. We at Edvantia are trying to find out whether this training helps teachers.

One part of our study involves giving students like yourself a short 30-minute science test to see how science students learn over time. This test is not part of your science grade—we just want to get an idea about how teachers in the school district teach science. We won't know what student filled out the tests because we won't have your name. We ask for your ID number only because we want to match the test you take now with a test you will take later in the year.

You may not know how to answer some of the questions. That's ok. You can either make your best guess or skip to the next question. When you have completed your test, place it in the envelope provided by your teacher. Your teacher will send all the tests to Edvantia; your teacher will not grade your test.

Thank you very much for your assistance!

Houston SciPack Study
Student Grade 8 Pretest

Student ID #: | | | | | |

(***Your teacher will provide your Student ID Number***)

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case and then fill in the corresponding oval on the answer sheet.

Like this: ● Not this: ⦻ ✓

1. Dramatic variations in the polar ice caps most likely suggest changes in —

____ the Moon's orbit
____ Earth's climate
____ ebb and flow of tides
____ global water consumption

2. Identical rock types, identical fossils, and very similar mountain ranges are found on different continents that are separated by a wide ocean. Which of these best explains these observations?

____ Organisms traveled between these continents on land bridges.
____ The same forces erode mountains in different locations.
____ These continents were joined together at one time in the past.
____ Some rock types are very common and are found everywhere.

3. An earthquake occurs when the tectonic plates below Earth's surface suddenly shift. These shifts of the tectonic plates are caused by

____ movements in Earth's core
____ movements in Earth's mantle
____ deposition of sediments
____ eruption of volcanoes

Continue to Next Page ➡

4. Which of these describe the most common way that material is added to a continental shelf?

____ Evaporation from continental watersheds
____ Deposition of continental sediments
____ Eruption of continental volcanoes
____ Subduction of continental plates

5. Which of the following provides evidence for plate tectonics?

____ sea-floor topography
____ ocean currents
____ Coriolis effect
____ atmospheric temperatures

6. Which of the following processes will change a sedimentary rock into an igneous rock?

____ melting and crystallization
____ erosion and deposition
____ deformation and deposition
____ faulting and fracturing

Continue to Next Page ➡

7. Which of the following areas is most likely to form metamorphic rocks such as gneiss and schist?

____ a sea floor
____ a windblown desert
____ a site deep underground
____ a site covered by a glacier

8. A rift valley is evidence of which kind of plate boundary?

____ convergent
____ divergent
____ transform
____ uniform

9. Permanent deforestation can contribute to potential global warming by

____ decreasing atmospheric CO_2 levels
____ increasing atmospheric CO_2 levels
____ decreasing atmospheric N_2 levels
____ increasing atmospheric N_2 levels

10. Which of the following statements best explains why earthquakes occur more frequently on the West Coast of the United States than on the East Coast?

____ The rock found on the West Coast is igneous, but the rock found on the East Coast is sedimentary.
____ The West Coast is located on the boundary of two crustal plates, but the East Coast is not.
____ The rock under the West Coast is soft, but the rock under the East Coast is hard.
____ The west coast is located on a continental plate, but the east coast is not.

Continue to Next Page ➡

Table of Geologic Time

Era	Period	Years Before the Present
Cenozoic	Quaternary	recent – 2 million
	Tertiary	2 – 65 million
Mesozoic	Cretaceous	65 – 136 million
	Jurassic	136 – 190 million
	Triassic	190 – 225 million
Paleozoic	Permian	225 – 280 million
	Carboniferous	280 – 345 million
	Devonian	345 – 395 million
	Silurian	395 – 430 million
	Ordovician	430 – 500 million
	Cambrian	500 – 570 million
Precambrian		570 million – 4.6 billion

11. Rocks found on land are up to 3.8 billion years old, but those in the ocean are no more than 180 million years old. Using the information shown, during which era could parts of the ocean floor have formed?

____ Triassic
____ Paleozoic
____ Precambrian
____ Mesozoic

12. What energy resource is made possible by volcanic activity?

Ⓐ hydroelectricity
Ⓑ nuclear power
Ⓒ geothermal energy
Ⓓ solar energy

Continue to Next Page ➡

13. Which of the following is *most* responsible for the formation of new crust at the edge of a tectonic plate?

____ mountain building at a continent-continent convergent boundary
____ magma rising up from the mantle at a divergent boundary
____ two tectonic plates sliding past one another at a transform boundary
____ subduction of one oceanic plate under another at a convergent boundary

14. Which type of volcano would be the *least* explosive?

____ cinder cone
____ strato volcano
____ shield volcano
____ composite cone

15. Landslides are caused by a combination of environmental factors, such as heavy precipitation, and geologic factors, such as

____ karst topography and poor drainage
____ crust folding and artesian springs
____ reverse faulting and perched water tables
____ steep topography and unstable soil structure

16. A small car is being driven in a circular path at constant speed on a horizontal surface. What is the direction of the frictional force that keeps the car from skidding as it travels along this path?

____ opposite the direction of the velocity of the car
____ in the same direction as the velocity of the car
____ toward the center of the circle
____ outward from the center of the circle

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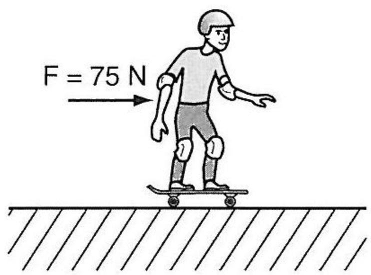
17. A car traveling 20 m/s south enters a new highway going east at 20 m/s. The car has

____ decreased its distance
____ changed its speed
____ accelerated
____ not changed its velocity



18. A 50-kg child on a skateboard experiences a 75-N force as shown. What is the expected acceleration of the child?

____ 0.67 m/s^2
____ 1.50 m/s^2
____ 6.70 m/s^2
____ 25.00 m/s^2

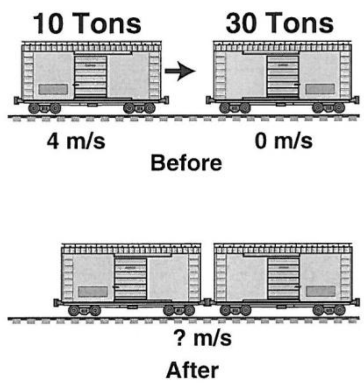
19. A student does an experiment to measure the acceleration of a falling object, which is 9.8 m/s^2. The student obtains an experimental value of 14.6 m/s^2. The reason for this variation is *most* likely due to

____ human error
____ air resistance
____ local fluctuation in gravity
____ the mass of the object

Continue to Next Page ➡

20. A cheetah runs eastward at a velocity of 27 m/s. Two seconds later, it tackles its prey to the ground. What is the cheetah's acceleration?

____ 27 m/s eastward
____ 27 m/s/s eastward
____ 13.5 m/s eastward
____ -13.5 m/s/s eastward



21. When these two freight cars of different mass collide and couple, what will be their resultant velocity?

____ 1 m/s
____ 2 m/s
____ 4 m/s
____ 8 m/s

22. You have made a house of cards on top of your table. Suddenly, a gust of wind blows through an open window and your house of cards comes tumbling down. The wind applied _____ to your house of cards.

____ friction
____ a balanced force
____ an unbalanced force
____ a gravitational force

Continue to Next Page ➡

23. A student places a ball on the ground and kicks it. The ball moves along the ground. Why does the ball move?

____ The kick decreases the weight of the ball.
____ The kick applies a contact force to the ball.
____ The kick decreases the force of gravity acting on the ball.
____ The kick removes friction between the ball and the ground.

24. A student attempts to measure the mass of a brick by measuring the force required to accelerate it at 1 m/s^2 on a level surface. The force required is 2N, and the student concludes that the brick has a mass of 2 kg. A balance shows that the mass of the brick is really 1.5 kg. The experiment error is most likely due to

____ gravity
____ work
____ friction
____ inertia

25. A 10-newton force and a 15-newton force are acting from a single point in opposite directions. What additional force must be added to produce equilibrium?

____ 5 N acting in the same direction as the 10-N force
____ 5 N acting in the same direction as the 15-N force
____ 10 N acting in the same direction as the 10-N force
____ 25 N acting in the same direction as the 15-N force

26. A soccer player kicks a 0.5-kilogram stationary ball with a force of 50 newtons. What is the force on the player's foot?

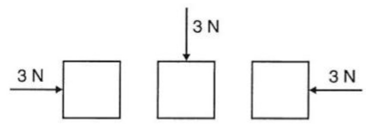
____ 0 N
____ 25 N
____ 50 N
____ 100 N

Continue to Next Page ➡

27. A temporary force acting on a 2-kg object traveling at a velocity of 5 m/s causes the object to slow to a velocity of 2 m/s. What was the decrease in momentum of the object?

____ 4 kg m/s
____ 5 kg m/s
____ 6 kg m/s
____ 7 kg m/s

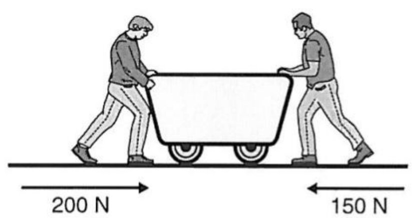
28. A force is acting on each of the objects below.



What can be concluded about these forces?

____ They are the same because they point toward the objects.
____ They are the same because they have the same magnitude.
____ They are different because they have different magnitudes.
____ They are different because they have different directions.

29. Two students are pushing a cart, as shown below



The cart will move as if it were acted on by a single force with a magnitude of

____ 50 N
____ 150 N
____ 200 N
____ 350 N

Continue to Next Page ➡

30. A force of 5 N is required to increase the speed of a box from a rate of 1.0 m/s to 3.0 m/s within 5 s along a level surface. What changes would most likely require additional force to produce the same results?

____ reduce the mass of the box

____ increase the mass of the box

____ make the surfaces of the box smooth

____ make the surface of the floor smooth

Thank you for your participation! Please place your completed assessment in the envelope provided by your teacher.

Adapted from CA State Standards Released Test Items (Earth Science/Physics/Science); NC Testing Program EOG Grade 8 Sample Items 2007; Grade 8 Science and Technology/Engineering Test 2006-2007 Released Items; OH Achievement Tests Grade 5 Science Student Test Booklet May 2007; VA Standards of Learning End of Course Earth Science Spring 2007 Released Test; OK School Testing program Sample Assessment Items for Grade 8 Science, 2006; TX Assessment of Knowledge and Skills Science Grade 8 2008 Released Items; FL Comprehensive Assessment Test Grade 8 Science Sunshine State Standards; Holt Science and Technology

Edvantia, 8/21/09

Appendix E:

Teacher Pre/Post Assessment

Subject: Earth’s Changing Surface

Test Id: 50

Test Name: Pilot: Earth’s Changing Surface

Question Id	Question	Correct Answer
648	Heat from within Earth comes from two primary sources. Which of the following represents one of these sources?	Radioactive decay of elements in the earth
654	Which of the following best represents a process that can dramatically change the shape of the earth’s surface in a relatively long amount of time?	Tectonic Uplift
659	The formation of the Grand Canyon is a dramatic example of Earths changing surface. Would the agent of change that led to formation of the Grand Canyon be classified as constructive or destructive?	Destructive
660	The formation of the Mississippi River delta is a clear example of Earths changing surface. Would the agent of change that led to the formation of the Mississippi River delta be classified as constructive or destructive?	Constructive
652	In which of the following regions will you observe the least number of mountains or mountain ranges?	At the border of transform faults
653	Which of the following best represents a process that can dramatically change the shape of the earth’s surface in a relatively short amount of time?	Volcanic eruption
646	Which of the following statements about the features of divergent boundaries is correct?	They occur on oceans and continents, adding an average of 3 cm per year of new crust to the lithosphere along both sides of the boundary.
647	When the border of an oceanic plate collides with a continental plate, the oceanic plate generally sinks under the continental crust in a process called subduction. Which type of boundary defines a subduction zone?	Convergent Boundary
649	Heat from within Earth comes from two primary sources. Which of the following represents one of these sources?	Gravitational energy left over from the formation of the
650	In general, what is the cause of earthquakes and volcanoes that occur along plate boundaries	The relative movement and interaction of plates
651	This image depicts the Mid-Atlantic Ridge, a divergent plate boundary. Which of the following statements best described the geologic phenomena you would expect to find associated with the Mid-Atlantic Ridge?	Formation of a mountain range, new crust, and earthquake activity
658	Which of the following best represents an example of chemical weathering/erosion?	Iron minerals in some rocks react with oxygen, producing rust that weathers relatively quickly

Question Id	Question	Correct Answer
664	Because of human activity, the amount of sediment discharged by the Mississippi river today is only about 50% of its historical value. With less sediment discharged by a river, which of the following changes will most likely occur?	The river delta will be reduced in size
665	In many cases, human activity does not create new processes affecting changes in the environment; rather, such activity causes changes in the rate and scale of natural processes that affect the environment. Which of the following best illustrates this point?	Deforestation can lead to an increase in the natural rate of erosion, depositing an increase in the amount of sediment deposited in streams and rivers.
663	Due to human activities, the rate of soil erosion in modern times is estimated to be 2-3 times higher than the natural rate. Which of the following human activities has the largest impact on the rate of soil erosion?	Clearing land for agriculture
656	Generally speaking, the erosion caused by wind is slower and less powerful than erosion caused by moving water because...	Air is less dense than water
661	All of the following geologic processes can be affected by human activities. Which of the following geologic processes is least likely to be affected by human activity?	
662	All of the following geologic processes can be affected by human activities. Which of the following geologic processes is most likely to be affected by human activity?	Sinking of river deltas
655	Which of the following factors most likely has the biggest impact on the rate at which a stream will erode the environment through which it flows (its channel)?	The velocity of the water moving in the stream
657	Which of the following best represents an example of physical weathering/erosion?	A trees roots grows into the cracks of large rocks and splits the rock into smaller pieces
666	In many cases, human activity does not create new processes affecting changes in the environment; rather, such activity causes changes in the rate and scale of natural processes that affect the environment. Which of the following best illustrates this point?	An increase in the amount of greenhouse gasses emitted into the atmosphere may be causing an increase in global temperatures because more of the heat naturally radiating from the surface of the earth is being trapped in the atmosphere.

Subject: Force and Motion

Test Name: Pilot: Force and Motion

1. Which of the following best defines the term speed?

- **A measure of how fast something is moving, with no description of the direction in which it's moving.**
- A measure of where an object is, specified as a distance from some reference point and an angle with respect to some reference line.
- A measure of how fast an object is moving, coupled with information about the direction in which the object is moving.
- A measure of how fast an object's velocity is changing.

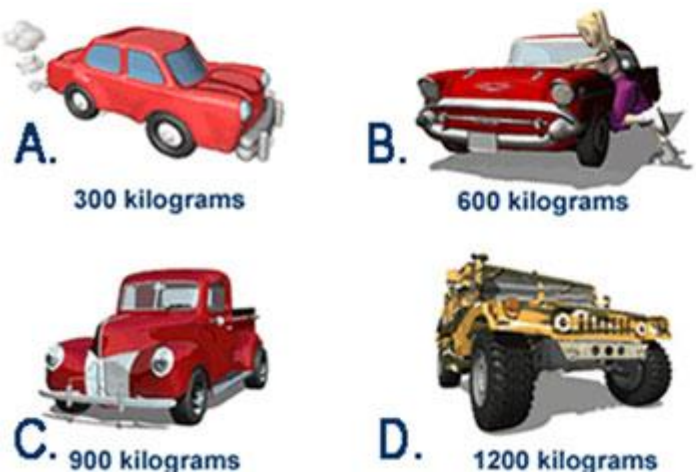
2. Which of the following best defines the term velocity?

- A measure of how fast an object's velocity is changing.
- A measure of where an object is, specified as a distance from some reference point and an angle with respect to some reference line.
- A measure of how fast something is moving, with no description of the direction in which it's moving.
- **A measure of how fast an object is moving, coupled with information about the direction in which the object is moving.**

3. You are sitting by the side of a country road, and a car comes speeding along. Suddenly it stops in front of you for just a second, then speeds off again in the same direction, going faster and faster as it disappears from view. Which of the following is true regarding the car's motion?

- Its average speed during the motion was equal to zero.
- Its instantaneous speed was never equal to zero.
- Its instantaneous velocity changed direction during its motion.
- **Its average speed was never equal to zero.**

4. Pictured below are four cars. Each car has the same-size engine, and therefore can produce the same forward force. The cars have different masses, as indicated on the drawing. Each car has a driver whose mass is 80 kilograms. We're going to add passengers. Each passenger has a mass of 100 kilograms. To the car A we'll add five passengers, to the car B we'll add one passenger, to the car C we'll add two passengers, and to car D we'll add no passengers. Which car will have the smallest acceleration?



- Car - A
- They will all have the same acceleration
- **Car - D**
- Car - C
- Car - B

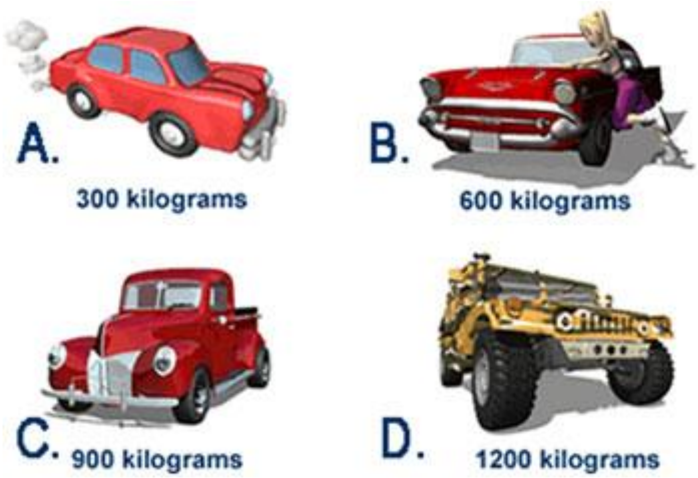
5. Newton’s third law supports which of the following statements?

- If an object has enough mass, it does not necessarily obey Newton’s third law.
- Whenever one object exerts a force on another object, the second object will definitely move.
- **Whenever two objects interact, any force one object exerts on the other object is exerted back on the first object**.
- Objects in action-reaction pairs are exerted at different times. It depends on which force is exerted first.

6. Newton's second law is summarized in the equation F=ma. Which of the following is true regarding this equation?

- To use this equation, you need to add all the forces together numerically, ignoring direction, before knowing what to put in for F.
- **To use this equation, you need to add all the forces together, accounting for different directions, before knowing what to put in for F.**
- It's impossible to get any information from this equation until you know, ahead of time, exact values for F, m, and a.
- To figure this out, you need to evaluate F=ma for each separate force acting on an object, and then average the results.

7. Pictured below are four cars. Each car has the same-size engine, and therefore can produce the same forward force. The cars have different masses, as indicated on the drawing. Each car has a driver whose mass is 80 kilograms. Prior to adding any passengers, the cars will have different accelerations when the driver pushes the accelerator all the way down. Which car will have the largest acceleration?



- **Car - A**
- They will all have the same acceleration
- Car - D
- Car - C
- Car - B

8. Which of the following is true regarding Newton’s first law?

- Newton’s first law applies only if friction forces are present.
- You must consider only forces acting in the direction of the change in motion when applying Newton’s first law.
- You must consider all of the forces acting on something when applying Newton's first law.
- Newton’s first law applies only if no friction forces are present.

9. What would happen to the objects on the surface of the Earth if the Earth suddenly stopped spinning and came to a halt?

- The spinning of the Earth has nothing to do with objects attached to it.
- A push from the Earth's surface will stay with objects, so they will be pushed out into space.

- **Because every object on Earth has inertia, those objects will continue moving when the Earth stops spinning, most likely leading to quite a bit of destruction.**

- Because every object on Earth has inertia, those objects will stop along with the Earth.

10. Which of the following best defines the term acceleration?

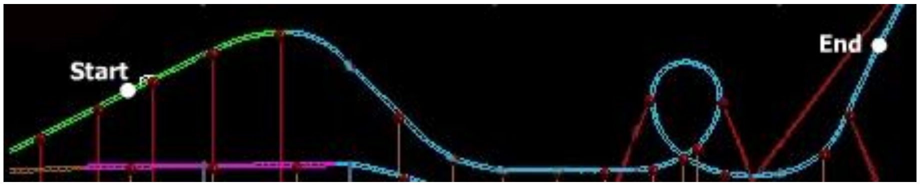
- **A measure of how fast an object's velocity is changing.**

- A measure of how fast something is moving, with no description of the direction in which it's moving.

- A measure of how fast an object is moving, coupled with information about the direction in which the object is moving.

- A measure of where an object is, specified as a distance from some reference point and an angle with respect to some reference line.

11. Shown below is a side-view diagram of a roller coaster simulation. This diagram represents the path a roller coaster car would travel on the simulated track, starting at the "START" label. The green portion reflects the portion of the roller coaster journey where a chain pulls the car up to the top of the hill. At the end of its forward motion, the car stops and goes backward. Consider that end point. Let's assume that the horizontal distance from the starting point of the car (START) to where it turns around (END) is 200 meters. Using an angle and a distance, what is the approximate position of the car from the starting point when it stops and goes backward?



- **About 200 meters from the start, at an angle of about 5 degrees with the horizontal**.

- About 210 meters from the start, at an angle of about 5 degrees with the horizontal.

- About 210 meters from the start, at an angle of about 5 degrees with the vertical.

- About 200 meters from the start, at an angle of about 5 degrees with the vertical.

12. You apply a very small force, say 0.001 newtons, to a very large truck, with a mass of 2000 kilograms. What can you say for sure about what will happen to the truck?

- The truck will not move because small forces cannot move large objects.

- The truck will accelerate (move from rest to motion) as long as the small applied force is large enough to overcome the inertia of the truck.

- An extremely small force can never accelerate such a large truck. The truck will not move under any circumstance.

The truck will accelerate (move from rest to motion) as long as that tiny force is larger than any force of friction that opposes it.

13. Violent collisions are part of the game of football. Fines for dangerous hits aside, which of the following is true with respect to these collisions?

A defensive player running at full speed and hitting a running back will hit that running back with a greater force than any force the defensive player gets in return.

If a running back has a full head of steam, then whoever tackles that running back is going to get hit with a greater force than the running back receives.

No matter who is hitting or who is getting hit, each player in a collision receives the same force.

It's all about metaphysics. If you are in touch with the universe, you will never get hit very hard. Karma.

Appendix F:

SciPack Final Assessment

ECS Final Assessment

1.

The motion of Earth's plates is driven by ________________.

- ○ solar energy
- ○ gravity
- ○ tectonic activity
- ○ mantle convection

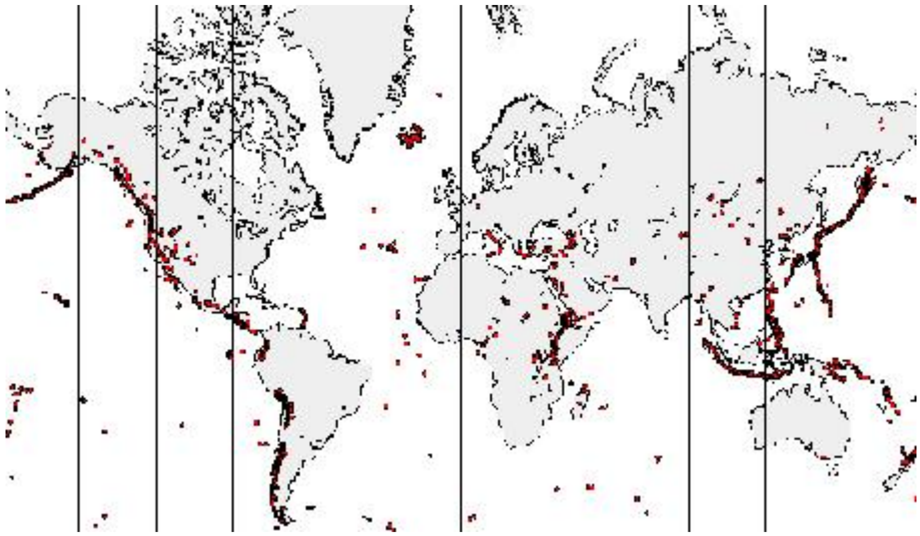
2.

Which processes contributed to heat up Earth in its early history? Check all that apply.

- ☐ uneven heating from the Sun
- ☐ volcanic eruptions
- ☐ collisions with space debris
- ☐ gravitational contraction
- ☐ variations in Earth's orbit

3.

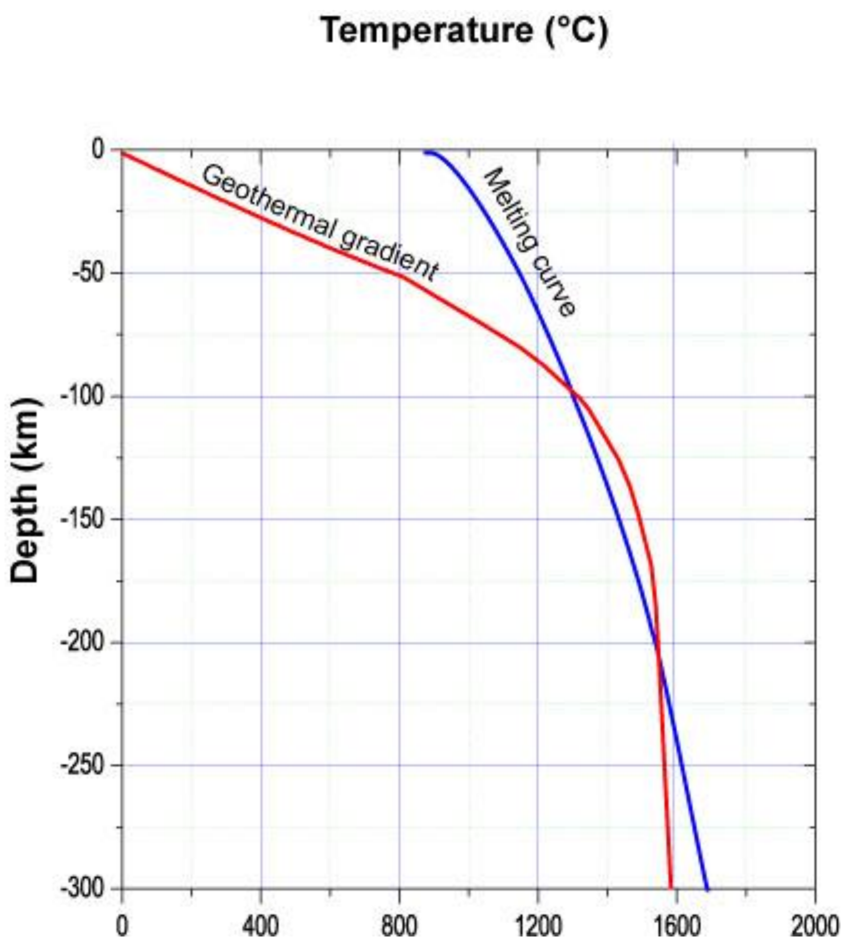
The map below shows the location of historically active volcanic areas. The location of Earth's volcanic activity marks the _________________.



- margins between tectonic plates
- margins of continents
- margins between Earth's layers
- margins between oceanic and continental crust

4.

The eruption of molten lava to the surface from volcanoes implies that melting of rocks occurs inside within the mantle. The graphic below represents the geothermal gradient and the melting curve of mantle rocks. Click on the graphic where melting of rocks may occur. A number '1' will appear where you click.



5.

The Mid-Atlantic Ocean Ridge is associated with __________. Check all that apply.

- ☐ ocean-continent convergent boundaries
- ☐ subduction zones
- ☐ spreading centers
- ☐ volcanism
- ☐ transform faults

6.

A canyon is ______________________.

- ○ a narrow valley carved by a fast-flowing river
- ○ a wide, large valley cut by a glacier
- ○ a steep slope formed by mass wasting
- ○ a fracture in the crust caused by earthquakes

7.

The features shown in the images below were formed over different time scales. Match each picture with the time it took to form.

1. Thousands of years
2. Minutes
3. Millions of years

☐ 1 ☐ 2 ☐ 3

☐ 1 ☐ 2 ☐ 3

☐ 1 ☐ 2 ☐ 3

8.

Geological processes that change Earth's surface can be classified as constructive, destructive, or both. Match each of the processes in the list below with the label that indicates whether it is constructive, destructive, or both.

1. Both constructive and destructive
2. Destructive
3. Constructive

Delta formation	☐ 1 ☐ 2 ☐ 3
Soil erosion	☐ 1 ☐ 2 ☐ 3
Glacier abrasion	☐ 1 ☐ 2 ☐ 3
Formation of meanders	☐ 1 ☐ 2 ☐ 3
Wave action	☐ 1 ☐ 2 ☐ 3
Mass wasting	☐ 1 ☐ 2 ☐ 3

9.

Match each of the images below with the label that identifies the geological process that carved it.

1. Mass wasting
2. Wave action
3. Glacier erosion
4. River erosion

☐ 1 ☐ 2 ☐ 3 ☐ 4

☐ 1 ☐ 2 ☐ 3 ☐ 4

☐ 1 ☐ 2 ☐ 3 ☐ 4

☐ 1 ☐ 2 ☐ 3 ☐ 4

10.

Match each process with the label that classifies it as physical or chemical weathering.

1. Chemical weathering

2. Physical weathering

Ice freezing inside rocks' cracks	☐ 1	☐ 2
Change in a rock's composition	☐ 1	☐ 2
Exfoliation	☐ 1	☐ 2
Actions of tree roots on rocks	☐ 1	☐ 2
Removal of materials from a quarry	☐ 1	☐ 2
Oxidation of a rock's surface	☐ 1	☐ 2

11.

Which of the following processes contributed to the formation of the Grand Canyon? Check all that apply.

☐ Glaciation

- [ ] Erosion
- [ ] Tectonic uplift
- [ ] Seismic activity
- [ ] Volcanism

12.

A delta is built by ________________________.

- ( ) accumulation of rock fragments from landslides
- ( ) accumulation of sand particles by wave action
- ( ) accumulation of debris at a glacier’s terminus
- ( ) accumulation of sediment discharged by a river

13.

Human activities have the potential to affect the scale of geological processes or the rate at which they occur. Which of the following processes can be affected by human activities? Check all that apply.

- [ ] earthquake activity
- [ ] river deposition and erosion
- [ ] soil erosion

- [ ] tectonic uplifting
- [ ] glacial accumulation

14.

Today the Mississippi River's discharge of sediment to the Gulf of Mexico is about 50% of what used to be in historical times. Which of the following is responsible for the current decrease in sediment discharge?

- ○ Engineered structures have been built to control the river.
- ○ The pattern of precipitation that feeds the river has changed.
- ○ The channel walls are made of hard rock that the river cannot erode.
- ○ The river has changed its course and discharges elsewhere.

15.

Soil erosion ________________. Check all that apply.

- [ ] is the result of natural processes
- [ ] has slowed down globally in recent times
- [ ] is accelerated by agricultural practices
- [ ] is a local, not a global problem

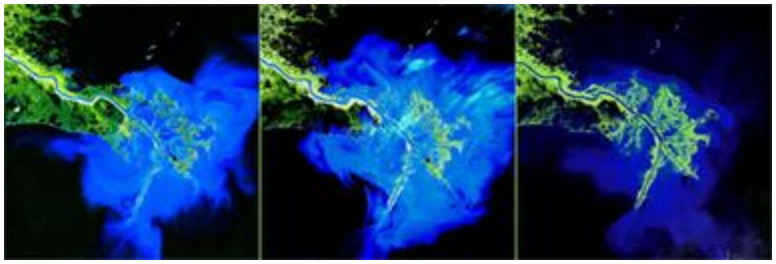
16.

Which of the following Earth processes is NOT affected by deforestation?

- the rate of soil erosion
- the rate of soil formation
- frequency of floods
- the rate of cooling of Earth's interior
- the rate of weathering

17.

The images below show changes in the Mississippi River delta over a period of 30 years. The delta is built by the accumulation of sediment deposited by the river. Based on these images, the amount of sediment discharged by the Mississippi River has _______________.



- decreased
- stayed the same
- increased

18.

Processes that change Earth's surface can be slow or fast. Sometimes the same process can happen quickly or slowly, depending on external conditions. For each process below, determine whether it happens quickly, slowly, or both quickly and slowly.

1. quickly—minutes, days, or months
2. both quickly and slowly
3. slowly—years or longer

Erosion	☐ 1	☐ 2	☐ 3
Landslides	☐ 1	☐ 2	☐ 3
Chemical weathering	☐ 1	☐ 2	☐ 3
Tectonic uplift	☐ 1	☐ 2	☐ 3
Physical weathering	☐ 1	☐ 2	☐ 3

19.

Mass wasting is a process that moves loosened rock debris downslope. Which of the following factors affect mass wasting? Check all that apply.

☐ direction and intensity of the wind

☐ amount of solar radiation

☐ steepness of the slope

☐ seismic activity

☐ amount of rainfall

☐ mass and size of the rock debris

20.

The images below represent three different landscapes. Match each landscape with the time it took for the landscape to form.

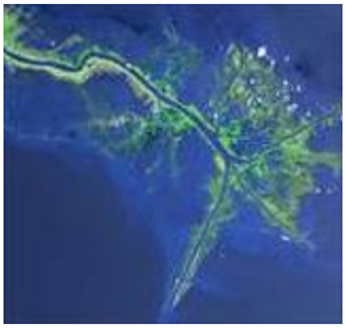
1. millions of years

2. hundreds or thousands of years

3. minutes

☐ 1 ☐ 2 ☐ 3

☐ 1 ☐ 2 ☐ 3



☐ 1 ☐ 2 ☐ 3

21.

Processes that shaped Earth in the past ________________.

- always occured slowly, resulting in minor changes
- are very similar to those that still occur today
- are drastically different from those that still occur today
- always occured abruptly, resulting in massive changes

22.

Earth's surface can be shaped by natural processes or by human-impact factors. Identify whether each landscape below was shaped by natural processes or by human-impact factors.

1. human-impact factors
2. natural processes

☐ 1 ☐ 2

☐ 1 ☐ 2

☐ 1 ☐ 2

☐ 1 ☐ 2

☐ 1 ☐ 2

☐ 1 ☐ 2

Force and Motion Final Assessment

1.

Match the numbered description on the top with its correct term on the bottom.

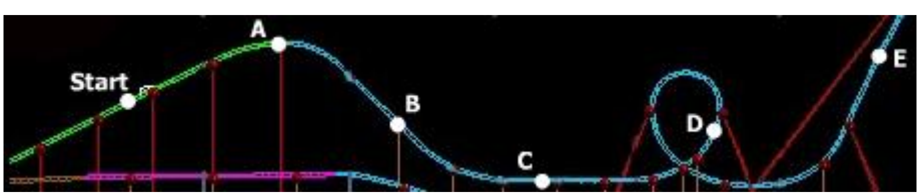
1. A measure of how fast something is moving, with no description of the direction in which it's moving.
2. A measure of how fast an object's velocity is changing.
3. A measure of how fast an object is moving, coupled with information about the direction in which the object is moving.
4. A measure of where an object is, specified as a distance from some reference point and an angle with respect to some reference line.

velocity	☐ 1	☐ 2	☐ 3	☐ 4
speed	☐ 1	☐ 2	☐ 3	☐ 4
position	☐ 1	☐ 2	☐ 3	☐ 4
acceleration	☐ 1	☐ 2	☐ 3	☐ 4

2.

Shown below is a diagram of the roller coaster simulation you saw earlier in this SciPack. At the end of its forward motion, the car stops and goes backward. Consider that end point.

Let's assume that the *horizontal* distance from the starting point of the car (START) to where it turns around (POINT E) is 200 meters. Using an angle and a distance, what is the approximate position of the car from the starting point when it stops and goes backward?



About 210 meters from the start, at an angle of about 5 degrees with the vertical.

About 200 meters from the start, at an angle of about 5 degrees with the vertical.

About 200 meters from the start, at an angle of about 5 degrees with the horizontal.

About 210 meters from the start, at an angle of about 5 degrees with the horizontal.

3.

You are sitting by the side of a country road, and a car comes speeding along. Suddenly it stops in front of you for just a second, then speeds off again in the same direction, going faster and faster as it disappears from view. Which of the following is true regarding the car's motion?

Its instantaneous velocity changed direction during its motion.

Its average speed was never equal to zero.

Its instantaneous speed was never equal to zero.

Its average speed during the motion was equal to zero.

4.

Launch and watch the simulation several times. Then look at the question.

Launch Simulation

Click on places, in the image of the roller coaster track, where its acceleration is equal to zero. Each time you click on a location, that location will be labeled with a number, "1," "2," ..etc.

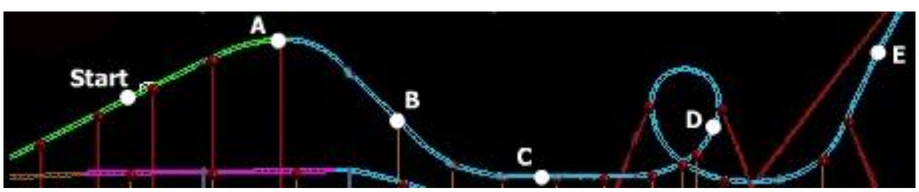
You need to select two (2) locations on the image below. When you are happy with your two choices, move on to the next question. If you wish to change your selection, hit "reset" and make another choice.

5.

Now click on all locations, in the image below, where the acceleration of the car is relatively large. Each spot you click on will show a number when you click on it, "1," "2," "3,"...etc. It's impossible from the information given to determine exactly where the acceleration is largest, so just choose places where you know the acceleration is large If you need to watch the simulation again use the link that follows.

[Launch Simulation]

You need to select three (3) locations on the image below. When you are happy with your choices, move on to the next question. If you wish to change your selection, hit "reset" and make another choice.



6.

Which of the following is true regarding Newton's first law?

- Newton's first law applies only if friction forces are present.
- You must consider *all* of the forces acting on something when applying Newton's first law.
- Newton's first law applies only if no friction forces are present.
- You must consider only forces acting in the direction of the change in motion when applying Newton's first law.

7.

What would happen to the objects on the surface of the Earth if the Earth suddenly stopped spinning and came to a halt?

- Because every object on Earth has inertia, those objects will continue moving when the Earth stops spinning, leading to death and destruction.
- Because every object on Earth has inertia, those objects will stop along with the Earth.
- The spinning of the Earth has nothing to do with objects attached to it.
- A push from the Earth's surface will stay with objects, so they will be pushed out into space.

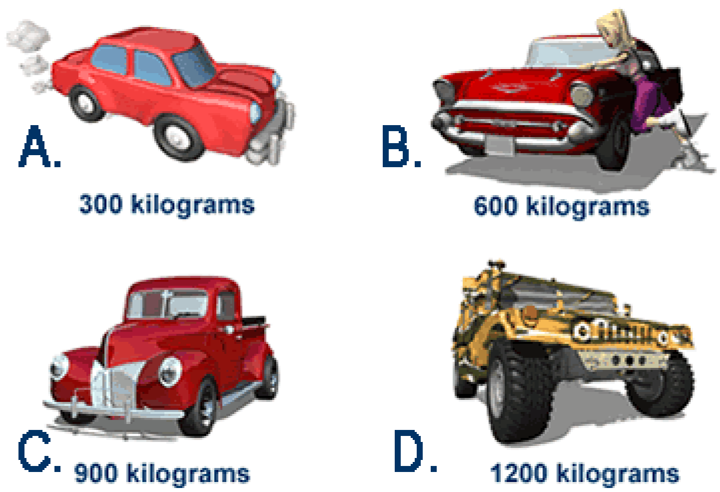
8.

Pictured below are four cars. Each car has the same-size engine, and therefore can produce the same forward force. The cars have different masses, as

indicated on the drawing. Each car has a driver whose mass is 80 kilograms. Prior to adding any passengers, the cars will have different accelerations when the driver pushes the accelerator all the way down.

Click on the car that will have the largest acceleration. This car will be labeled with the number "1." If you wish to change your selection, hit "reset" and make another choice.

Then, click on the car that will have the smallest acceleration. This car will be labeled with the number "2." If you wish to change your selection, hit "reset" and make another choice. When you are happy with your choices, move on to the next question.



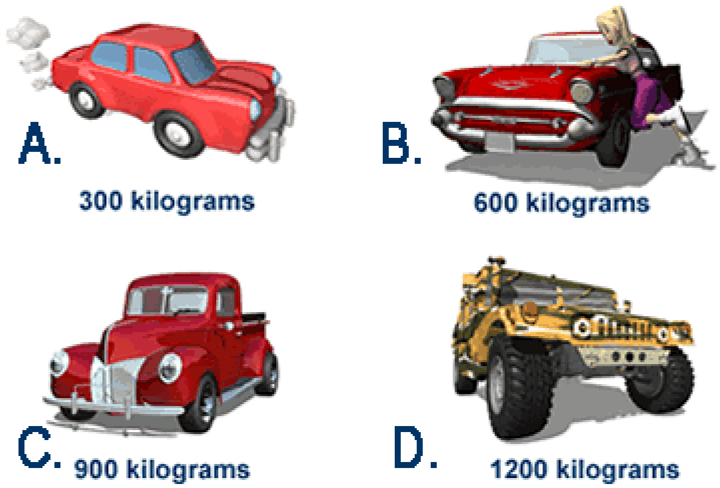
9.

This is a follow-up on the previous question. We're going to add passengers. Each passenger has a mass of 100 kilograms. To the car A we'll add five passengers, to the car B we'll add one passenger, to the car C we'll add two passengers, and to car D we'll add no passengers.

Assuming the force remains the same as before, do the following.

Click on the car that will have the largest acceleration. This car will be labeled with the number "1." If you wish to change your selection, hit "reset" and make another choice.

Click on the car that will have the smallest acceleration. This car will be labeled with the number "2." If you wish to change your selections, hit "reset" and make another choice. When you are happy with your choices, move on to the next question.



10.

Newton's second law is summarized in the equation ***F=ma***. Which of the following is true regarding this equation?

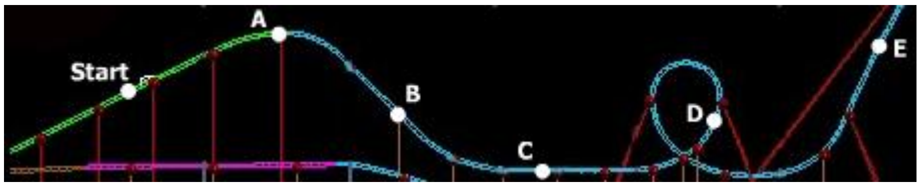
- To figure this out, you need to evaluate ***F=ma*** for each separate force acting on an object, and then average the results.
- It's impossible to get any information from this equation until you know, ahead of time, exact values for ***F***, ***m***, and ***a***.
- To use this equation, you need to add all the forces together numerically, ignoring direction, before knowing what to put in for ***F***.
- To use this equation, you need to add all the forces together, accounting for different directions, before knowing what to put in for ***F***.

11.

Click on the link below to view the roller coaster simulation. Pay special attention to the first part of the simulation, where the roller coaster car is rising up to its first peak (Towards Point A).

Launch Simulation

During that motion, which of the following analyses apply?



- Because the car is moving in that portion of the track, there must be a net force acting on the car.

- The car is not changing speed nor direction, so it's not accelerating. Therefore, no net force can be acting on the car.

- The only upward force acting on the car is the force caused by the chain underneath. That force is slightly smaller than the force of gravity acting on the car.

- The car is not changing speed nor direction, so it's not accelerating. Therefore, no forces at all can be acting on the car.

12.

You apply a very small force, say 0.001 newtons, to a very large truck, with a mass of 2000 kilograms. What can you say for sure about what will happen to the truck?

- The truck will accelerate (move from rest to motion) as long as that tiny force is larger than any force of friction that opposes it.

- The truck will not move because small forces cannot move large objects.

○ The truck will accelerate (move from rest to motion) as long as the small applied force is large enough to overcome the inertia of the truck.

○ An extremely small force can never accelerate such a large truck. The truck will not move under any circumstance.

13.

Newton's third law supports which of the following statements?

○ Whenever one object exerts a force on another object, the second object will definitely move.

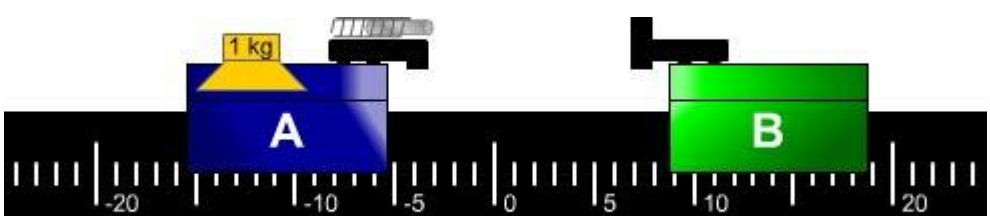
○ Whenever two objects interact, any force one object exerts on the other object is exerted back on the first object.

○ Objects in action-reaction pairs are exerted at different times. It depends on which force is exerted first.

○ If an object has enough mass, it does not necessarily obey Newton's third law.

14.

The diagram below shows a snapshot of a simulation you saw earlier, one in which carts on an air track interacted. Which of the following is true regarding the interaction of those carts?



The large cart will always exert a larger force on the small cart than the small cart exerts on the large cart.

The small cart will always exert a larger force on the large cart than the large cart exerts on the small cart.

The force exerted on each cart is the same. It has nothing to do with the mass of each cart or how hard each cart pushes on the other.

Which force is larger depends not on the size of the carts, but rather on which cart exerts the larger force to begin with.

15.

Violent collisions are part of the game of football. Fines for dangerous hits aside, which of the following is true with respect to these collisions?

A defensive player running at full speed and hitting a running back will hit that running back with a greater force than any force the defensive player gets in return.

No matter who is hitting or who is getting hit, each player in a collision receives the same force.

It’s all about metaphysics. If you are in touch with the universe, you will never get hit very hard. Karma.

If a running back has a full head of steam, then whoever tackles that running back is going to get hit with a greater force than the running back receives.

Appendix G:

NSTA “Houston SciPack Study” Information Sheet

NSTA "HOUSTON SCIPACK STUDY" INFORMATION SHEET

With funding from ExxonMobil, the National Science Teachers Association (NSTA) is able to offer new science teachers in HISD access to online professional development experiences. One type of experience is a SciPack, which is a 10-hour online learning module based on national science standards. ExxonMobil is interested in learning what happens as a result of giving teachers access to these resources. Hence, the foundation has included funding for a study to be conducted as part of this professional development effort. We are calling this the "Houston SciPack Study."

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to examine the effects and outcomes of two NSTA SciPacks (*Earth's Changing Surface*; *Force & Motion*). HISD staff have determined that these topics are important for teacher professional development. The study is being conducted by a research company called Edvantia. Edvantia will take all the data collected, analyze the data, and report at the group level the extent to which the SciPacks may be helping you and other teachers increase your content knowledge. This study is *not* about evaluating you individually as a teacher.

WHAT WILL HAPPEN?

You will be asked to participate in data collection efforts from now until January 2010. After completing a survey and assessment, you will be assigned to one of two groups, Group A or Group B. Your assigned group will determine the time window during which you will have access to each SciPack. Please see the table below for the timeline. The table also provides information about other activities in which you can engage on the Learning Center during the time window when you are not completing a SciPack. We call this period your time "at rest."

We hope to get the most valid results possible. In order to do this, it is important that everyone follow the schedule of activities. If your group is *at rest*, please do not go searching for information about the topic the other group is learning about. This is like refraining from reading the newspaper if you are sitting on a jury; doing so can color a juror's understanding of the case in unpredictable ways, just as searching for information about force and motion when you have not yet taken the SciPack can affect you and your practice In ways that will make the results we obtain confusing and invalid. The areas shaded blue are the times when you can access each SciPack. Note that on November 16, you will have access to all resources in NSTA's Learning Center.

SciPack Schedule

	July 23 - Sept 30 (Elementary) Aug 6 - Sept 30 (Middle School)	Oct 1 – Nov 15	Nov 16	Nov 16 – Jan 5	Jan 6 - 10
Group A	Take *Force & Motion* SciPack	Explore Learning Center free resources, create collections, develop PD plan	Full access to all Learning Center resources	Take *Earth's Changing Surface* SciPack	Teacher content post-assessments -- *Force & Motion* and *Earth's Changing Surface*
Group B	Explore Learning Center free resources, create collections, develop PD plan	Take *Earth's Changing Surface* SciPack	Full access to all Learning Center resources	Take *Force & Motion* SciPack	Teacher content post-assessments-- *Force & Motion* and *Earth's Changing Surface*

HOW AND WHEN WILL DATA BE COLLECTED?

The methods used to examine effectiveness include Teacher Surveys and Assessments, Student Assessments, and Teacher Focus Groups. Data will be collected at different times throughout the length of the study. You will receive e-mail notifications in advance of each activity. See the tables below for detailed timelines of data collection activities.

Teacher Assessment / Survey Schedule

	July 23/Aug 6	Sept 30	Nov 15	Jan 6-10
Group A	Teacher Practices Survey #1 Teacher Content Pre-Assessment	Teacher Practices Survey #2 and *Force & Motion* Final Assessment and Post-Assessment	Teacher Content *(Earth's Changing Surface)* Post-Assessment	Teacher Practices Survey #3 and *Earth's Changing Surface* Final Assessment and Post-Assessment
Group B	Teacher Practices Survey #1 Teacher Content Pre-Assessment	Teacher Practices Survey #2 and *Force & Motion* Post-Assessment	Teacher Content *(Earth's Changing Surface)* Final Assessment and Post-Assessment	Teacher Practices Survey #3 and *Force & Motion* Final Assessment and Post-Assessment

Student Assessment Schedule

	Late August / Early September -- at teacher discretion	By Oct 31	By Dec 18
Elementary Groups A and B	Student Content Pre-Test – Earth Science	N/A	Student Content Post-Test – Earth Science
Middle School Groups A and B	Student Content Pre-Test – Earth Science Student Content Pre-Test –Force & Motion	Student Content Post-Test –Force & Motion	Student Content Post-Test – Earth Science

GLOSSARY OF DATA COLLECTION ACTIVITIES:

- Teacher Survey: An online survey that you will take 3 times during the course of the study.
- Teacher Pre/Post-Assessments: Content assessments that are given before you have access to the SciPacks and after you complete each SciPack.
- Teacher Final Assessments: Assessments that are embedded in the SciPacks; you will complete these assessments as you work through the SciPacks.
- Student Pre/Post-tests: A paper assessment that you will administer to students in your classroom before you begin science instruction. Student Tests will be mailed to your school address. Detailed instructions will be included with these tests to help you administer them to your students.

WHOM DO I CONTACT WHEN I HAVE QUESTIONS ABOUT DATA COLLECTION ACTIVITIES?

If you have a question or concern about the data collection activities at any time during the course of the study, please contact the following staff members at Edvantia:

- Chandra O'Connor: chandra.o'connor@edvantia.org, or 800.624.9120, ext. 5404
- Dr. Kristine Chadwick: kristine.chadwick@edvantia.org, or 800.624.9120, ext. 5429