JASON ACADEMY SUMMATIVE PROGRAM EVALUATION

FINAL REPORT

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JASON Academy Evaluation Study

Summary of Findings

Primary Research Question: What effect does participating in a JASON Academy course online have on science teachers content knowledge and their teaching?

Research Hypotheses with regard to content knowledge.

1. Participation in a JASON Academy course is an *effective means* for increasing teachers' content knowledge in science topics in the *National Science Education Standards (NSES)* that teachers are expected to cover.

2. Teachers who participate *more actively* in the JASON Academy will show greater gains in content knowledge than those who participate less actively.

Research hypotheses about teachers' preparation to teach to standards.

1. Teachers who participate in JASON Academy courses will feel better prepared to teach to the science content standards their states expects them to teach.

2. Teachers who participate in JASON Academy courses will incorporate more NSES-aligned science process skills in their teaching.

3. Teachers who participate in JASON Academy courses will report incorporating more technology into their instruction, as required by the NSES.

Method: SRI conducted an evaluation study of JASON Academy courses to ascertain whether they are effective in increasing teachers' content knowledge on topics that they must teach and that are part of most state standards and curriculum frameworks. SRI, in conjunction with JASON Academy staff, selected two JASON Academy courses for study, *Structure of the Earth* and *Forces and Motion*. These courses were selected because of the popularity of the courses and their clear connections to teaching standards. Students in one course served as a control for the other course.

SRI's summative evaluation used a pre-post, comparison-group (quasi-experimental) design with teacher content knowledge as the chief outcome variable of interest. Because treatment and comparison groups were not matched, SRI used statistical controls to account for differences between groups in its analysis. Teacher surveys provided information on levels of participation; data from surveys were matched to assessment data to test the second hypothesis. Both the survey and content knowledge tests were developed by SRI. The content tests were aligned to content standards in the NSES. The surveys and assessments were administered to a total of 4 cohorts of students during the period from February 2, 2004 to November 19, 2004.

SRI, in conjunction with JASON Academy staff, prepared the pre- and post-course survey on teacher background, current teaching practices, and impact of the course on teaching practices. SRI crafted a pre- and post-course assessment for each course that focuses on

conceptual understanding of core items in each course as identified in the NSES. The surveys and assessments were administered to a total of 4 cohorts of students.

Results: Teachers made statistically significant gains in content knowledge, as compared to a control group, after taking the JASON Academy courses. Teachers self-reports indicated that many felt they had achieved their goals of gaining content knowledge and learning new ways to teach the science content as a result of taking the class. For neither of the courses was a correlation between self-reported activity level and gain on the assessment detected. Because the study did not randomly assign teachers to condition, these results cannot provide conclusive evidence that JASON Academy courses caused these gains; however, they do provide promising evidence of efficacy that could be investigated in future studies.

Our survey found that these teachers generally did not take the JASON Academy course in order to be able to incorporate more state or NSES content or process standards into their teaching, although most were familiar with the NSES and some reported feeling more prepared after taking the course. They instead reported goals of understanding science concepts better and gaining curriculum resources for their classroom. When asked to state how the course affected their approach to teaching science, the majority of teachers said that they learned new science content that they could in turn teach to their students. While many did not report feeling *strongly* that they were more prepared to incorporate NSES into their teaching after the course, they did feel more prepared to teach complex scientific ideas to their students. 43% of the participants said they "very much achieved" an improvement in their skills in incorporating technology into their teaching.

Table 1. Claims Supported by the Study Results

Research Question	Claims
Participation in a JASON Academy course is an effective means for increasing teachers' content knowledge in science topics in the *National Science Education Standards* (NSES) that teachers are expected to cover.	Compared with a matched comparison group, teachers from the JASON Academy course on Forces and Motion improved their own understanding of forces and motion, topics all middle school teachers are expected to teach, according to the NSES.
Teachers who participate more actively in the JASON Academy will show greater gains in content knowledge than those who participate less actively.	As measured, level of activity in the online course was not seen to be a factor in improvement in teachers' knowledge.
Teachers who participate in JASON Academy courses will feel better prepared to teach to science content standards outlined by their state.	Comparing pre- and post-course self-reports, JASON Academy participants say they are much better prepared to teach complex scientific concepts to their students.
Teachers who participate in JASON Academy courses will incorporate more NSES-aligned science process skills in their teaching.	Teachers did not report a significant increase in incorporating more science process skills in their teaching; however, they also reported that this was not their primary goal in taking the JASON Academy course.
Teachers who participate in JASON Academy courses will report incorporating more technology into their instruction, as required by NSES standards.	75% of teachers reported that the JASON Academy content was aligned with standards they are expected to teach, and relevant to their students. Half of the teachers in the study reported improved skills in integrating technology in their instruction than at the beginning of their participation.

Goals of the Study

The JASON Academy is funded by the US Department of Education under a STAR Schools grant to the JASON Foundation for Education. The Academy is an online professional development environment for science teachers that teaches science content and inquiry in five-week long courses. The Department desires scientific data to prove that the grant program is contributing to better teaching. Ideally, we would want to show that the content knowledge gained through participation in an Academy course translates to better student achievement (Hill & Ball, 2004, Porter, et al., 2000). To do so, a study would be required that was conducted over a longer time period with a more extensive data collection protocol that related teacher participation in a JASON Academy course to student achievement. However, given the limited timeframe and budget for this project, we were not able to test for gains in student achievement.

This study contributes to an understanding of how augmenting teachers' knowledge of science can contribute to more effective teaching. The objective is to conduct an evaluation of the JASON Academy focused on whether the Academy increases teachers' content knowledge in two of its most popular courses. The chief hypothesis to be tested is:

> **H_1:** Participation in a JASON Academy course is an effective means for increasing teachers' content knowledge in science topics that appear in the National Science Education Standards.

The evaluation provides data on teachers' backgrounds and participation to help interpret the outcome data. We anticipated that teachers who participate more actively in the program will show greater gains on our assessment tasks. Our secondary hypothesis to be tested in this evaluation is:

> **H_2:** Teachers who participate more actively in the JASON Academy will show greater gains in content knowledge than those who participate less actively.

Due to the changing requirements on teachers, incorporating standards and technology into instruction is increasingly expected. We considered, then, whether JASON Academy courses impacted standards-based instruction in three ways: content standards, process standards, and technology. Our hypotheses in this area were:

> **H_3:** Teachers who participate in JASON Academy courses will feel better prepared to teach to the science content standards their states expects them to teach.
>
> **H_4:** Teachers who participate in JASON Academy courses will incorporate more NSES-aligned science process skills in their teaching.
>
> **H_5:** Teachers who participate in JASON Academy courses will report incorporating more technology into their instruction, as required by the NSES.

Research Design

This research employs a quasi-experimental design to measure the effects of two JASON Academy courses on teacher content knowledge. This design enables us to measure what

teachers learn while participating in a JASON Academy course in comparison to another group of teachers not participating in the course. Statistical tests of differences allow us, furthermore, to estimate an effect size of the courses, which indicates the magnitude of gains that might be expected from participating in the course. By also analyzing participation data gathered from teacher surveys, we are able to further analyze what kinds of participation are associated with gains in teacher content knowledge.

There are some important limitations to the study design that are important to note, which we sought to address through our instrument development process and analysis procedures. First, no acceptable assessments were available at the outset of the project to use to measure teacher content knowledge. We developed the assessments for the study ourselves, drawing on existing instruments in the field that are intended to be used by students. We worked to align and adapt these instruments for adults, using expert review as a strategy for validation. Second, quasi-experimental designs often yield different results than do experiments that use random assignment (Agodini & Dynarski, 2001). Such designs do not permit one to make causal claims about effects, because of potential differences between treatment and control groups at the outset of the study. To increase the likely validity of estimates of effects, we have employed some of the methods outlined by Glazerman, Levy, and Myers (2003) as critical for quasi-experiments. In particular, we used pre-intervention measures of outcomes to adjust for differences between initial differences between treatment and comparison group teachers. In addition, we conducted regression analyses in which course participation was one of several factors included as likely contributors to teacher outcomes.

Sources of Data for the Study

We developed assessments of teacher content knowledge for two popular Academy courses. The Structure of the Earth course looks at the structure of matter, landforms, the rock cycle, and plate tectonics. The Forces and Motion course covers kinematics, acceleration, inertia, friction, and simple machines. Of these two courses, the latter is known by the Academy staff to be a difficult course for teachers due to its subject matter.

We began by identifying the teacher knowledge to be measured, using external and internal (to the Academy) sources. We considered which core concepts teachers are expected to learn, both from the Academy's point of view and with respect to the scientific and educational literature on these constructs. We used two sources as our guides for what content to assess: the courses themselves and the NSES standards for these topic areas. (The AAAS Benchmarks and the Atlas of Science Literacy were also consulted but the NSES proved more useful.)

Developing and validating an assessment can be a time-consuming process, and our timeline allowed limited time for piloting. Therefore, we identified candidate items from the literature that matched the core constructs we sought to assess. Items were drawn from the Geoscience Concept Inventory items developed by Julie Libarkin at Ohio University (Libarkin, 2001; Libarkin, Anderson, and Boone, 2003), the Force Concept Inventory developed by Hestenes (Hestenes, Wells & Swackhamer, 1992), motion graph items from the SimCalc project at SRI (Roschelle, Kaput, and Stroup, 2000), and some short answer questions developed by SRI staff and a JASON Academy instructor.

The Structure of the Earth assessment was generated primarily from the Geoscience Concept Inventory (GCI) items. This bank of 45 items was developed to assess conceptual understanding and misconceptions in students in entry-level geoscience courses. The specific subset of items that were used in the pre- and post-test for the JASON Academy teachers were selected by the instructor of the first cohort of the course to be aligned with the course content. Additional items were developed by SRI staff.

We aligned items from the GCI with JASON's Structure of the Earth syllabus, and found a good deal of overlap using 18 of the most validated items. The alignment was best for weeks 3, 4, and 5, with only a few questions matching up with weeks 1 and 2 of the course. This is likely due to the fact that GCI is a basic conceptual knowledge test, and weeks 1 and 2 of the course mainly cover geology terms and concepts that people might not be aware of until they are exposed to a geology course. Appendix C presents the results of the alignment task.

All items on the Forces and Motion assessment were vetted by the instructor. The Force Concept Inventory items focused on kinematics and motion in one dimension, consistent with the course syllabus. In addition, we followed the same alignment procedures internally to identify potentially instructionally-sensitive items for the assessment. The alignment for the Forces and Motion course is shown in Appendix C. The assessments for each course are shown in Appendix D.

Working in cooperation with the JASON Academy staff, we also developed a participant survey. The intent is to gather background data on teachers, information on course participation, and perceptions of the courses. Surveys asked teachers to report on their science teaching practices before and after the course, including their preparedness to teach to national and state science and inquiry standards, and to integrate technology into their classrooms.

Study Procedure

Once the assessments were prepared, we used them in a quasi-experimental study of growth in teachers' content knowledge. To measure growth in Earth science content knowledge, participants in the Structure of the Earth course were used as the treatment group, and participants in the Forces and Motion were used as the comparison group. To measure growth in physical science content knowledge, the same participants were used, but participants in the Structure of the Earth courses were used as the comparison group, and participants in the Forces and Motion courses were used as the treatment group. Thus, subjects were not randomly assigned to treatment vs. control. We continued collecting data over 4 course sessions in an attempt to collect good data from 50 participants for each treatment, for a total of 100 participants; the final numbers are shown below.

Course	Treatment N	Control N
Structure of the Earth	40	28
Forces and Motion	28	40

The pre- and post-assessments were the same and were delivered via a commercial survey collection service called Infopoll. Only participants who completed both assessments were considered in the analysis. A few who were taking both courses were omitted from the analysis

as they might skew the comparison group. Participants were compensated $100 for completing both pre- and post-course assessments and pre- and post-course surveys (described below). Students did not need to be taking the course for credit in order to participate: auditors were permitted to participate as well. However, the instructor had to judge that they had "completed" the course in order to qualify to participate and to qualify for the stipend; drop-outs did not participate in the study.

All of the items were either selected response or simple constructed response (fill-in-the-blank or definition). We developed a rubric for one constructed response question on the Force and Motion test (see Appendix D). We scored all of the assessments at the end of the data collection, and validated the scoring by randomly selecting 20% of the scores and having them scored by another scorer. We tested the reliability of the rubric using 3 scorers, the second two testing the scoring on a sample of 20% of the answers. We achieved greater than 80% inter-rater reliability.

At the beginning and end of each course, all teachers also completed the survey developed to measure participation, goals for the course, and perceptions of the JASON Academy. These were also administered through Infopoll.

Analysis of Results

We analyzed all results from the content tests for gains in teacher understanding. In our analysis of gains, we took into account the fact that participants from the different groups may have been different with respect to their initial knowledge. We therefore used their pre-test content knowledge scores as a co-variate in all our analyses. We conducted tests of statistical significance and also computed an *effect size,* an estimate of the magnitude of effects of the program. These results are discussed in the following sections.

Our analysis of surveys focused on four areas: profiles of participants, course participation, course perceptions, and projected changes in teaching practice. We developed profiles of the course participants as a group, describing the grades they teach and their prior professional preparation in science. We looked at teachers' reports of the time they spent working on courses, broken down by course. We also looked at teachers' perceptions of the course, with special attention to how they met the participation requirements.

In addition to a descriptive analysis (reported in Appendix B) of survey data, we looked at changes in their perception of how prepared they are to teach to standards, and how much they report teaching to standards from pre- to post-course, using a *t* test to test the statistical significance of those changes.

Results: Gains in Content Knowledge

Our main hypothesis is that JASON Academy courses are an *effective* means for increasing content knowledge. Comparing pre-course and post-course assessment scores for each treatment group, against a control group will allow us to confirm or disprove this hypothesis. We performed the following analyses on the data that had been scored by the scorers.

Calculation of difficulty level of assessment items. For each item, we calculated the percentage of participants who got the answer correct on the pre-test, and incorrect on the post-test. Items that were too easy (greater than 80% correct on the pre-test) and too hard

(greater than 80% incorrect on the post-test) were eliminated from the analysis. We eliminated items that were too easy at the time of pre-test, because there would be little opportunity for either group to demonstrate gains on the item. We eliminated items that were too difficult at the time of post-test, because such items are also less likely to provide accurate estimates of knowledge gains. No items were omitted from the Forces and Motion assessment, but for the Structure of the Earth Assessment, 11 items needed to be omitted out of the 17 leaving only 6 items. (Appendix C details the items that were omitted.)

Recalulation of mean scores. Each participant's score for the Structure of the Earth test was recalculated with the too-easy items omitted.

***t* test for difference of means.** The difference score, or *gain,* for participants in Structure of the Earth (SE) and Forces and Motion (FM) were calculated. There was no significant difference in gain scores between treatment and control for SE ($p = .438$) but there was for FM ($p = .007$). There was also no significant difference in the pre-scores between the treatment and comparison groups for SE ($p = .537$) but there was for FM ($p = .039$). This was likely an artifact of the number of items that needed to be omitted from the SE test.

ANCOVA Results. In order to understand the relationship of the dependent variable (post-test score) to a preexisting variable (pre-test score), we ran an ANCOVA to control for the pre-test score. In effect, this analysis "removes the variance" in the post-test score that is caused by association with the pre-test score. This allows us to check for significance of the treatment aside from differences in the pre-test scores. In this analysis (Tables 2, 3, and 4), we find significant effects of the JASON Academy courses, thus providing promising evidence for our effectiveness hypothesis. This result could be further investigated in studies that randomly assign teachers to conditions to provide conclusive evidence.

Table 2. Pre- and Post-test Mean Scores and Standard Deviations

	Pretest		Posttest	
	M	***SD***	***M***	***SD***
FM	42.30	16.91	48.44	20.25
SE	65.46	22.75	78.09	19.01

Table 3. Analysis of Covariance of Gain Scores as a Function of Group (SE versus Control), With Pre-test Scores as Covariate

	Df	***SS***	***MS***	***F***	**sig**
Covariate: Pre-test Scores for SE	1	391.95	391.95	1.37	0.246
SE (treatment)	1	2181.79	2181.95	7.634	0.007
Error	64	18291.7	285.8		

Table 4. Analysis of Covariance of Gain Scores as a Function of Group (FM versus Control), With Pre-test Scores as Covariate

	Df	***SS***	***MS***	***F***	**sig**
Covariate: Pre-test Scores for FM	1	9093.3	9093	45.83	0.000
FM (treatment)	1	2558.35	2558.35	12.89	0.001
Error	65	12896.45	198.40		

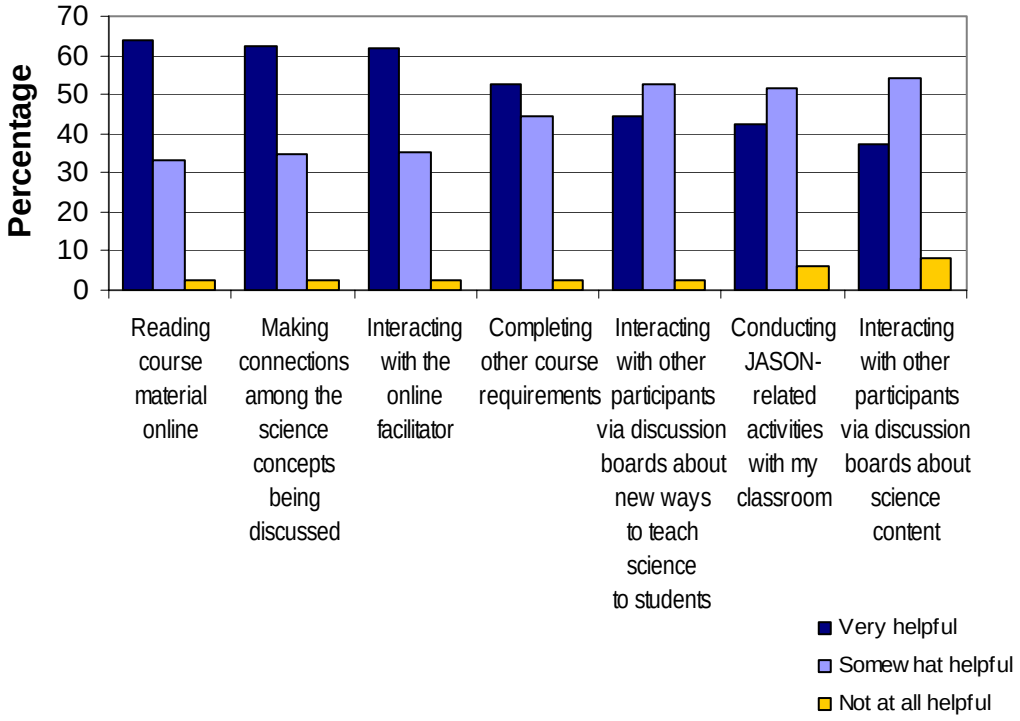
Results: Gains in Content Knowledge Based on Activity Level

We conducted regression tests to determine if there was a significant connection between activity level, as reported in the survey, and content gains for each course, as measured by the assessments. We did not have the resources to measure activity level in a rigorous way, such as counting postings to the online bulletin board. Instead, we asked participants to report on how much time they spent on various course activities such as interacting with the online facilitator), and made a composite variable out of the result. (The specific questions asked can be found in the post-course survey in Appendix E, Question A3.) The regression analysis looked at pre-test scores, post-test scores, and the composite *activity level* variable. The result showed that the *activity level* variable was not a significant factor in the differences in the assessment scores (pre- and post-test). However, consistent with results from the ANCOVA, group membership—whether teachers were part of the treatment or comparison group—was a significant factor in the regression, as was pre-test score (see below).

Course	Activity Level Factor *P*	Treatment Factor *P*	Pre-Test Score Factor *P*
Structure of the Earth	.207	0	.004
Forces and Motion	.101	.004	.034

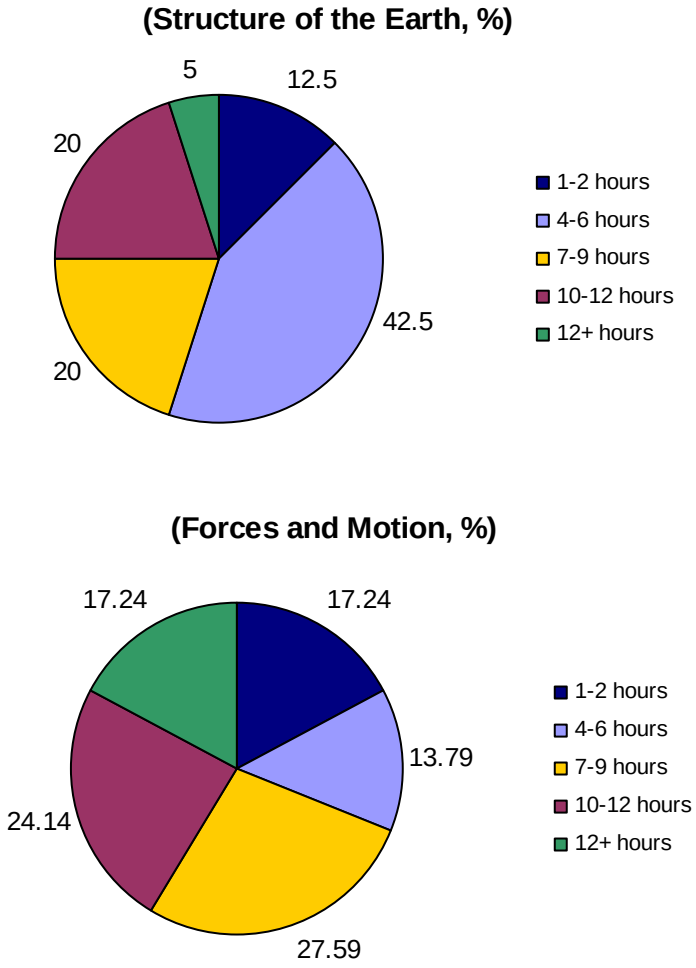
Teachers did report that they made gains in understanding science concepts and principles, and that this was an important goal for them. 92% of the participants thought that learning more about science concepts and principles was an important goal, and of those, 77% reported that their goal was very much achieved.

Figure 1. How Helpful Were these Activities to You in Deepening Your Own Science Content Knowledge?



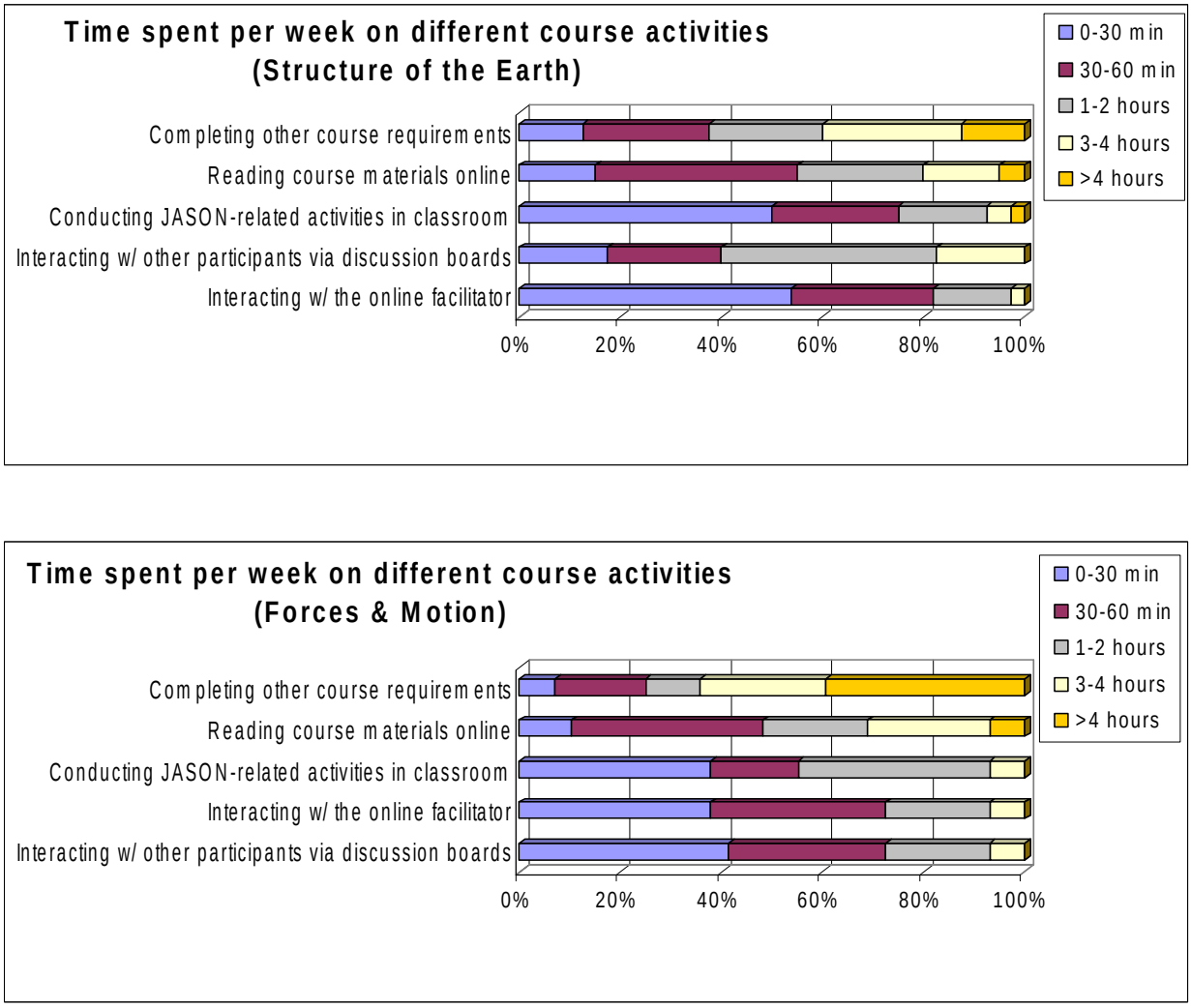
We investigated what activities participants were spending their time on, and how they rated the utility of those activities (Figure 1, above). They reported that making connections among the concepts they were learning was a very helpful activity, as was interacting with the facilitator for the course and reviewing the course material. Most of the participants spent from 4-9 hours per week on the course, with 62% of Structure of the Earth spending this amount of time and 20% spending 10-12 (Figure 2, below). In contrast, 41% of Forces and Motion participants spent 4-9 hours, 24% spent 10-12 and 17% spent more than 12 hours on the course (Figure 2, below). As expected, the more difficult content in physical science required more time on the part of teachers.

Figure 2. Amount of Time Spent on Structure of the Earth vs. Forces and Motion



As shown in Figure 3 (below), Structure of the Earth participants spent less time interacting with their online facilitator, and more time interacting with other participants and reading course materials online. Forces and Motion students spent about equal time on their interactions with the facilitator and other participants, and also spent more time in their classroom conducting JASON-related activities.

Figure 3. Course Activities Time: Structure of the Earth vs. Forces and Motion



Results: Preparation to Teach to Science Content Standards

We examined the mean change of teachers' reported preparation to teach to content standards ($M = +0.188$, $SD = 0.522$) from their answers on the pre-survey with their responses to the post-survey. The results of the t test showed that these gains were significant ($N = 69$, $t(68) = 2.996$, $p = 0.004$). Teachers also reported feeling more prepared to teach complex scientific ideas.

At the same time that teachers feel better prepared to teach to content standards as a result of taking a JASON Academy course (Figure 4, below), 32% of the total participants reported that gaining a better understanding of standards is not a goal for them and 30% reported that for learning to integrate standards into their curriculum was not a goal. Of the remaining who reported that these were goals, a majority said that this was very much achieved (Figures 5 and 6, below).

Figure 4. Post-Course Preparedness to Teach Complex Ideas vs. Integrating NSES

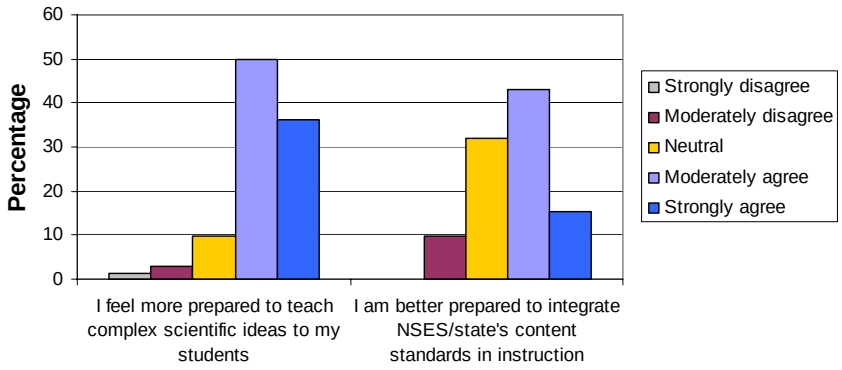


Figure 5. Achieving Goals of Understanding NSES Content Standards vs. the Importance of those Goals

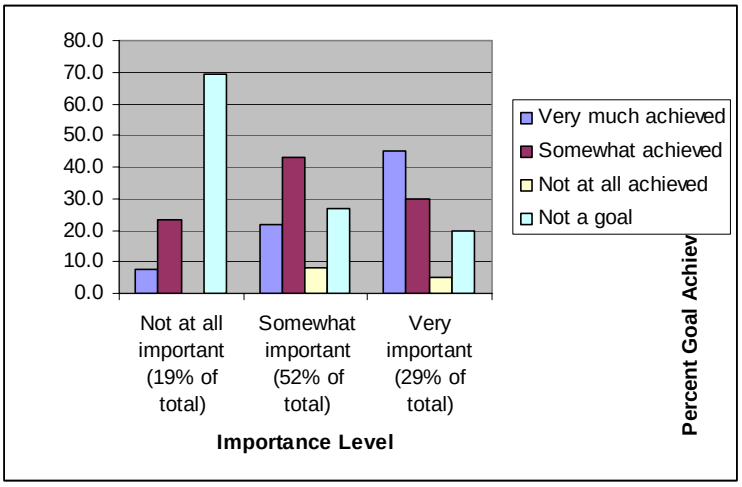
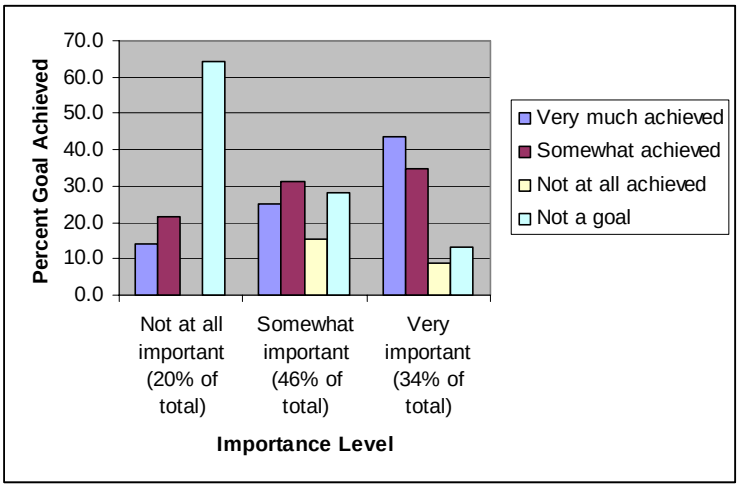
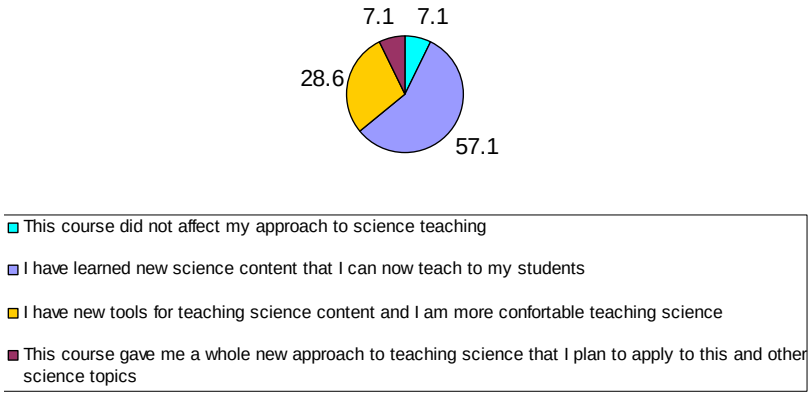


Figure 6. Achieving Goals of Learning to Integrate NSES Content Standards into Teaching vs. the Importance of those Goals



Teachers reported an effect of the course they took on their approach to teaching science. Our questions that focused on the nature of that change indicated that their assessment practices had not changed, but as shown in Figure 7, the majority reported that they had learned new science content.

Figure 7. Effect of Course on Approach to Teaching Science



Results: Incorporation of More NSES-aligned Science Process Skills in Teaching

We sought to understand how the JASON Academy courses influenced teachers' understanding of NSES process and inquiry skills, and whether they had learned to integrate these skills into their curriculum. The JASON Academy instructors model an inquiry-oriented approach to teaching, and encourage discussions about inquiry methods in their online classrooms. We asked teachers to rate, on a 3-point scale, how goals in these areas were achieved by participating in the JASON Academy course. We conducted a *t* test on teacher's pre- and post-course answers to these questions. The results of the *t* test suggested that the gains were not significant (for $N = 45$).

More promising results came from the questions around changes in inquiry practices. We asked teachers to rate the frequency with which their students engaged in the following inquiry practices and compared pre- and post-test course answers using a *t* test. The *P* values reported are from *N* = 69. Teachers' reports of how frequently they had students pose questions, plan investigations, and communicate results of investigations changed significantly over the course of their participation in the Academy course. They were much more likely to report engaging their students in these activities at the end of the course than at the beginning.

Figure 8: Changes in Inquiry Practices from Pre- to Post-survey

Questions asked about student inquiry practices	*P* =
When your students participate in science investigations or labs when learning science, how often do they…	
…develop their own questions about what to investigate?	.015
…plan an investigation, deciding what procedures they will use?	.018
…develop their own hypotheses about what they will observe when they conduct an investigation?	.101
…collect data to answer a scientific question?	.651
…use probeware to collect data?	.829
…analyze data to determine the answer to a question?	.497
…develop presentations and communicate the results of an investigation?	.055
…discuss and debate the validity and meaning of experimental results?	.017
…use computers to support the analysis and communication of data?	.090

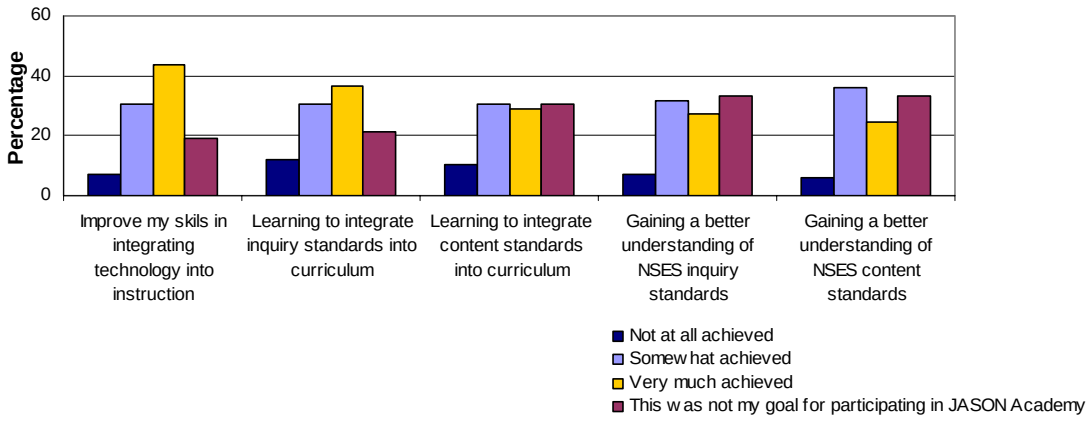
We also investigated changes in assessment practices, seeking to understand whether participation made a difference in whether teachers moved from homework and test/quizzes as evidence of learning, and toward contributions to group work, class participation, demonstrations of depth of understanding, and final products of group work. We found no change in these areas from pre-survey to post-survey, and surmise that these areas are not places to look for effects on teaching from courses that focus on content and provide limited opportunities for teachers to learn about assessment. Other JASON Academy courses do focus on assessment; in these courses, we would predict that teachers might report changes in their assessment practices.

When asked about inquiry practices that directly deal with deepening student understanding (eliciting relationships between student's experiences and material being taught, asking students to explain their reasoning, eliciting their ideas about content) we also found no change pre- to post-survey.

Results: Incorporation of More Technology in Instruction

We hypothesized that the JASON Academy courses are likely to increase teachers comfort with, and use of, technology in their teaching. We asked teachers two kinds of questions. One addressed the degree (on a 3 point scale) to which they had improved their skills in integrating technology into their instruction. The other asked about the frequency with which teachers used email, chat, discussion forums, and internet/web search in personal use, classroom preparation, and classroom instruction.

Figure 9: Relative Gains in Technology and Standards Use



We conducted a *t* test on teacher's pre- and post-course answers to these questions to detect if the change was significant. Some of the respondents said that this was not their goal in taking the course, of the remainder ($N = 55$) the results of the *t* test suggested that the gains were not significant $t(54) = .973$, $p = 0.335$. This suggests that teachers are not likely to change their habits around technology use in a significant way after a 5-week course. Nevertheless, teachers *reported* that their goals in integrating technology into instruction were "very much achieved" (Figure 9). There may be ways other than the ones we asked about that teachers are considering in their use of technology.

Discussion and Recommendations

The sampled JASON Academy courses were shown to be effective in improving content knowledge for teachers.

Recommendation 1: Conduct a follow-on study.

The JASON Academy should consider using this preliminary efficacy data to pursue funding for a larger study that would contribute to the research base in understanding how to improve teacher quality. Refined assessments, a larger sample, and a combined quantitative and qualitative study would likely provide not only more robust data on effectiveness, but also a better understanding of the factors that lead to success in teaching content. For example, it might be that activity level, as we measured it, was not an indicator for success in the course, but that other more sensitive measures of participation could be a good indicator. It may also be useful in future studies to investigate effects for other courses, and to devote more time and resources to assessment development and validation.

Recommendation 2: Identify teachers whose goals are aligned with NSES.

If the JASON Academy wants to promote these courses as improving teacher's ability to incorporate NSES science content and process standards in their classroom teaching, it might look for teachers whose goals are aligned with these standards or develop methods to help teachers align their goals in taking the classes (e.g., learning to teach complex scientific concepts, gaining curriculum resources for their classroom) with standards. Investigating *how* teachers actually change their teaching to "teach to the NSES content standards" would be a

useful study and would require more than just survey data.. Given the lack of a significant difference in incorporation of more science process skills in their teaching, the Academy might wish to study what process skills teachers would *like* to incorporate and then target those with specific material.

Recommendation 3: Investigate further changes in inquiry practices.

Understanding better the nature of the significant changes reported in inquiry practices such as developing questions and discussing the meaning of experimental results bears further investigation. Observational data and logs would be valuable to help verify teacher reports of change in practice found in the survey and would also help to understand better the effects found from this study.

Recommendation 4: Raise district awareness of benefits of online learning.

Data from the descriptive analysis (Appendix D) suggest that school districts either are not aware of the opportunities provided by online learning or that teachers themselves are not aware of how their district perceives this professional development opportunity. Reporting on the significance of these results will help raise the level of awareness. Increasing the signup of groups (e.g., a cohort from a whole district that might also have face-to-face meeting time), and then studying the differential effect of this type of learning could shed some light on the variations that can arise from purely online vs. mixed learning.

Appendix A: References

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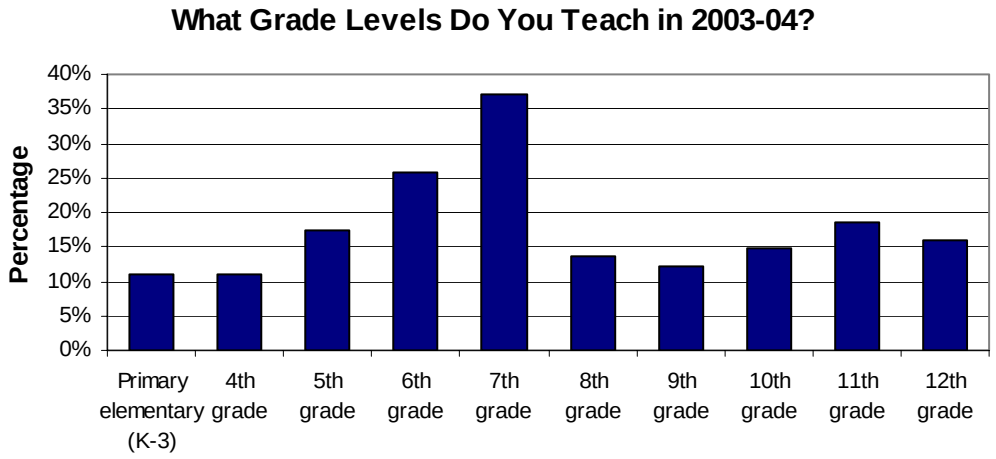
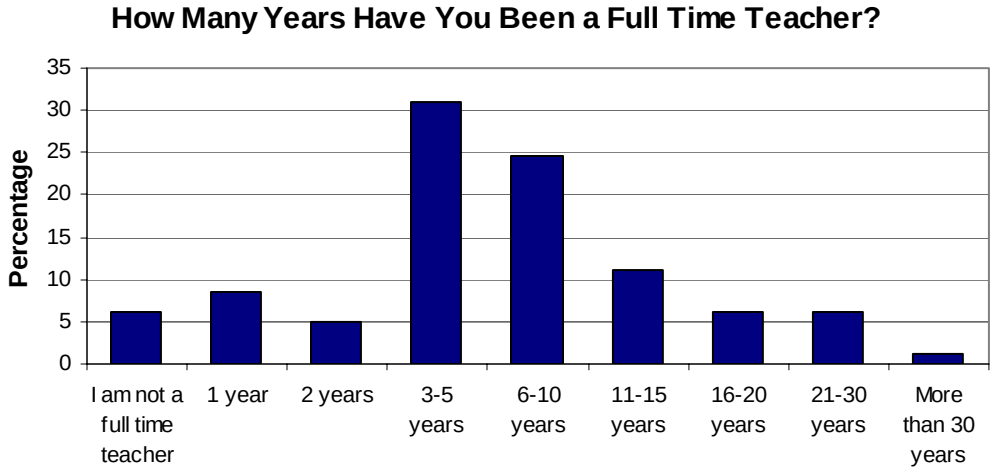
Appendix B: JASON Academy Descriptive Analysis

This appendix presents a descriptive analysis of the JASON Academy study participants from both courses and across all cohorts. There were generally no differences in responses for students taking Forces and Motion versus Structure of the Earth, so unless noted otherwise, responses have been summed across all cohorts and all courses.

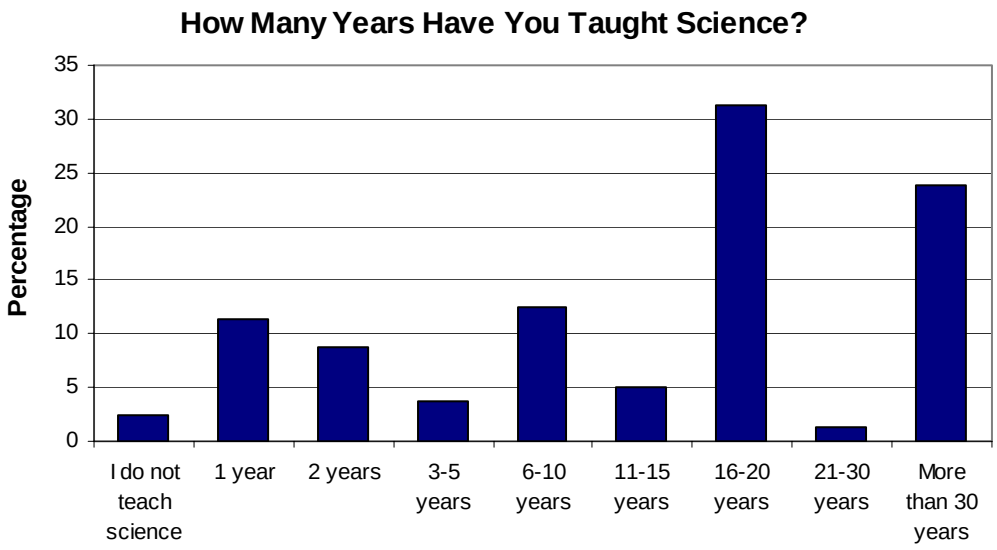
Teacher Background

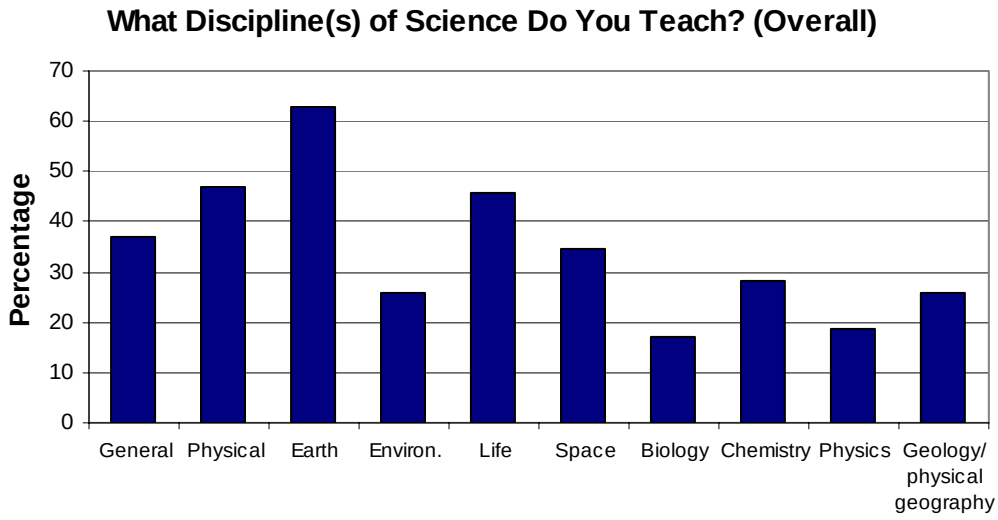
Teachers in the study teach mainly upper elementary and middle school, and most have been teaching 3–10 years. Very new and very experienced teachers, it appears, do not take JASON Academy courses as much as their early career colleagues.





However, not all of the teachers are early in their science teaching careers. Some of them have a lot of experience in teaching science (although it may not have been full-time teaching). Their disciplines are largely earth science, life science, and physical science.


How Many Years Have You Taught Science?
Percentage
35
30
25
20
15
10
5
0
I do not teach science
1 year
2 years
3-5 years
6-10 years
11-15 years
16-20 years
21-30 years
More than 30 years


What Discipline(s) of Science Do You Teach? (Overall)
Percentage
70
60
50
40
30
20
10
0
General
Physical
Earth
Environ.
Life
Space
Biology
Chemistry
Physics
Geology/ physical geography

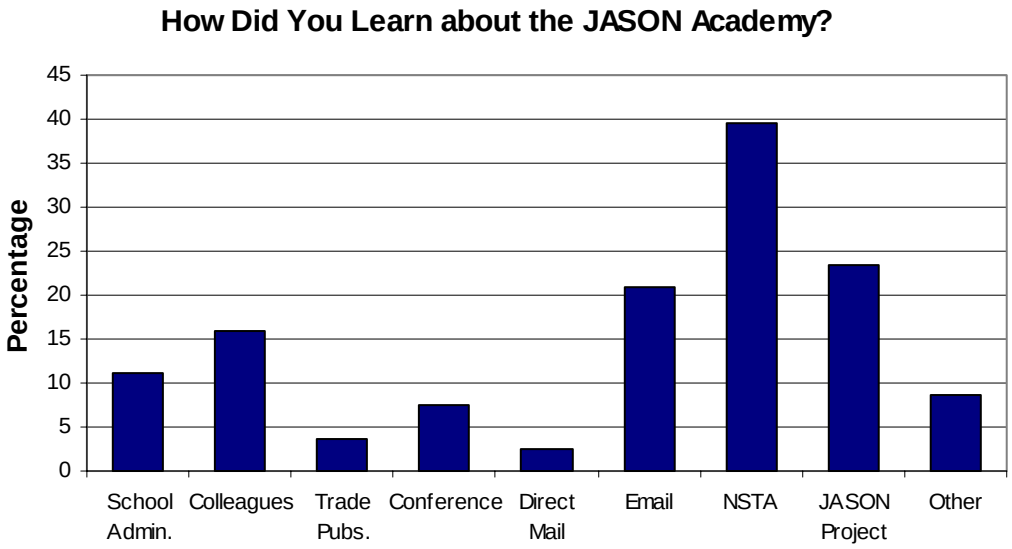
Professional Development Activities

Most of these participants' recent professional development in science was in the form of short workshops on specific science topics. About half reported self study and summer institutes or extended workshops. A little over one-third (37%) had participated in online professional development. About half had received their undergraduate degree in the past 5 years, and also about half had done some graduate work in the past 5 years.

Pre-service or In-service Professional Development in the Past 5 Years	Percentage
Undergraduate major in science	16%
Undergraduate major in science education	7.4%
Undergraduate major in other area	25.9%
Graduate degree in science	2.5%
Graduate degree in science education	23.5%
Graduate degree in other area	22.2%
Undergraduate course work in science	28.4%
Graduate course work in science	27.2%
Short (1-2 day) workshops on specific science topics	70.4%
Summer institutes or extended workshops on specific science topics	44.4%
Participation in a school- or district-wide science reform initiative	30.9%
Worked with a professional scientist on a study	6.2%
Online course, listserv, or virtual community	37%
Self Study	58%
Peer support or mentoring	32.1%

The classes taught by these teachers are about half suburban (55%), a small amount of rural (15%) and about one-third urban (30%), and their students are mostly mixed ability and achievement levels (91%).

Only 18% of these teachers have taken a JASON Academy course before, yet 40% had taken at least one online course before. The NSTA mailing, and their exposure through the JASON project, were the predominant means of learning about the courses.



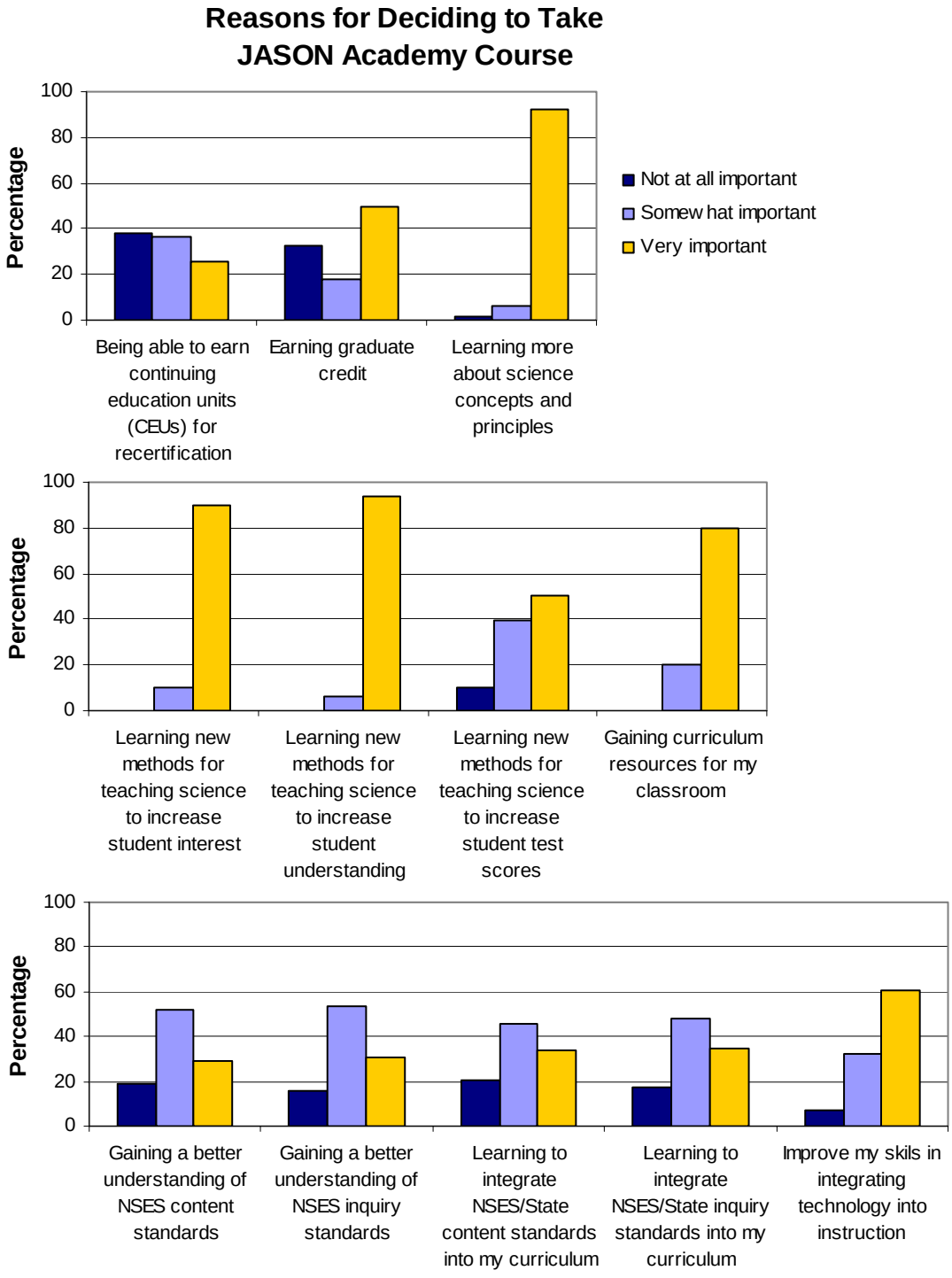
Reasons for Taking JASON Academy Courses

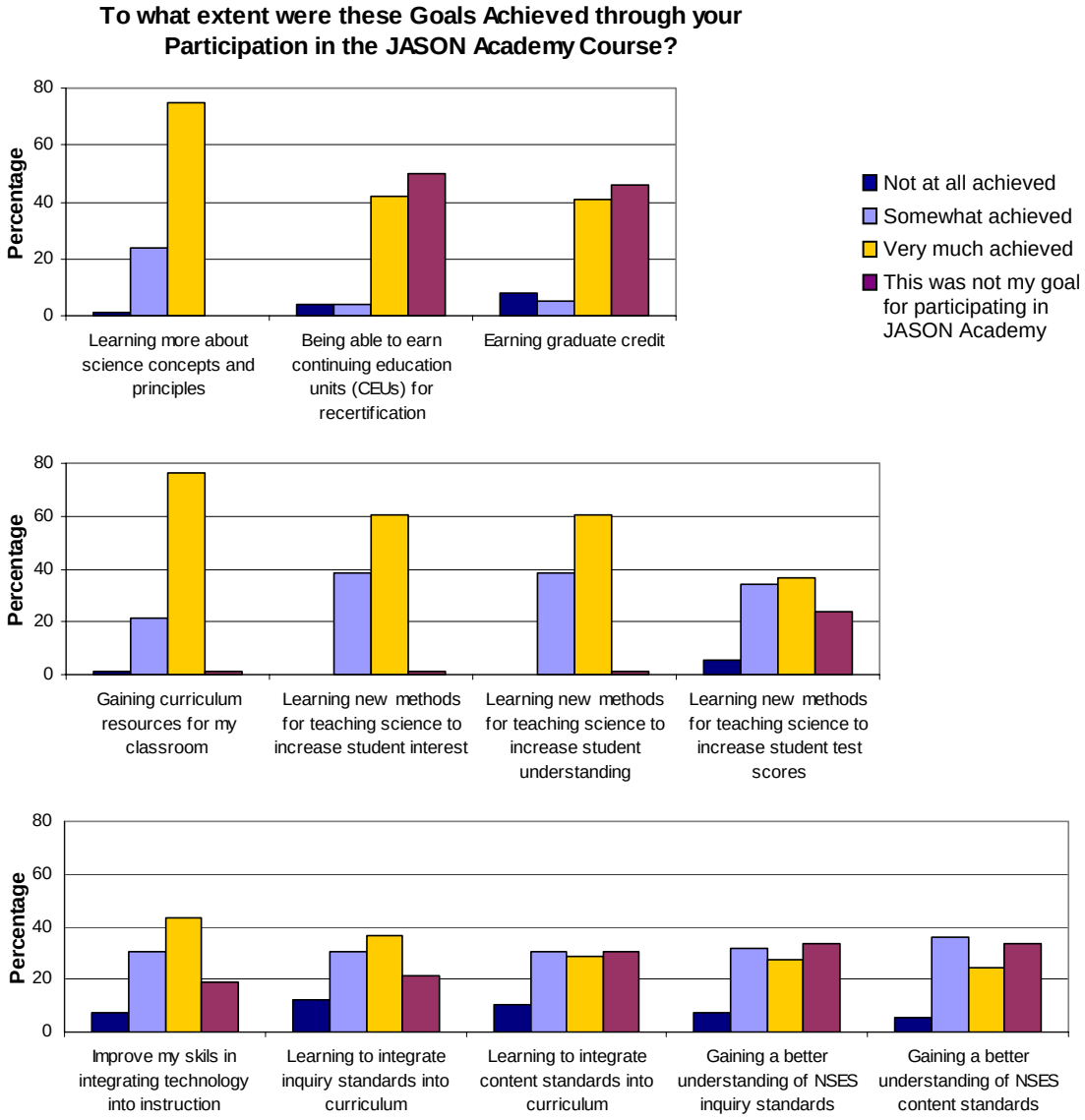
12 of the participants had taken JASON Academy courses before, 2 of whom had taken two courses. The motivation for taking the course ranged from improving content knowledge to learning more about using technology in a classroom. (Note that participants were allowed to select more than one option.)

Courses	Frequencies
Earth in the Solar System	4
Electricity and Magnetism	3
Earth's History	2
Structure of the Earth	2
Science Literacy	1
Transfer of Energy	1
Teaching Project-Based Science	1
Ocean Science	1

Categories	Frequencies
Improve content knowledge	35
Content is related to what I teach	22
Toward a degree/certification/highly qualified status or need for professional development hours.	12
Course appeared to be interesting or is in an area of interest to me	10
Improve teaching	6
Cost	6
Cancellation of another class	5
Convenience	4
JASON Expedition reputation	3
Desire to increase use of technology in the classroom	2

Teachers rate learning science concepts, learning new methods for teaching science, and gaining curriculum resources for their classroom as very important reasons for taking JASON Academy courses. The 3 graphs on the next page show that teachers felt that these goals were achieved, especially gaining curriculum resources for their classroom.




To what extent were these Goals Achieved through your Participation in the JASON Academy Course?
Percentage
80
60
40
20
0
Learning more about science concepts and principles
Being able to earn continuing education units (CEUs) for recertification
Earning graduate credit
Not at all achieved
Somewhat achieved
Very much achieved
This was not my goal for participating in JASON Academy
Gaining curriculum resources for my classroom
Learning new methods for teaching science to increase student interest
Learning new methods for teaching science to increase student understanding
Learning new methods for teaching science to increase student test scores
Improve my skils in integrating technology into instruction
Learning to integrate inquiry standards into curriculum
Learning to integrate content standards into curriculum
Gaining a better understanding of NSES inquiry standards
Gaining a better understanding of NSES content standards

Support for taking the JASON Academy Courses

The majority of teachers paid for their JASON Academy course themselves. This result could be skewed by the perceived discount in the courses that were included in the study due to the stipend offered to the participants. Nevertheless, teachers feel a climate of support for their professional development and are not discouraged from taking online courses.

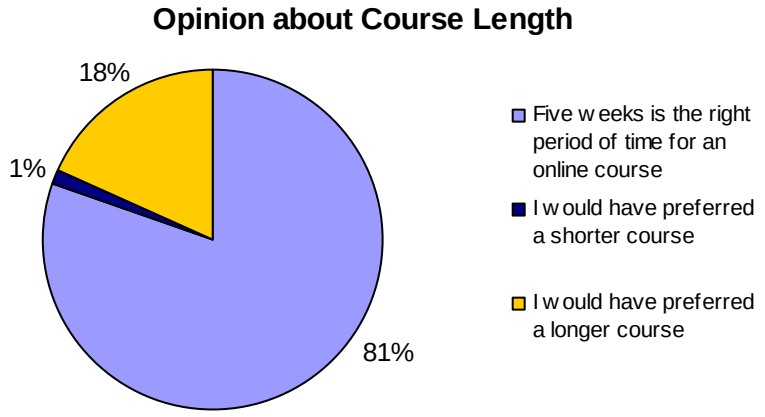
	Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree	No opinion
My school provides opportunities to learn how to integrate technology into the classroom	11.1	8.6	4.9	37	35.8	2.5
My school provides a wide range of formal and informal opportunities for professional development	7.4	17.3	8.6	37	29.6	0
My school provides opportunities for teachers to collaborate with each other	4.9	14.8	12.3	39.5	28.4	0
The administration at my school tries to find ways to support teachers in trying new ideas, even when the ideas cost money	9.9	13.6	13.6	35.8	27.2	0
At my school, I have to seek out my own professional development opportunities	12.3	16	9.9	33.3	25.9	2.5
My school district favors face-to-face workshops over online professional development	8.8	6.3	35	12.5	8.8	28.8
My school district does not trust the quality of online professional development courses	27.2	8.6	30.9	4.9	1.2	27.2

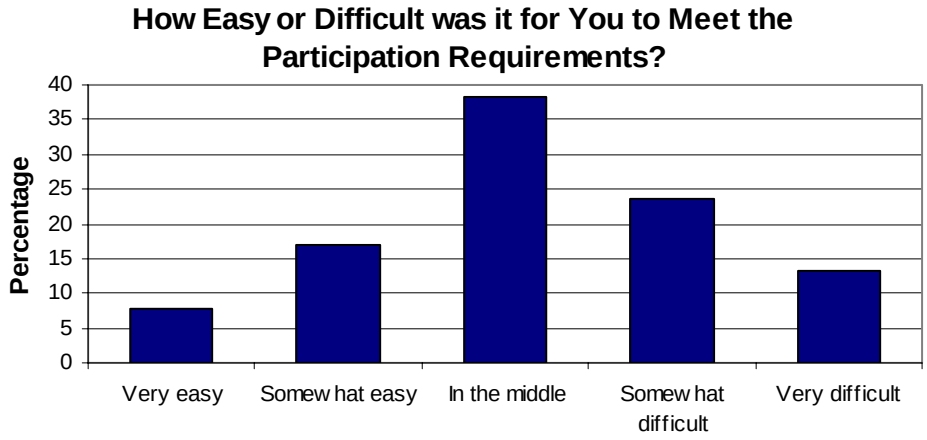
Opinions about the JASON Academy Courses

Teachers found that making connections among science concepts and learning new ways to teach science were helpful in improving their teaching. A majority also thought the courses were the right length and that they could meet the participation requirements.

How helpful were the activities below to you in deepening your own pedagogy skills?

	Very helpful	Somewhat helpful	Not at all helpful
Making connections among the science concepts being dicussed	55.3	42.1	2.6
Interacting with other participants via discussion boards about new ways to teach science to students	50	47.4	2.6
Reading course material online	46.1	44.7	9.2
Completing other course requirements	42.1	55.3	2.6
Conducting JASON-related activities with my classroom	41.7	48.6	9.7
Interacting with the online facilitator	41.3	52	6.7
Interacting with other participants via discussion boards about science content	28.9	63.2	7.9



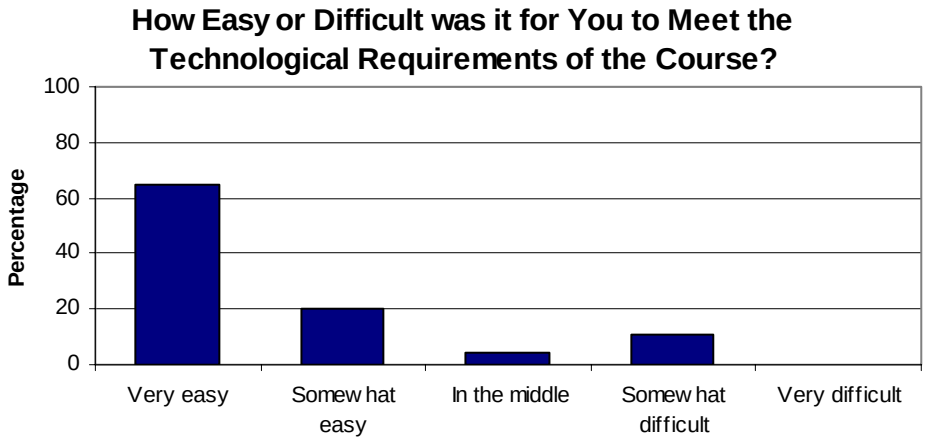


Teachers experienced little difficulty to meeting the technological requirements of the course. Many accessed the course from their home or classroom over varying kinds of connections. No problems were reported with the technical features of the course, all of them working close to 100% of the time.

Where the course was accessed	Percent
Home	98.7
My classroom	60.5
School computer lab	18.4
Other	5.3
School library or media center	3.9
Public library or community center	3.9

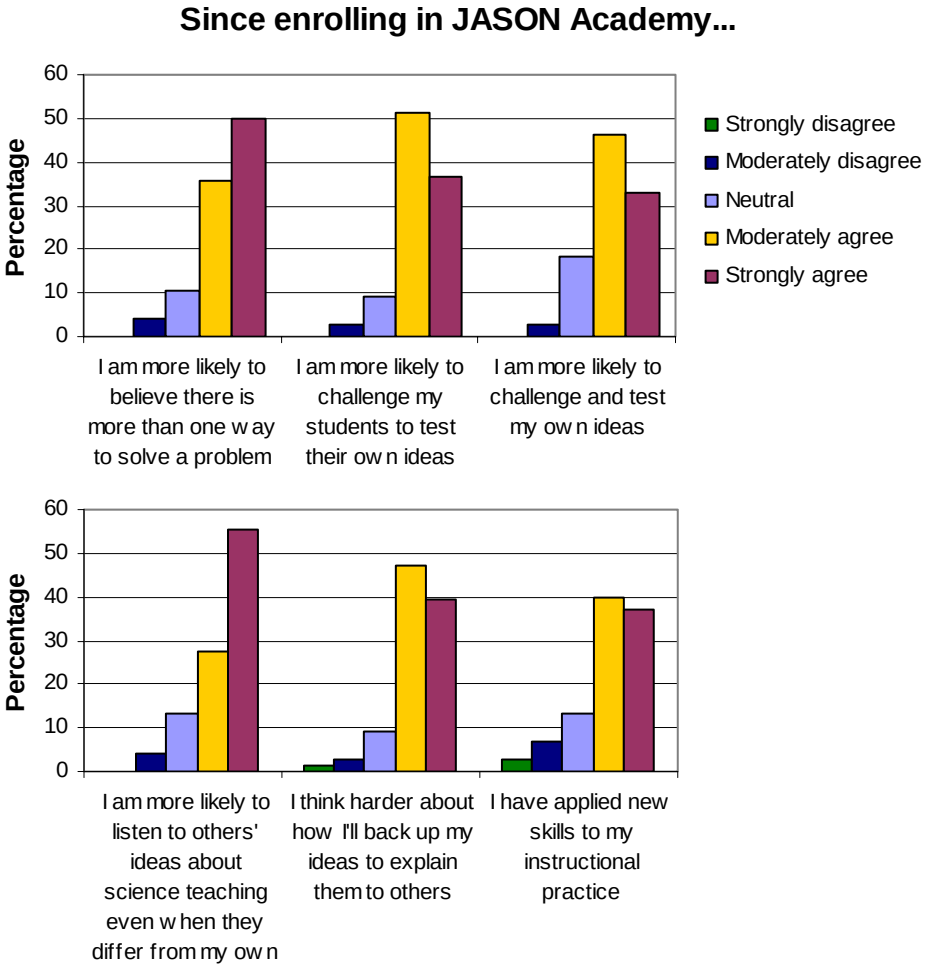
Frequency with which technology worked	Percent
Discussion boards	96.1
Links (to other Web sites or pages within the site)	93.4
Animations	92.1
Pop-up boxes	88.2

Means of accessing the course	Percent
I used a high-speed cable modem or DSL	53.9
I used a high-speed connection over our school's T1 line	52.6
I used a low-speed connection over a dial-up modem	52.6



Perceived Changes in Teaching after Taking a JASON Academy Course

Teachers taking these JASON Academy courses reported positive changes in their views on ways of teaching science in a more discussion-oriented, inquiry fashion. Participants reported seeing that there is more than one way to solve a problem and felt able to listen to others opinions even when they differ from their own.



Getting online was not a barrier to participation for the participants. Although not reporting problems with specific site features such as pop-ups and the discussion boards, still only half (53%) reported strong agreement with the statement that "The features on the class site worked reliably well." Teachers' beliefs about content alignment with standards was 76% for moderate to strong agreement, although as discussed, for many teachers integrating or learning about standards was not a reason for taking the course. Perhaps worth further investigation is the difference between Forces and Motion and Structure of the Earth with respect to beliefs about the programs' content not being relevant for their students. This goes against the large number of teachers who said that they took the course because it seemed relevant to what they taught, but could be explained by the presence of elementary teachers in the study.

To what extent was each of the following barriers or supports to participating as you would have liked in JASON Academy?

	Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree
I was able to get online whenever I needed to	3.9	5.3	2.6	11.8	76.3
The features on the class site worked reliably well	1.3	2.7	4	33.3	58.7
JASON Academy's content was well aligned with content standards I'm expected to teach	0	12	12	33.3	42.7
The programs' content was relevant to my students' backgrounds and abilities	3.9	7.9	11.8	42.1	34.2
The program matched my initial expectations for what I would learn	5.3	13.2	6.6	42.1	32.9
I had adequate support from my principal for me to participate	8.1	4.1	50	6.8	31.1

As expected, lack of time was a barrier to some teachers' participation. Of note is the relatively high percentage of teachers who would have liked more experience with inquiry approaches to teaching.

To what extent was each of the following barriers or supports to participating as you would have liked in JASON Academy?

	Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree
My own comfort and skill in using technology got in the way of my participation	61.8	15.8	5.3	10.5	6.6
The Internet connection I used for the course wasn't fast enough	55.3	14.5	6.6	17.1	6.6
My own comfort and skill with the content being covered in the course got in the way of my participation	53.9	22.4	6.6	10.5	6.6
The program was not focused enough on developing science content knowledge	53.9	30.3	6.6	7.9	1.3
The program was not focused enough on how to apply what I learned to classroom teaching	46.1	27.6	10.5	15.8	0
The program was not focused enough on developing on science process/inquiry skills	35.5	36.8	15.8	11.8	0
I didn't have enough time available to participate in course activities online	23.7	17.1	10.5	31.6	17.1

Appendix C: Alignment of Course Syllabi with Assessment Items

This section describes the Forces and Motion course and the Structure of the Earth course. Assessment items are shown mapped against the course syllabus, and the Structure of the Earth items that needed to be omitted from the final analysis are also indicated in the table for that course.

Forces and Motion

Focusing on conceptual understanding, week one introduces Kinematics, the study of how things move on a straight path. Week two advances this understanding into accelerated motion and introduces inertia. During this week, gravity is introduced within a multidisciplinary arena. Week three introduces dynamics, the study of forces and why things move, and looks at inertia, mass, and weight. Week four presents opportunities to measure forces and to examine their effects. Coverage includes Bernoulli's principles, friction, terminal velocity, and buoyancy. Week five explores the everyday world with its focus on mechanical advantage, work, and simple machines.

Structure of the Earth

This course examines the physical Earth including its internal structure and the processes that make it an ever-changing place. Week one begins by looking at the structure of matter, including atomic bonding and the formation of minerals. The second week concentrates on the origin of landforms and constructive forces like volcanoes, earthquakes, and mountain building. During this week, igneous and metamorphic processes and their contribution to the rock cycle are examined. Week three takes a close-up look at weathering, erosion, and other destructive forces that not only re-shape Earth's surface, but also contribute sediment to that portion of the rock cycle. Finally, in weeks four and five, the learner digs deep into the inner depths of the planet to examine Plate Tectonic theory and is rewarded with a greater understanding of the internal forces which help drive our dynamic Earth.

Structure of the Earth alignments

Week One: Crystals, Minerals, and the Atomic Structure of Matter This week provides a general introduction to the atomic structure of matter, chemical bonding, and the formation and properties of minerals. Week One topics include: A. Matter, Matter, Everywhere. Defines the meaning of matter, including its properties and states. B. Dividing the Indivisible. Introduces the structure of atoms. C. It's All Elementary. Discusses the nature of chemical elements and links to an interactive periodic table of elements. D. Common Bonds. Introduces the process of chemical bonding and explains how compounds form from individual elements. E. Crystals, They're Habit Forming! Explains the process of crystal formation within a rock and describes the various ways that crystals can grow. F. Breaking Up Is Hard To Do! Explains the process whereby minerals break, including the properties of fracture and cleavage. G. Mineral Color, Luster, and Streak. H. Silicates on Parade. Discusses the nature and composition of silicate minerals, the most common minerals found on Earth. I. Non-silicate Minerals. Explains the structure of some of the more important non-silicate minerals (including sulfates and carbonates).	Geosciences concept inventory (GCI) items: GCI A: 21 GCI B: 12	Items in final assessment. Grayed-out items were omitted from the final analysis as too easy. 16 13 SRI items: 1 and 2
Week Two: The Earth Beneath Our Feet—Constructive Forces This week provides an introduction to the constructive forces that shape the crust of the planet, including volcanoes, earthquakes, and tectonic uplift. Week Two topics include: A. Volcanoes. B. The Inside Story: Intrusive Igneous Rocks. Explains the difference between intrusive igneous rocks and volcanic igneous rocks. C. Making Mountains Out of Molehills. Describes the process of mountain building and explains the different ways that Earth's crust gets uplifted. D. Earthquakes and Seismology. Explains the origins of earthquakes and describes the generation and propagation of different types of earthquake waves. E. We All Have Our Faults! Describes the different types of faults and the forces responsible for motion along them. F. The Big Squeeze: Metamorphic Processes in Action. Explains the differences between contact and regional metamorphism.	GCI A: 7	Not used per JASON instructor SRI item 3

Week Three: Tearing Down the Earth—Destructive Forces

This week provides a general introduction into the destructive forces that shape the Earth's crust, including weathering, and erosion by streams, wind and ice. It also introduces sedimentary processes and the rock cycle.

Week Three topics include:
A. Weathering of Rocks.. Includes a classroom activity on rock weathering.
B. Mass Movements and Gravity.
C. Stream Erosion.
D. A River Runs Deep: The Development of Stream Systems. Describes the development of different types of stream systems and explains how drainage patterns are controlled by many factors, including the underlying structure of the bedrock.
E. Glaciers in Action. Explains the mechanics of glacial flow and describes how glaciers can be agents of erosion, transport, and deposition.
F. Wind Erosion and Transport.
G. Coastal Erosion and Deposition. Explains the dynamic interplay of wind, waves, and current action in the erosion and transport of sediment in coastal zones.
H. Deposition and the Formation of Sedimentary Rocks.
I. The Rock Cycle. Summarizes the components of the rock cycle and describes the processes by which minerals can be recycled into different rocks.

GCI A: 16	15
GCI B: 14	not used
GCI B: 21	17

Week Four: The Development of Plate Tectonic Theory This week provides a general introduction to modern plate tectonic theory and discusses the various lines of evidence used to support it. Week Four topics include: A. Mapping Earth's Surface. B. Continental Drift:. Discusses the work of Alfred Wegener and his early theories of continental drift. C. The Ocean Floor: What a Relief! Explains how topographic measurements of the ocean floor helped to provide key evidence in support of the idea that Earth's crust is a dynamic entity. D. Sea Floor Spreading. Explains how sampling and age-dating rocks from the ocean crust led scientists to an understanding that the distribution of the sea floor changed over time. E. Wandering Poles and Magnetic Stripes. Describes the phenomena of remnant magnetism in rocks and explains how periodic changes in the direction of Earth's magnetic field helped geologists unravel the motion of crustal plates. F. Ring Around the Ocean. Explains how the plotting of earthquakes and volcanic activity around the Earth helped to confirm the idea that sections of the crust were free to move over time. G. Plate Tectonic Theory: Wegener's Revenge. Explains how modern plate tectonic theory helped to pull all the pieces together and how it serves as a unifying principle in geology today.	GCI A: 4 GCI A: 5 GCI A: 9 GCI A: 11 GCI A: 20 GCI B: 11	4 5 7 9 not used 14 SRI item 3
Week Five: The Inside Story This week provides an introduction to Earth's internal structure and discusses the origin of the planet based on the overall geologic evidence. Week Five topics include: A. Earth's Internal Structure. B. Density: That Sinking Feeling. Explains how density differences between the rocks of the crust and mantle help to drive plate tectonic action. C. Convection Currents and Geothermal Energy. Explains how the differential heating of material in the mantle helps to generate large-scale convection currents, which provide the motor for plate tectonic action. D. Earth's Magnetic Field: The Dynamo Effect. Discusses the origins of Earth's magnetic field and describes the so-called dynamo effect. E. Earthquake Shadow Zones. Explains how seismic data has been used to identify different layers inside the Earth. F. Origins of the Earth. Discusses current theories on the origins of the Earth and explains how the geophysical data supports the "proto-planetary" hypothesis.	GCI A: 6 GCI A: 10 GCI A: 12 GCI A: 13 GCI A: 15	6 8 10 11 12

Forces and Motion alignments

Week One: The Force Is Always with Us Kinematics introduction. A. Intro to Galileo's theories B. Describing motion on Earth C. Representing motion D. Representing constant motion E. Galileo's theories F. Historical and modern views of motion	Force concept inventory items (1995 version): 19, 20, 29	graph items 1, 2, 5 from SimCalc SRI open response item 2
Week Two: All About Moving This week introduces acceleration and inertia. A. Representing constant velocity. B. Hockey puck example of acceleration. C. Change in velocity = acceleration D. Free Fall E. Motion graphs and their slope F. Velocity and acceleration without gravity	1, 3, 6, 7, 9, 10, 18, 21, 22	FCI items: 1, 3, 8, 10 Motion graph items 3, 4, 6, 7 from SimCalc
Week Three: These Forces are Already With You This week introduces dynamics. A. Forces as vector quantities B. Inertia and force C. Inertia and motion in collisions D. Acceleration as a function of mass E. Conservation of momentum F. Universal gravitation G. Weight and mass	4, 5, 23, 24, 30	FCI item 30 SRI open response items 1, 4
Week Four: Real World Applications This week presents opportunities to measure forces and examine their effects. A. Balanced and unbalanced forces B. Friction as a force C. Air resistance D. Bernoulli effects E. Terminal velocity F. Buoyant forces	4, 15, 16, 17, 25, 26, 27, 28	FCI items 25 and 27 SRI open response item 5
Week Five: A World of Physics Exploration of force and motion using simple machines. A. Definition of Work B. Technology and energy C. Power = Work x Time D. Energy Issues E. Consider Alternative Ideas about Energy.		SRI open response item 3

Appendix D: Content Tests for Forces and Motion and Structure of the Earth

This section contains the assessments given to participants in the study. Only one item in the Forces and Motion assessment required a rubric. Initial scoring did not show consistency in giving 0.05 points. After creating this rubric, a new scorer re-scored the item in both the pre-test and the post test. A third scorer then re-scored a random sample of 20% of pre-test items, and 20% of post-test items. The inter-rater reliability for this scoring was 98%.

Rubric for JASON Forces & Motion Test Item: Part II Q3

Question: What is the relationship between power and work?

Pts	Criteria	Examples
1	Mentions Power=Work/Time or describes the correct relationship among power, work, and time. "P is the rate that work is done" is also okay, as the rate implies per unit time. May includes some errors, but deserves a point 1 as long as the correct relationship is mentioned.	"Power is the rate that work is done" "Power is work per unit time." "work = power x time"
0.5	Mentions proportional relationships between power and one of the other 2 variables (work or time).	"more power=more work, less power=less work" "They are proportional."
0	Wrong answer. Blank.	"power x distance = work" "power is needed to do work" "power is the measure of work done on an object." "more power makes work easier" "the amount of work depends on power applied." "they are directly related"

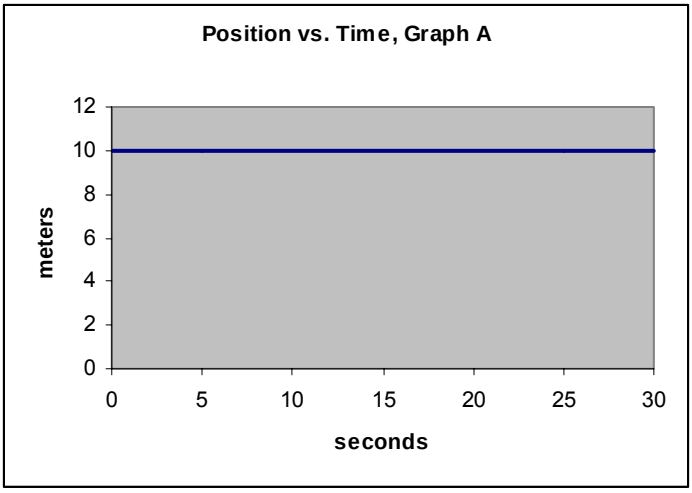
Part I. Motion Graphs Questions:

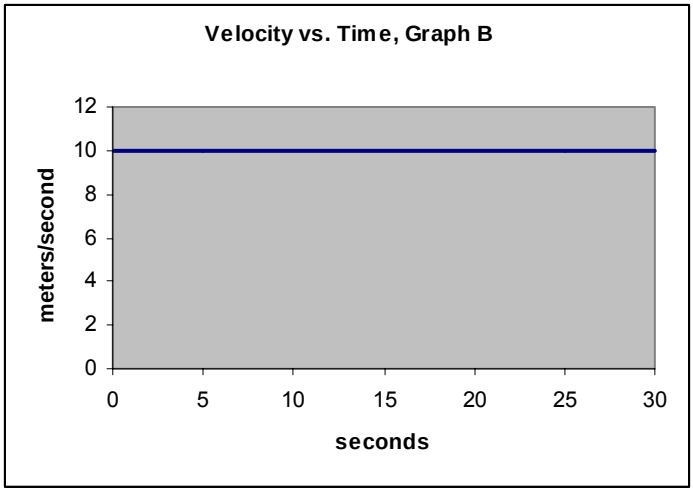
NOTE: You will see a number of different types of graphs in this section of the assessment. For example:

1. **Position graphs** represent where an object is with respect to time. The x-axis represents time, and the y-axis represents distance in meters (m).

2. **Velocity graphs** represent the speed an object is going with respect to time. The x-axis represents time, and the y-axis represents velocity in meters/second (m/s).

Graph A represents the motion of object A. Graph B represents the motion of object B. Choose the phrases that describe how objects A & B would move.





1. *Choose all that apply to A's motion only.*

a) A ends its trip where it began.

b) A changes direction.

c) A's maximum position is 10 meters.

d) A's maximum position is 300 meters.

e) A has constant velocity from time 0 to time 30.

2. *Choose all that apply to B's motion only.*

a) B ends its trip where it began.

b) B changes direction.

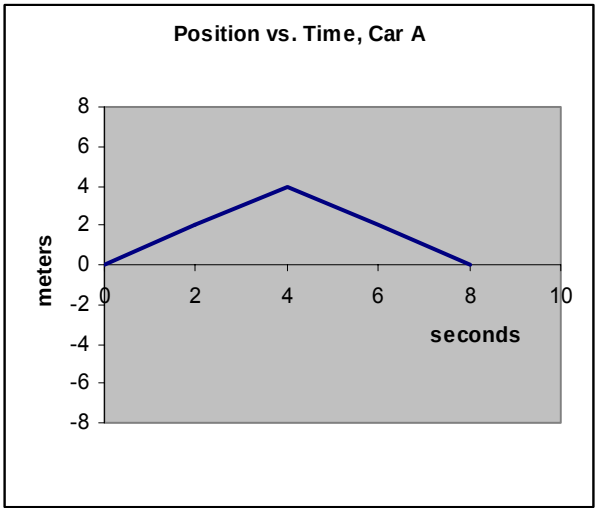
c) B's maximum position is 10 meters.

d) B's maximum position is 300 meters.

e) B has constant velocity from time 0 to time 30.

In each column below, circle all the descriptions that are true for the motion of the two cars as given by the graphs.

Car A



3. *Choose all that apply to A's motion <u>only</u>.*

a) A ends its trip where it began.

b) A changes direction.

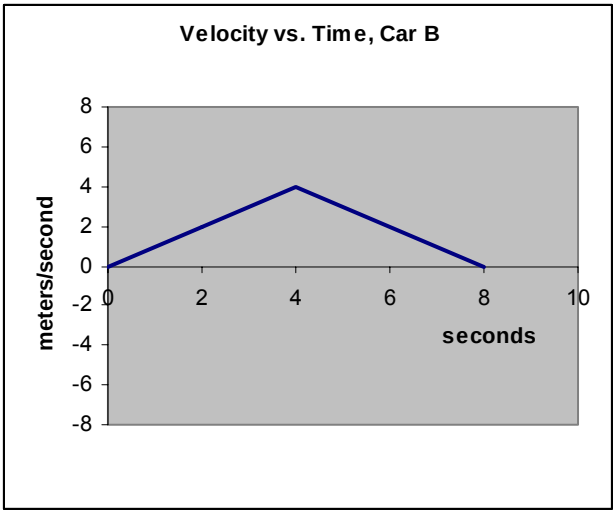
c) A increases speed, then decreases speed.

d) A's maximum position is 4 meters.

e) A's motion is comprised of constant speed.

f) A's motion is comprised of constant velocities.

Car B



4. *Choose all that apply to B's motion <u>only</u>.*

a) B ends its trip where it began.

b) B changes direction.

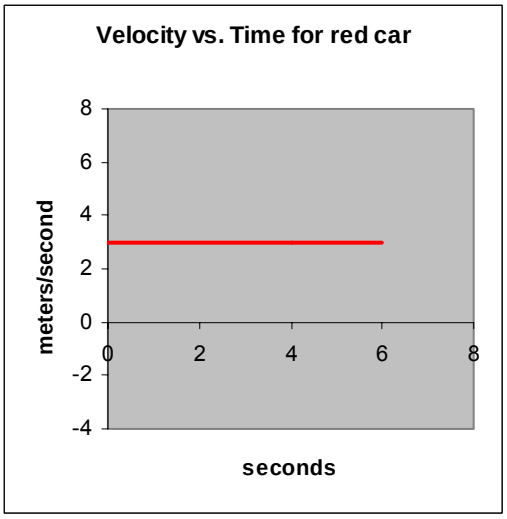
c) B increases speed, then decreases speed.

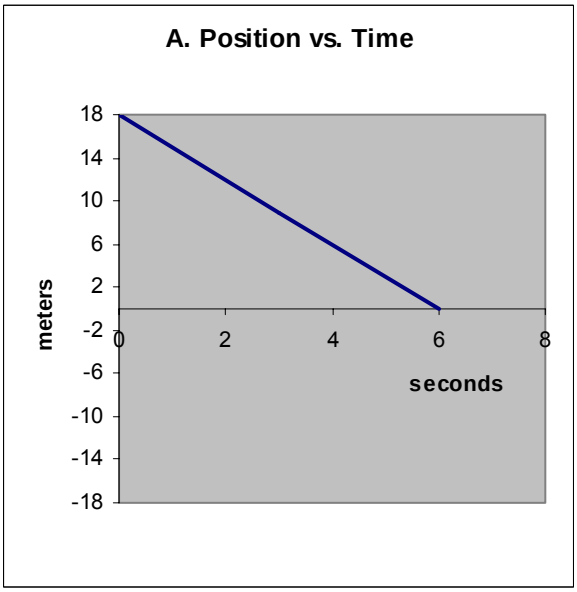
d) B's maximum position is 4 meters.

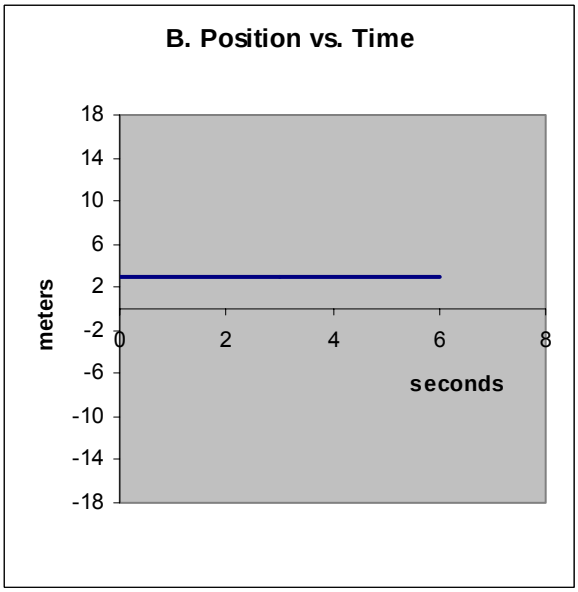
e) B's motion is comprised of constant speed.

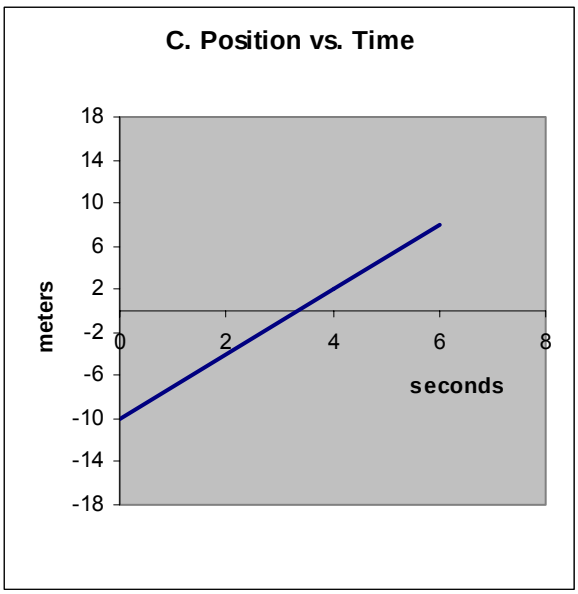
f) B's motion is comprised of constant velocities.

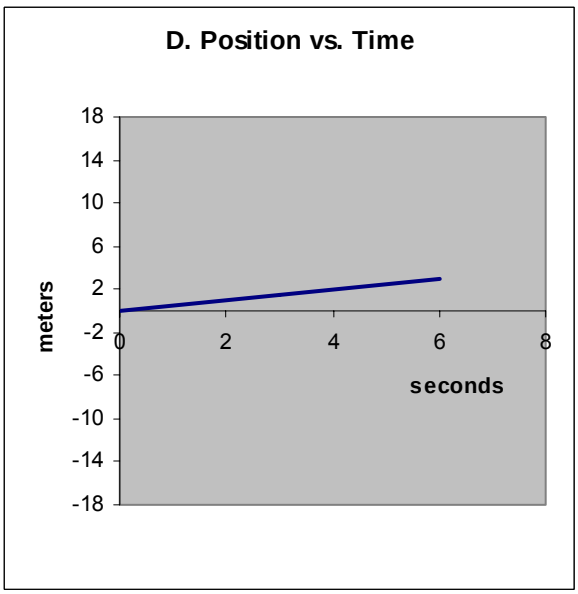
5. To the right is a velocity graph for a red car. Which of the position graphs below could correctly describe a motion for another car, a blue car, so that the blue car has the same velocity and travels the same distance and direction as the red car?





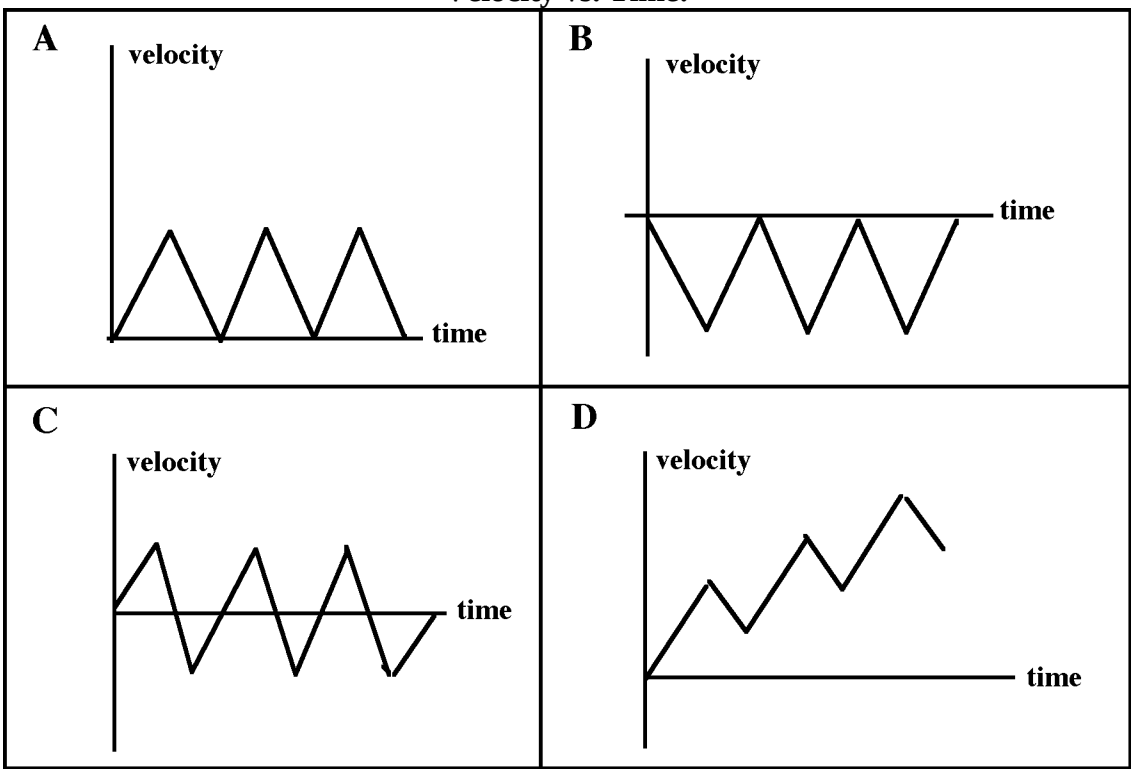




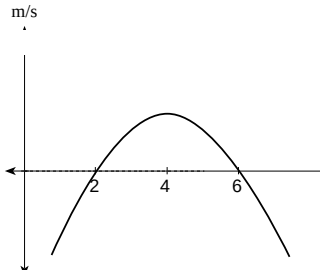


6. Please choose the graph that represents the velocity of an object as it travels back and forth between two points or objects, one of which may be the reference point.

Velocity vs. Time:

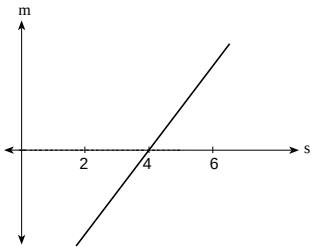


Velocity vs. Time

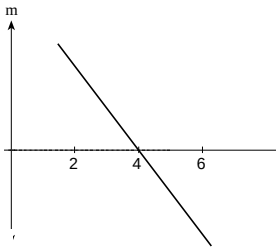


7. The velocity graph is shown in the figure above. Which of the following could be the position graph?

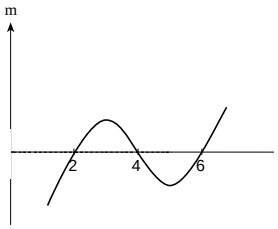
(A)



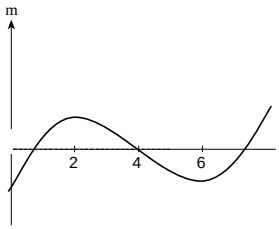
(B)



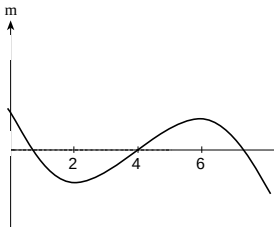
(C)



(D)



(E)



Part II. Short answer questions

Please enter your answers in the blanks on the web form.

1. The effect of a force on an object's acceleration will be _____ if the force is greater, and will be _____ if the object has more mass.

2. The steady motion of an object can be described by 3 variables: _____, _____, and _____.

3. What is the relationship between power and work?

4. A car is slowing at a stoplight. This is an example of _____ acceleration.

5. If an object is completely submerged in a liquid it displaces a volume of liquid equal to its own volume. The weight of the liquid displaced equals the _____.

Part III. Force concept inventory
Please choose the one answer that best describes each situation.

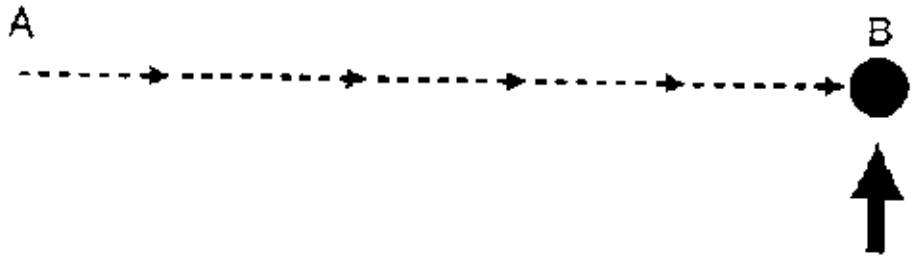
1. Two metal balls are the same size, but one weighs twice as much as the other. The balls are dropped from the roof of a single story building at the same instant. The time it takes the balls to reach the ground below will be:

A. about half as long for the heavier ball as for the lighter one.
B. about half as long for the lighter ball as for the heavier one.
C. about the same for both balls.
D. considerably less for the heavier ball, but not necessarily half as long.
E. considerably less for the lighter ball, but not necessarily half as long.

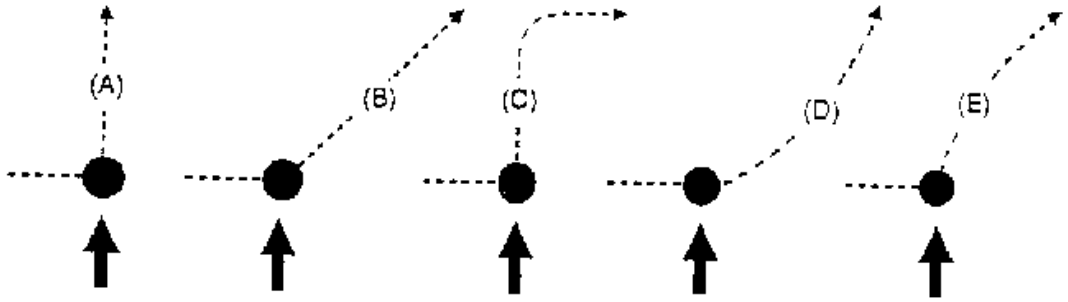
2. A stone dropped from the roof of a single story building to the surface of the Earth:

A. reaches a maximum speed quite soon after release and then falls at a constant speed thereafter.
B. speeds up as it falls because the gravitational attraction gets considerably stronger as the stone gets close to the Earth.
C. speeds up because of an almost constant force of gravity acting upon it.
D. falls because of the natural tendency of all objects to rest on the surface of the Earth.
E. falls because of the combined effect of the force of gravity pushing it downward and the force of the air pushing it downward.

USE THE FIGURE BELOW TO ANSWER THE NEXT THREE QUESTIONS.
The figure depicts a hockey puck sliding with a constant speed in a straight line from point "A" to point "B" along a frictionless horizontal surface. Forces exerted by the air are negligible. You are looking down on the puck. When the puck reaches point "B", it receives an swift horizontal "kick" in the direction of the heavy print arrow, perpendicular to the original sliding motion.



3. Which of the paths below would the puck most closely follow after receiving the kick?



4. Along the frictionless path the puck takes, the speed of the puck after receiving the kick:

A. is constant.
B. continuously increases.
C. continuously decreases.
D. increases for a while and decreases thereafter.
E. is constant for a while and decreases thereafter.

5. Along the frictionless path the puck takes, the main force(s) acting on the puck after receiving the kick is (are):

A. a downward force of gravity.
B. a downward force of gravity, and a horizontal force in the direction of motion.
C. a downward force of gravity, an upward force exerted by the surface, and a horizontal force in the direction of motion.
D. a downward force of gravity and an upward force exerted by the surface.
E. none. (No forces act on the puck.)

6. A woman exerts a constant horizontal force on a large box. As a result, the box moves across a horizontal floor at a constant speed. The constant horizontal force applied by the woman:

A. has the same magnitude as the weight of the box.
B. is greater than the weight of the box.
C. has the same magnitude as the total force which resists the motion of the box.
D. is greater than the total force which resists the motion of the box.
E. is greater than either the weight of the box or the total force which resists its motion.

7. If the woman in the previous question suddenly stops applying a horizontal force to the box, then the box will:

A. immediately come to a stop.
B. continue moving at a constant speed for a while, and then slow to a stop.
C. immediately start slowing to a stop
D. continue at a constant speed.
E. increase its speed for a while and then start slowing to a stop.

8. Despite a very strong wind, a tennis player manages to hit a tennis ball with her racquet so that the ball passes over the net and lands in her opponent's court. Consider the following forces:

(1.) a downward force of gravity
(2.) a force exerted by the "hit"
(3.) a downward force exerted by the air

Which of the above forces is (are) acting on the tennis ball after it has left contact with the racquet and before it touches the ground.

A. 1 only.
B. 1 and 2.
C. 1 and 3.
D. 2 and 3.
E. 1, 2, and 3.

Structure of the Earth Assessment

1. A mineral you pick up off the ground contains mostly matter that is in a:

(A) liquid state
(B) solid state
(C) plasma state
(D) gaseous state

2. Which are the most common types of minerals on earth?

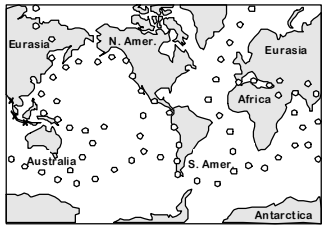
(A) carbonates
(B) phosphates
(C) halides
(D) silicates

3. Plate tectonics activity primarily takes place in the:

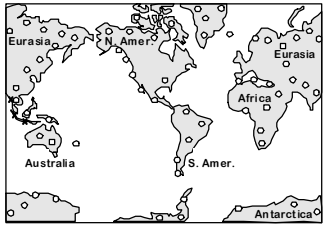
(A) biosphere
(B) stratosphere
(C) atmosphere
(D) lithosphere

4. The following maps show the position of the Earth's continents and oceans. The o's on each map mark the locations where earthquakes occur most frequently. Which map do you think best represents where earthquakes occur most frequently on Earth?

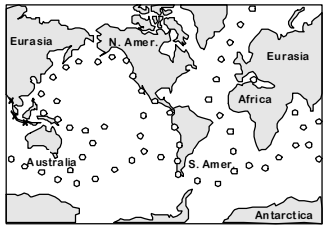
Circle one: **A** **B** **C** **D** **E**



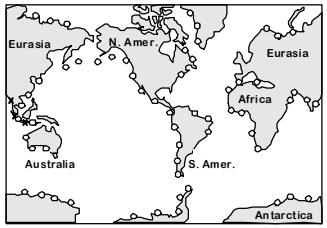
A. In continental and oceanic crust, and along continental margins



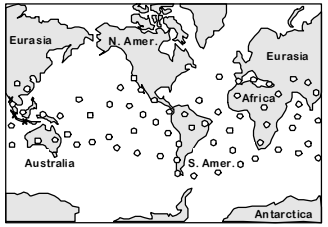
B. Mostly in continental crust



C. Only in oceanic crust



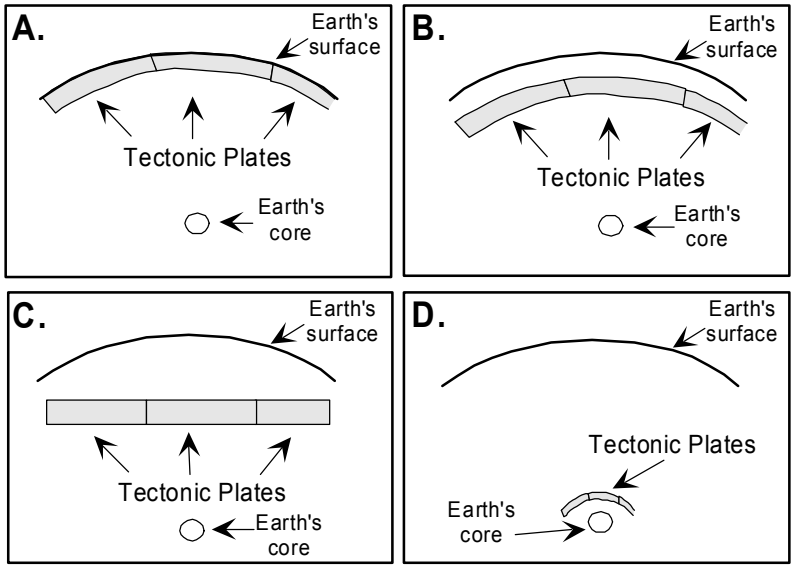
D. Mostly along continental margins



E. Mostly in warm climates

5. Scientists often talk about the Earth's tectonic plates and their role in mountain formation, volcanism, and earthquake occurrence. Which of the following figures most closely represents the location of the Earth's tectonic plates?

Circle one: **A** **B** **C** **D**



6. Some people think the Earth has a magnetic field. Which of the following statements do you think provides the strongest evidence for this belief?

(A) People would float off into space without a magnetic field
(B) People can use the magnetic field to help them navigate
(C) The Earth revolves around the Sun because of its magnetic field
(D) The Earth rotates about its axis because of its magnetic field
(E) None of the above, the Earth does not have a magnetic field

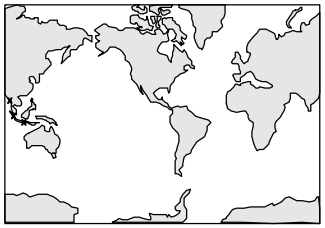
7. Which of the following best describes what scientists mean when they use the word "earthquake"?

(A) All earthquakes create visible cracks on the Earth's surface
(B) When an earthquake occurs, the earth shakes at least once every 10 seconds for a period of at least 1 minute
(C) All earthquakes damage man-made structures
(D) When an earthquake occurs, energy is released from inside the Earth
(E) When an earthquake occurs, the gravitational pull of the Earth increases

8. Which answer best describes what the surface of the Earth would be like if you could travel back to the time when the Earth first formed as a planet?

(A) The Earth was about the same temperature as today, and covered with jungles at the surface
(B) The Earth was about the same temperature as today, and covered with water at the surface
(C) The Earth's surface and temperature were similar to today, although no cities existed yet
(D) The Earth's surface was very hot and covered with melted rock
(E) The Earth's surface was very cold and covered with ice

9. The map below shows the position of the Earth's continents and oceans today. The gray areas represent land, and the white represents water. Which of the following best explains why the ocean basins look the way they do?



(A) Meteor impacts caused the ocean basins to form this way
(B) Ocean basins form as continents move
(C) The ocean basins formed in cracks that were created as the whole Earth cooled after its formation
(D) The ocean basins formed in cracks that were created as the whole Earth heated after its formation

10. Some people believe that they have evidence that can prove whether the very center of the Earth is a solid, liquid, or gas. Which of the following is an accurate statement about the innermost part of the Earth?

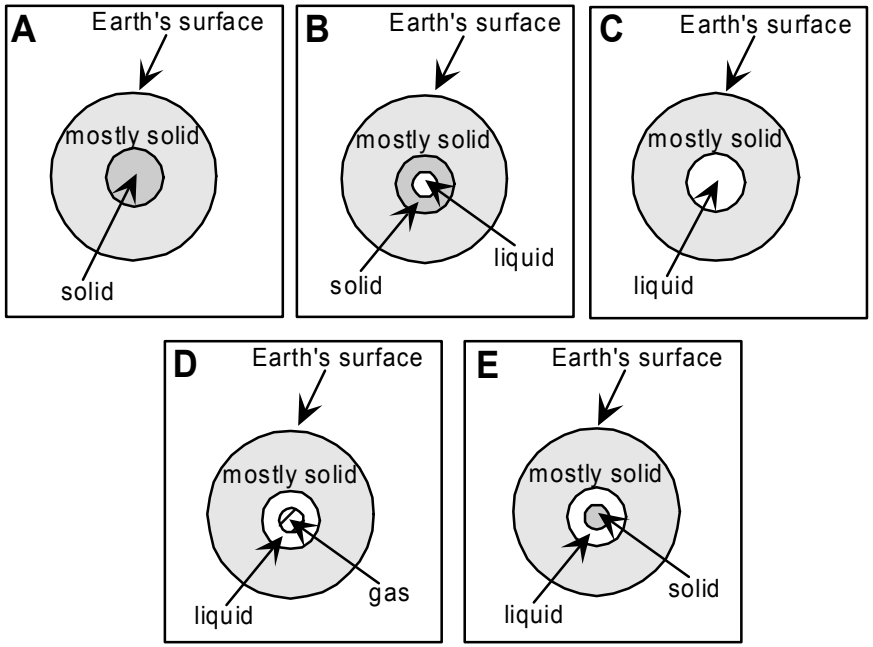
(A) The very center of the Earth is mostly made up of gases
(B) The very center of the Earth is mostly made up of liquids
(C) The very center of the Earth is mostly made up of solids
(D) Scientists do not have enough evidence yet to indicate whether gases, liquids, or solids make up most of the very center of the Earth

11. The Earth probably has a magnetic field because of:

(A) Changes in the composition of the Earth's crust
(B) Gravity
(C) Liquid metal moving inside the Earth
(D) The order of the planets in the solar system
(E) None of the above, the Earth does not have a magnetic field

12. Which of the following figures do you believe is most closely related to what you might see if you could cut the Earth in half?

Circle one: **A** **B** **C** **D** **E**



13. Which of the following statements about the age of rocks is most likely true?

(A) Rocks found in the ocean are about the same age as rocks found on continents
(B) Rocks found on continents are generally older than rocks found in the ocean
(C) Rocks found in the ocean are generally older than rocks found on continents
(D) None of the above; we cannot figure out the age of rocks precisely enough to figure out which rocks are older

14. How far do you think continents move in a single year?

(A) A few inches
(B) A few hundred feet
(C) A few miles
(D) Scientists do not have enough information to calculate the speed of continents
(E) Continents do not move

Please note the following questions may have more than one correct answer. Choose all that apply.

15. Where do you think glaciers can be found today?
Choose all that apply.

(A) In the mountains
(B) At sea level
(C) At the South pole
(D) Along the equator only
(E) Anywhere except along the equator

16. Some people say that radioactivity is a process that sometimes occurs on Earth. Which of the following statements about radioactivity do you think are true? **Choose all that apply.**

(A) Radioactivity only occurs if carbon is present
(B) Radioactivity cannot occur at the Earth's surface, although it can occur in the atmosphere
(C) The only way radioactivity can be created is by people, such as in nuclear power plants
(D) Half-life is a measure of how quickly radioactivity decreases as a radioactive element changes.
(E) Half-life decays away and eventually disappears

17. Rocks found in oceans can be _____. **Choose all that apply.**

(A) Formed by animals
(B) Made up of pieces of continental rocks
(C) Formed by volcanic activity

Appendix E: Teacher Surveys

JASON Academy Pre-Course Survey

Please provide your name: _____

A. Teacher Background

A1. Please check all the grade levels that you are teaching in 2003-04.
(Check all that apply.)

1☐ Primary elementary (K-3)
2☐ 4th Grade
3☐ 5th Grade
4☐ 6th Grade
5☐ 7th Grade
6☐ 8th Grade
7☐ 9th Grade
8☐ 10th Grade
9☐ 11th Grade
10☐ 12th Grade

A2. How many years have you been a full-time K-12 teacher?

1☐ I'm not a full-time teacher.
2☐ This is my first year of teaching.
3☐ This is my second year of teaching.
4☐ 3-5 years
5☐ 6-10 years
6☐ 11-15 years
7☐ 16-20 years
8☐ 21-30 years
9☐ more than 30 years

A3. How many years have you taught science?

1☐ I don't teach science.
2☐ This is my first year teaching science.
3☐ This is my second year teaching science.
4☐ 3-5 years
5☐ 6-10 years
6☐ 11-15 years
7☐ 16-20 years
8☐ 21-30 years
9☐ more than 30 years

A4. My school is
1☐ Urban
2☐ Suburban
3☐ Rural

A5. Please categorize your classroom arrangement.

1☐ I teach all core subjects in a self-contained classroom.
2☐ I teach science and 1-2 other subjects in a self-contained classroom.
3☐ I teach science and 1-2 other subjects in a school where students change classes.
4☐ I teach science only in a school where students change classes.
5☐ I teach science in a before- or after-school program or club.

A6. The students in my classes, program, or club are:

1☐ Nearly all from low-income families (76% or more on free/reduced lunch).
2☐ Mostly from low-income families (50-75% on free/reduced lunch).
3☐ Mostly from middle-income families (25-49% on free/reduced lunch).
4☐ Nearly all from middle- or upper-income families (less than 25% on free-reduced lunch).

A7. What discipline(s) of science do you teach?
(Check all that apply.)

1☐ general science
2☐ physical science
3☐ earth science
4☐ environmental science
5☐ life science
6☐ space science
7☐ biology
8☐ chemistry
9☐ physics
10☐ geology/physical geography

A8. How would you characterize the ability level(s) of science students do you teach?
(Check all that apply)

1☐ low ability/achievement in science
2☐ mixed ability/achievement in science
3☐ honors in science
4☐ Advanced Placement science

A9. What degree work, pre-service, and in-service professional development have you participated in for science in the past five years? *(Check all that apply.)*

An undergraduate major in:
1☐ science
2☐ science education
3☐ other
A graduate degree in:
4☐ science
5☐ science education
6☐ other
7☐ Undergraduate course work in science
8☐ Graduate course work in science
9☐ Short (1-2 day) workshops on specific science topics
10☐ Summer institutes or extended workshops on specific science topics
11☐ Participation in a school- or district-wide science reform initiative
12☐ Work with a professional scientist on a study
13☐ Online professional development course, listserv, or virtual community
14☐ Self-study
15☐ Peer support or mentoring

B. Your Experience and Expectations of Online Learning

B1. Which course(s) are you currently enrolled in?

1☐ Structure of the Earth
2☐ Forces and Motion

B2. Have you taken JASON Academy courses before?
1☐ Yes
2☐ No

If yes, provide the name of the course(s):

B3. How did you learn about the JASON Academy? (Check all that apply.)
1☐ School Administration
2☐ Colleagues
3☐ Trade Publication
4☐ Conferences
5☐ Direct Mail
6☐ Email
7☐ NSTA
8☐ JASON Project
9☐ Other

B4. How did you decide to take the particular course you selected?

B5. How many online courses had you taken before enrolling in this JASON Academy course?

1☐ None
2☐ 1
3☐ 2-3
4☐ 4-5
5☐ 6 or more

B6. Have you ever been on a listserv or a participant in a virtual community of any kind?

1☐ Yes, as a regular contributor and reader
2☐ Yes, as a regular reader
3☐ Yes, as an occasional contributor or reader
4☐ I've never been on a listserv or a participant in a virtual community
5☐ I'm not sure what a listserv or virtual community is

B7. Familiarity with the **National Science Education Standards (NSES):**
(Check all that apply)

- ❑ I have not seen NSES.
- ❑ I have read the standards but do not refer to them frequently.
- ❑ I frequently refer to the standards when designing curriculum.
- ❑ My school science department/colleagues make a point to integrate NSES into the curriculum.
- ❑ I have participated in online or conference discussions regarding the standards.
- ❑ I have attended a workshop/training about the standards.
- ❑ I have played an active role in integrating the standards in the school's science curriculum.

B8. In your opinion, how well prepared are you to incorporate the NSES and/or state science <u>content standards</u> in your teaching?

1 ☐	2 ☐	3 ☐	4 ☐
Not prepared	Somewhat prepared	Well prepared	Very well prepared

B9. In your opinion, how well prepared are you to incorporate the NSES and/or state <u>science process/inquiry skill standards</u> in your teaching?

1 ☐	2 ☐	3 ☐	4 ☐
Not prepared	Somewhat prepared	Well prepared	Very well prepared

C. Technology Use

C1. How frequently do you use the following for <u>PERSONAL USE</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

C2. How frequently do you use the following for <u>CLASSROOM PREPARATION</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

C3. How frequently do you use the following in <u>CLASSROOM INSTRUCTION</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

C4. In your opinion, how well prepared are you to use computers and the Internet for classroom instruction?

1 ☐	2 ☐	3 ☐	4 ☐
Not prepared	Somewhat prepared	Well prepared	Very well prepared

D. Your Goals

Please rate how important each of the following reasons for deciding to take this JASON Academy course was.

		Not at all important	Somewhat important	Very important
D1.	Being able to earn continuing education units (CEUs) for recertification	1☐	2☐	3☐
D2.	Earning graduate credit	1☐	2☐	3☐
D3.	Learning more about science concepts and principles	1☐	2☐	3☐
D4.	Gaining a better understanding of NSES content standards	1☐	2☐	3☐
D5.	Gaining a better understanding of NSES process/inquiry skill standards	1☐	2☐	3☐
D6.	Learning to integrate the NSES/state content standards into my curriculum	1☐	2☐	3☐
D7.	Learning to integrating the national/state process/inquiry skill standards into my curriculum	1☐	2☐	3☐
D8.	Improving my skills in integrating technology into instruction	1☐	2☐	3☐
D9.	Learning new methods for teaching science to increase student interest	1☐	2☐	3☐
D10.	Learning new methods for teaching science to increase student understanding	1☐	2☐	3☐
D11.	Learning new methods for teaching science to increase student test scores	1☐	2☐	3☐
D12.	Gaining curriculum resources for my classroom	1☐	2☐	3☐

E. Support for Your Participation

E1. The JASON Academy course I am taking was paid for by:

1☐ My principal/the school
2☐ District funds
3☐ Grant funds
4☐ State funds
5☐ Budget given to me for my classroom
6☐ Self

The following questions ask you to characterize the climate of support for professional development in your school. Please answer by indicating the degree to which you agree or disagree with each statement. Select one answer for each question.

		Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree	No opinion
E2.	My school provides a wide range of formal and informal opportunities for professional development.	1☐	2☐	3☐	4☐	5☐	6☐
E3.	At my school, I have to seek out my own professional development opportunities.	1☐	2☐	3☐	4☐	5☐	6☐
E4.	My school provides opportunities for teachers to collaborate with each other.	1☐	2☐	3☐	4☐	5☐	6☐
E5.	The administration at my school tries to find ways to support teachers in trying out new ideas, even when the ideas cost money.	1☐	2☐	3☐	4☐	5☐	6☐
E6.	My school provides opportunities to learn how to integrate technology into the classroom.	1☐	2☐	3☐	4☐	5☐	6☐
E7.	My <u>school district</u> favors face-to-face workshops over online professional development.	1☐	2☐	3☐	4☐	5☐	6☐
E8.	My <u>school district</u> does not trust the quality of online professional development courses.	1☐	2☐	3☐	4☐	5☐	6☐

F. Classroom Teaching Practices

The following questions ask about your science teaching practice.

In the **past month,** when you have asked students questions when teaching science, how often were you trying to accomplish the following goals?

		Hardly ever	Sometimes	Frequently	Almost always
F1.	Elicit students' ideas and opinions about something they are studying or discussing.	1☐	2☐	3☐	4☐
F2.	Get students to justify and explain their reasoning.	1☐	2☐	3☐	4☐
F3.	See if students know the right answer.	1☐	2☐	3☐	4☐
F4.	Elicit students' ideas about how what they are learning relates to their own experiences.	1☐	2☐	3☐	4☐

In the **past month,** how often did your students, while learning science, take part in the following types of activities?

		Not at all	1-3 times per month	1-3 times per week	Almost every day
F5.	Students complete worksheets related to a topic they are studying.	1☐	2☐	3☐	4☐
F6.	Students work in small groups to come up with a joint solution or approach to a problem or task.	1☐	2☐	3☐	4☐
F7.	Students listen to the teacher explain a concept in the curriculum.	1☐	2☐	3☐	4☐
F8.	Students work on projects that take a week or more.	1☐	2☐	3☐	4☐

About how often do your students, while learning science, take part in the following types of activities?

		Never	1-3 times per semester	1-3 times per month	Once a week or more
F9.	Students work on their own on assignments at their desks.	1☐	2☐	3☐	4☐
F10.	Students are assigned a task with no indisputably correct answer—where truth is complex and perhaps impossible to know.	1☐	2☐	3☐	4☐
F11.	Students are asked to answer review questions at the end of a chapter in the textbook.	1☐	2☐	3☐	4☐

Inquiry Practices

When your students participate in science investigations or labs when learning science, how often do they:

		Hardly ever	Sometimes	Frequently	Almost always
F12	develop their own questions about what to investigate?	1☐	2☐	3☐	4☐
F13	plan an investigation, deciding what procedures they will use?	1☐	2☐	3☐	4☐
F14	develop their own hypotheses about what they will observe when they conduct an investigation?	1☐	2☐	3☐	4☐
F15	collect data to answer a scientific question?	1☐	2☐	3☐	4☐
F16	use probeware to collect data?	1☐	2☐	3☐	4☐
F17	analyze data to determine the answer to a question?	1☐	2☐	3☐	4☐
F18	develop presentations and communicate the results of an investigation?	1☐	2☐	3☐	4☐
F19	discuss and debate the validity and meaning of experimental results?	1☐	2☐	3☐	4☐
F20	use computers to support the analysis and communication of data?	1☐	2☐	3☐	4☐

When I grade my students in science, I use the following types of assessment information:

		Not at all	As a small part of the grade	As a pretty big part of the grade	As the majority of the grade
F21	Homework assignments	1☐	2☐	3☐	4☐
F22	Tests and quizzes	1☐	2☐	3☐	4☐
F23	Frequency of class participation	1☐	2☐	3☐	4☐
F24	Understanding or depth of thinking exhibited during class participation	1☐	2☐	3☐	4☐
F25	Individual contribution to group work	1☐	2☐	3☐	4☐
F26	Team accomplishments during group work	1☐	2☐	3☐	4☐
F27	Final products or performances as the result of a student project	1☐	2☐	3☐	4☐

Thank you very much for your time and participation.

JASON Academy Post-Course Survey

Please provide your name: _____

A. Participation Questions

A1. Which course(s) have you just completed? *(Check all that apply.)*

$_1$☐ Structure of the Earth
$_2$☐ Force and Motion

A2. Since becoming involved in JASON Academy, about how many hours did you spend on all JASON-related activities each week, on average?

$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐
1-3 hours	4-6 hours	7-9 hours	10-12 hours	12+ hours

A3. Since starting JASON Academy, on average, about how much time did you spend each week engaged in each of the following JASON-related activities?

	0-30 minutes	30 mins-1 hour	1-2 hours	3-4 hours	>4 hours
Reading course material online	$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐
Interacting with other participants via discussion boards	$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐
Interacting with the online facilitator	$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐
Conducting JASON-related activities with my classroom	$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐
Completing other course requirements	$_1$☐	$_2$☐	$_3$☐	$_4$☐	$_5$☐

A4. How helpful were each of the activities below to you in deepening your own science content knowledge?

	Very helpful	Somewhat helpful	Not at all helpful
Reading course material online	1☐	2☐	3☐
Interacting with other participants via discussion boards about science content	1☐	2☐	3☐
Interacting with other participants via discussion boards about new ways to teach science to students	1☐	2☐	3☐
Interacting with the online facilitator	1☐	2☐	3☐
Conducting JASON-related activities with my classroom	1☐	2☐	3☐
Completing other course requirements	1☐	2☐	3☐
Making connections among the science concepts being discussed	1☐	2☐	3☐

A5. How helpful were each of the activities below to you in deepening your own pedagogy skills?

	Very helpful	Somewhat helpful	Not at all helpful
Reading course material online	1☐	2☐	3☐
Interacting with other participants via discussion boards about science content	1☐	2☐	3☐
Interacting with other participants via discussion boards about new ways to teach science to students	1☐	2☐	3☐
Interacting with the online facilitator	1☐	2☐	3☐
Conducting JASON-related activities with my classroom	1☐	2☐	3☐
Completing other course requirements	1☐	2☐	3☐
Making connections among the science concepts being discussed	1☐	2☐	3☐

A6. Which of the following best describes your participation in online discussions in this course?

1☐ I contributed to the discussion 5 or more times a week and read all of the postings.
2☐ I contributed to the discussion about twice a week and read nearly all of the postings.
3☐ I contributed to the discussion once a week or less and read or skimmed most of the postings.
4☐ I read or skimmed some of the postings.
5☐ I didn't read or skim the postings at all.

A7. Which of the following describes your feeling about the course length? *(Check one.)*

1☐ Five weeks is the right period of time for an online course.
2☐ I would have preferred a shorter course.
3☐ I would have preferred a longer course.

A8. Overall, how easy or difficult was it for you to meet the participation requirements (e.g., completing assignments, contributing to group discussion, implementing activities with your class) of the JASON Academy course(s)?

1☐	2☐	3☐	4☐	5☐
Very easy	Somewhat easy	In the middle	Somewhat difficult	Very difficult

A9. If you answered "Somewhat difficult" or "Very difficult" to the above question, please explain what problems you had.

_____
_____
_____
_____
_____

B. Technology Use

B 1. How frequently do you use the following for <u>PERSONAL USE</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

B2. How frequently do you use the following for <u>CLASSROOM PREPARATION</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

B3. How frequently do you use the following in <u>CLASSROOM INSTRUCTION</u>?

	every day	2-4 times per week	weekly	monthly	1-2 times a semester	not at all
Email	❑	❑	❑	❑	❑	❑
Chat	❑	❑	❑	❑	❑	❑
Discussion forums	❑	❑	❑	❑	❑	❑
Internet/Web search	❑	❑	❑	❑	❑	❑

B4. In your opinion, do you feel better prepared to use computers and the Internet for classroom instruction as a result of taking an online course?

1 ☐	2 ☐	3 ☐	4 ☐
Not prepared	Somewhat prepared	Well prepared	Very well prepared

B. Technology Use

B5. In which locations did you use a computer to participate in this JASON Academy course? (Check all that apply.)

1☐ My classroom
2☐ School computer lab
3☐ School library or media center
4☐ Home
5☐ Public library or community center
6☐ Other (please specify):

B6. Which of the following features worked for you nearly every time you tried to use or access them?

1☐ Discussion Boards
2☐ Animations
3☐ Pop-up boxes
4☐ Links (to other Web sites or pages within the site)

B7. Check all that apply concerning how you accessed the online course.

1☐ I used a high-speed cable modem or DSL.
2☐ I used a high-speed connection over our school's T1 line.
3☐ I used a low-speed network connection over a dial-up modem.
4☐ Other. (Please specify.)

B8. Overall, how easy or difficult was it for you to meet the technological requirements (e.g., being able to get online, navigate the course Web site) of this JASON Academy course?

1☐	2☐	3☐	4☐	5☐
Very easy	Somewhat easy	In the middle	Somewhat difficult	Very difficult

B9. If you answered "Somewhat difficult" or "Very difficult" to the above question, please explain what problems you had.

_____
_____
_____
_____
_____
_____

D. Achieving Your Goals

To what extent were each of the following goals achieved through your participation in the JASON Academy course?

		Not at all achieved	Somewhat achieved	Very much achieved	This was not my goal for participating JASON Academy
D1.	Being able to earn continuing education units (CEUs) for recertification	1☐	2☐	3☐	4☐
D2.	Earning graduate credit	1☐	2☐	3☐	4☐
D3.	Learning more about science concepts and principles	1☐	2☐	3☐	4☐
D4.	Gaining a better understanding of NSES content standards	1☐	2☐	3☐	4☐
D5.	Gaining a better understanding of NSES process/inquiry skill standards	1☐	2☐	3☐	4☐
D6.	Learning to integrating the NSES/state content standards into my curriculum	1☐	2☐	3☐	4☐
D7.	Learning to integrating the national/state process/inquiry skill standards into my curriculum	1☐	2☐	3☐	4☐
D8.	Improving my skills in integrating technology into instruction	1☐	2☐	3☐	4☐
D9.	Learning new methods for teaching science to increase student interest	1☐	2☐	3☐	4☐
D10.	Learning new methods for teaching science to increase student understanding	1☐	2☐	3☐	4☐
D11.	Learning new methods for teaching science to increase student test scores	1☐	2☐	3☐	4☐
D12.	Gaining curriculum resources for my classroom	1☐	2☐	3☐	4☐
D13.	Finding out what online learning is about.	1☐	2☐	3☐	4☐

E. Impact of JASON Academy

Indicate whether you agree or disagree with each of the following statements.

	Since enrolling in JASON Academy…	Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree
E1.	I have gained better understanding of scientific ideas and concepts.	1☐	2☐	3☐	4☐	5☐
E2.	I feel more prepared to teach complex scientific ideas to my students.	1☐	2☐	3☐	4☐	5☐
E3.	I am more likely to challenge and test my own ideas.	1☐	2☐	3☐	4☐	5☐
E4.	I am more likely to challenge my students to test their own ideas.	1☐	2☐	3☐	4☐	5☐
E5.	I am more likely to believe there is more than one way to solve a problem.	1☐	2☐	3☐	4☐	5☐
E6.	I am more likely to listen to others' ideas about science teaching even when they differ from my own.	1☐	2☐	3☐	4☐	5☐
E7.	I think harder about how I'll back up my ideas to explain them to others.	1☐	2☐	3☐	4☐	5☐
E8.	I am better prepared to integrate NSES/state's content standards in instruction.	1☐	2☐	3☐	4☐	5☐
E9.	I am better prepared to integrate NSES/state's process/inquiry skill standards in instruction.	1☐	2☐	3☐	4☐	5☐
E10.	I have broadened the range of technology I can use in my science classroom.	1☐	2☐	3☐	4☐	5☐
E11.	I have applied new skills to my instructional practice	1☐	2☐	3☐	4☐	5☐

E12. Which statement best describes how the course affected your *approach* to teaching science?

1☐	2☐	3☐	4☐
This course did not affect my approach to science teaching.	I have learned new science content that I can now teach to my students.	I have new tools for teaching science content and am more comfortable teaching science.	This course gave me a whole new approach to teaching science that I plan to apply to this and other science topics.

E13. In your opinion, now that you have finished the JASON Academy course, how well prepared are you to incorporate the NSES and/or state science content standards in your teaching?

1☐ Not prepared 2☐ Somewhat prepared 3☐ Well prepared 4☐ Very well prepared

F. Supports, Barriers, and Recommendations for Program Improvement

To what extent was each of the following barriers or supports to participating as you would have liked in JASON Academy?

		Strongly disagree	Moderately disagree	Neutral	Moderately agree	Strongly agree
F1.	The program matched my initial expectations for what I would learn.	1☐	2☐	3☐	4☐	5☐
F2.	I didn't have enough time available to participate in course activities online.	1☐	2☐	3☐	4☐	5☐
F3.	The program was not focused enough on developing on science content knowledge.	1☐	2☐	3☐	4☐	5☐
F4.	The program was not focused enough on developing on science process/inquiry skills.	1☐	2☐	3☐	4☐	5☐
F5.	The program was not focused enough on how to apply what I learned to classroom teaching.	1☐	2☐	3☐	4☐	5☐
F6.	The program's content was relevant to my students' backgrounds and abilities.	1☐	2☐	3☐	4☐	5☐
F7.	I was able to get online whenever I needed to.	1☐	2☐	3☐	4☐	5☐
F8.	The Internet connection I used for the course wasn't fast enough.	1☐	2☐	3☐	4☐	5☐
F9.	The features on the class site worked reliably well.	1☐	2☐	3☐	4☐	5☐
F10.	I had adequate support from my principal for me to participate.	1☐	2☐	3☐	4☐	5☐
F11.	JASON Academy's content was well aligned with content standards I'm expected to teach.	1☐	2☐	3☐	4☐	5☐
F12.	My own comfort and skill in using technology got in the way of my participating.	1☐	2☐	3☐	4☐	5☐
F13.	My own comfort and skill with the content being covered in the course got in the way of my participation.	1☐	2☐	3☐	4☐	5☐

G. Classroom Teaching Practices

The following questions ask about your science teaching practice.

In the **past month,** when you have asked students questions when teaching science, how often were you trying to accomplish the following goals?

		Hardly ever	Sometimes	Frequently	Almost always
G1.	Elicit students' ideas and opinions about something they are studying or discussing.	1☐	2☐	3☐	4☐
G2.	Get students to justify and explain their reasoning.	1☐	2☐	3☐	4☐
G3.	See if students know the right answer.	1☐	2☐	3☐	4☐
G4.	Elicit students' ideas about how what they are learning relates to their own experiences.	1☐	2☐	3☐	4☐

In the **past month,** how often did your students, while learning science, take part in the following types of activities?

		Not at all	1-3 times per month	1-3 times per week	Almost every day
G5.	Students complete worksheets related to a topic they are studying.	1☐	2☐	3☐	4☐
G6.	Students work in small groups to come up with a joint solution or approach to a problem or task.	1☐	2☐	3☐	4☐
G7.	Students listen to the teacher explain a concept in the curriculum.	1☐	2☐	3☐	4☐
G8.	Students work on projects that take a week or more.	1☐	2☐	3☐	4☐

About how often do your students, while learning science, take part in the following types of activities?

		Never	1-3 times per semester	1-3 times per month	Once a week or more
G9.	Students work on their own on assignments at their desks.	1☐	2☐	3☐	4☐
G10.	Students are assigned a task with no indisputably correct answer—where truth is complex and perhaps impossible to know.	1☐	2☐	3☐	4☐
G11.	Students are asked to answer review questions at the end of a chapter in the textbook.	1☐	2☐	3☐	4☐

Inquiry Practices

When your students participate in science investigations or labs when learning science, how often do they:

		Hardly ever	Sometimes	Frequently	Almost always
G12.	develop their own questions about what to investigate?	1☐	2☐	3☐	4☐
G13.	plan an investigation, deciding what procedures they will use?	1☐	2☐	3☐	4☐
G14.	develop their own hypotheses about what they will observe when they conduct an investigation?	1☐	2☐	3☐	4☐
G15.	collect data to answer a scientific question?	1☐	2☐	3☐	4☐
G16.	use probeware to collect data?	1☐	2☐	3☐	4☐
G17.	analyze data to determine the answer to a question?	1☐	2☐	3☐	4☐
G18.	develop presentations and communicate the results of an investigation?	1☐	2☐	3☐	4☐
G19.	discuss and debate the validity and meaning of experimental results?	1☐	2☐	3☐	4☐
G20.	use computers to support the analysis and communication of data?	1☐	2☐	3☐	4☐

When I grade my students in science, I use the following types of assessment information:

		Not at all	As a small part of the grade	As a pretty big part of the grade	As the majority of the grade
G21.	Homework assignments	1☐	2☐	3☐	4☐
G22.	Tests and quizzes	1☐	2☐	3☐	4☐
G23.	Frequency of class participation	1☐	2☐	3☐	4☐
G24.	Understanding or depth of thinking exhibited during class participation	1☐	2☐	3☐	4☐
G25.	Individual contribution to group work	1☐	2☐	3☐	4☐
G26.	Team accomplishments during group work	1☐	2☐	3☐	4☐
G27.	Final products or performances as the result of a student project	1☐	2☐	3☐	4☐

Thank you very much for your time and participation.