MySciLife

Bringing science to life

Research Report

2013-2014

Acknowledgements

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For More Information

For more information about MySciLife, please visit the MySciLife web site:

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Experiencing MySciLife: A study of the Impact of Social-Media Based Science Learning

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Executive Summary

In its 2010 report, "Preparing the Next Generation of STEM Innovators: *Identifying and Developing our Nation's Human Capital*," the National Science Foundation (NSF) included a Keystone Recommendation that, "students should learn at a pace, depth, and breadth commensurate with their talents and interests and in a fashion that elicits engagement, intellectual curiosity, and creative problem-solving—essential skills for future innovation" (p.2). In response to this report, educators and science, technology, engineering, and mathematics (STEM) partnerships are seeking to improve U.S. science achievement and attitudes toward science among today's students.

Students today continue to expand their use of social media and digital tools. Social media— tools like Facebook, YouTube, Twitter, Instagram, Snapchat, and more—all focus on textual, graphical, and/or video-based sharing and transfer of ideas and information. These social media, "play a central and expanding role in the academic and social lives of today's adolescents" (Liu, M., Horton, L., Olmanson, J., Toprac, P., 2011, p.250). A 2007 study by the Pew Foundation reported that 64% of online teens ages 12 to 17 have participated in one or more content creation activities—sharing artwork, photos, stories or videos. Living and Learning with New Media: Summary of Findings from the Digital Youth Project (2008), a report from the MacArthur Foundation, concluded that young people use social media not just to extend their friendships, but also, "to explore interests and find information that goes beyond what they have access to at school or in their local community" (Ito, Horst, et al., 2008, p.1).

Key Finding:

Many MySciLife students achieved increases in content-knowledge that were equal to or better than those of control group students of the same teacher using traditional teaching methods.

The MySciLife project, envisioned in 2010 by three educators affiliated with TeachersFirst—The Source for Learning's online resource for K-12 — offers a new approach to STEM education grounded in the burgeoning use of digital media and social networking by today's youth combined with the proven pedagogy of social learning. The MacArthur Foundation selected MySciLife as a finalist in The Digital Media and Learning Competition, but ultimately did not fund the project. In 2012-13, The Source for Learning [SFL] funded an initial two-semester MySciLife research pilot.

The success of that effort led SFL to expand MySciLife to a larger population of students and teachers, funding a second project—with a more robust research effort—during the 2013-14 academic year. Seventeen teachers and 651 students from middle-level (6th-8th grade) science classes across ten states took part. Twelve of the seventeen teachers were involved in a controlled experimental design that utilized a pre/post content-knowledge test to compare performance data between the MySciLife classes and control group classes. This report presents an analysis of that project.

Key Finding:

Students overwhelmingly felt that MySciLife provided more opportunities for peer collaboration and was a more enjoyable way to learn science.

MySciLife immerses students in an intensive digital approach to science learning within an online social learning environment. MySciLife students "live" as a science concept or object—portraying that identity inside a safe, social network environment—and communicating with other students in both their own class and other classes throughout the United States. Students work at their own pace, sharing discoveries with their peers through online postings of science-related discussion. Teachers offer comments and prompts as they monitor and coach students throughout each lesson, guiding student exploration and providing support for individual student needs.

Can this new model of science instruction improve students' perception,experience, and performance in the middle level science classroom?

Key Finding:

Teachers report that MySciLife is an effective instructional model that improves student experience in science: Students are motivated to produce and post high-quality work for peer review, and they enjoy learning from each other in a creative, collaborative process.

The results of the 2013-2014 pilot reinforce the power of MySciLife not only to help students equal or exceed achievement gained from more traditional instruction, but to fundamentally change their perceptions about science and its role in both their lives and the world at large. Just as importantly, this year's project has resulted in a deeper understanding of the fundamental shifts, professional development, and external support necessary for teachers to fully enable this new mode of learning. The results suggest that this teacher support can pay off—both quantitatively and qualitatively. They also offer a clear roadmap for strengthening future efforts.

Two questions guided the research during this year's pilot:

• **Outcome Question:** What effect does social media-based learning have on middle-level science performance?

• **Process Question:** How does social media-based learning affect student attitudes and perceptions about learning science?

"When I am looking at what other kids in different places are learning, I get to learn what they're learning, not just what my teacher is teaching me."

The research component of the second year pilot project explored both of these questions. The research on the Outcome Question expanded during the second year research to include controlled comparison of the performance of MySciLife students on pre/post-tests against similarly-grouped control groups studying the same content and taught by the same teachers, but using traditional instructional methods. As was the case during the first year, these tests showed that many MySciLife students achieved increases in content-knowledge scores that were equal to or better than those of the control group. These differences were statistically significant in many cases.

Open-ended student survey questions addressed the Process Question referring to student attitudes and perceptions about learning science. The second year research shows that students overwhelmingly felt that MySciLife provided more opportunities for peer collaboration and was a more enjoyable way to learn science. Some 62% of students surveyed (n=651, SD-=.94 based on five Likert-scale choices) either "agreed" or "strongly agreed" that MySciLife provided them with opportunities to "go deeper" after having mastered the essential elements of the curriculum.

Responses from teachers provided further data to support the results from the pre/post content knowledge tests and student surveys. Teacher surveys revealed their belief that using MySciLife is an effective instructional model that improves student experience in science. When asked what really worked well with the MySciLife modules, teachers responded that they liked collaborating with other MySciLife teachers; and they were pleased that students were excited about the tasks and taking charge of their own learning while writing in first person. MySciLife students were motivated to produce and post high-quality work for peer review, and they enjoyed learning from each other in a creative, collaborative process.

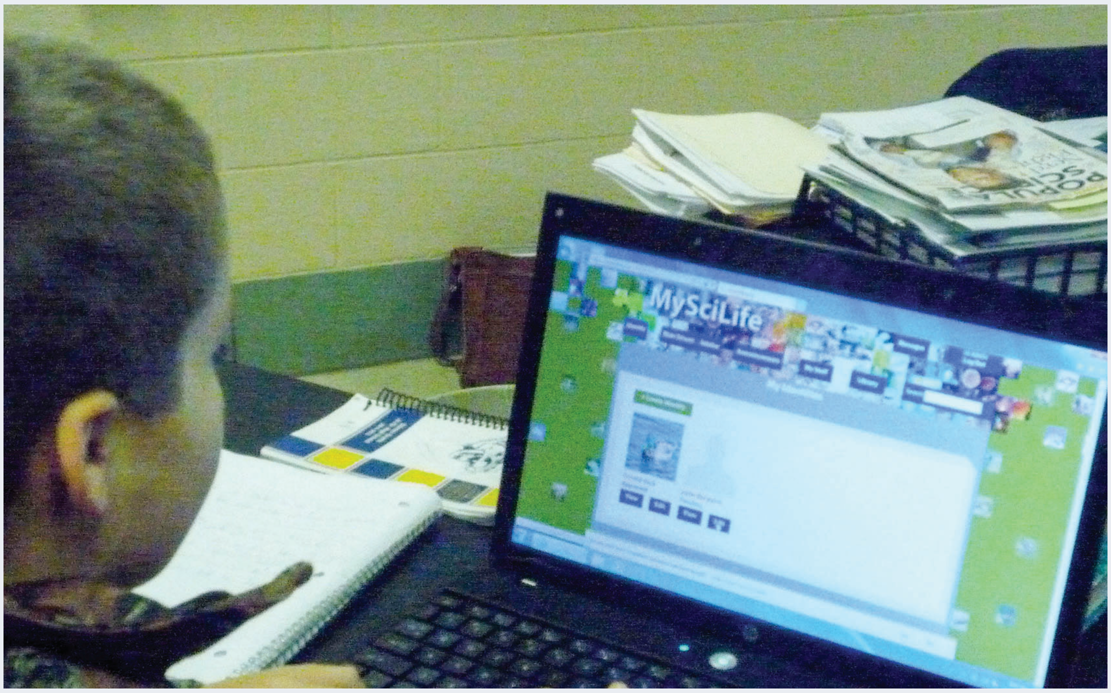
The results of the 2013-14 MySciLife study align with the STEM Case Study, conducted by Kärkkäinen, K. and S. Vincent-Lancrin (2013), which found that "collaboration can be an effective means to foster knowledge flows, new ideas and peer learning." While content-knowledge test scores remain an important measure of student success, the survey data also suggest that MySciLife succeeds in its effort to move students beyond recall of facts and measured outcomes to truly enhance STEM education, allowing students to develop the much-needed skills necessary for success in STEM fields in the 21st century.

Based on these results, SFL has extended its support for MySciLife into the 2014-2015 academic year. SFL is also funding the development of a new software platform for MySciLife that removes many of the impediments that have hindered more robust participation in MySciLife by students and teachers during its first two years. Teachers and students began using the new platform in the fall of 2014.

The Source for Learning believes that MySciLife has the potential to make a major impact on students' perceptions of science and their understanding of scientific concepts in relationship to a larger world. Throughout the two-year pilot period, MySciLife has demonstrated student achievement that equals or exceeds that of control groups. Teachers have also noted improvements in the online writing and communication fluency of students participating in MySciLife. Most important of all, MySciLife students continue to show more positive attitudes toward science that can lead to increased interest in pursuing further science studies.

Suggestions for Further Research

- Conduct further research on the impact of MySciLife on student science performance and on attitudes about learning science using the newly created, custom MySciLife platform.
- Expand the MySciLife community, supported by continued teacher professional development and collaboration.
- Investigate the impact of MySciLife on student learning and approaches to science over longer periods beyond initial learning modules (units).
- Explore the impact of teacher collaboration and professional development on successful implementation of digital media for learning.


MySciLife

Introduction

Can a new model of science instruction improve students' perception, experience, and performance in the middle-level science classroom? A study done by the Donahue Institute at the University of Massachusetts (2011) found that it is important for students to gain interest in STEM (science technology, engineering, and mathematics) subjects before they enter high school so they will sign up for the appropriate coursework needed for STEM majors in college.

This study examines the MySciLife model of science instruction, which utilizes an interactive technological approach to science within an online social learning environment. Students use a set of web-based software applications as they identify, design, and visualize themselves as a science concept or object. Students "live" as this science concept, communicating with students in their own class and throughout the United States, while interacting and writing responses to teacher prompts, peer questions, and others' posts. During the semesters covered in this study, students utilized Edmodo as the main web-based software platform for MySciLife through which they communicated with peers in a safe online educational environment.

Research Questions

Two main questions guided this research:

- **Outcome Question:** What effect does social media-based learning have on middle-level science performance?
- **Process Question:** How does social media-based learning affect student attitudes and perceptions about learning science?

This study set out to measure the effects of the MySciLife model on student achievement and student perceptions of science instruction. Middle-level science students participated in this study that took place throughout the 2013-2014 school year. We included seventeen teachers from middle-level science classes (6th-8th grade) across the country to collect data from 651 students. All students involved in the MySciLife instruction completed a survey at the end of the unit that focused on their attitudes and perceptions of science with respect to the MySciLife experience. Twelve teachers were involved in a controlled experimental design that utilized a pre/post-test to compare content knowledge test results between the MySciLife classes and their control group classes using traditional teaching methods.

MySciLife works with each school's standards-based science curriculum while encouraging a creative and safe online atmosphere for science discovery through peer interaction. Students work at their own pace while sharing discoveries with their peers through online postings of science content-based discussion. Teachers provide comments and prompts as they monitor and coach students throughout each lesson, while guiding student exploration and providing help for individual student needs. Students are comfortable with this self-paced, interactive method of learning because the majority of them already use very similar web-based social media outside the classroom. The MySciLife model of science instruction addresses many of the key elements spelled out in the U.S. Dept. of Education's report (2012) on Expanding Evidence Approaches for Learning in the Digital World. These key elements include an adaptive, individualized method of instruction that can be differentiated and personalized.

While not a curriculum by itself, MySciLife supports learning aligned to both NextGen Science Standards and Common Core Anchor Standards for College and Career Readiness in Writing. CCSS Anchor Standards for Writing —and many independent states' standards — specify that today's students need to master writing and collaborating via the Internet, requiring that students demonstrate the ability to, "Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others" (CCSS.ELA-LITERACY.CCRA.W.6). This is just one of several CCSS Literacy and Writing Standards that MySciLife supports.

MySciLife encourages students to write, publish, critique, and reply to other students' web posts throughout each unit and across different science topic units. This collection of online posts "can serve as an online portfolio to showcase student work" (Sawmiller, A., 2010). Student posts allow the "quiet" student to have an active voice; student work is available in real-time to students and teachers; and students are motivated to write interesting posts for critique by their peers (Sawmiller, A., 2010). Students work on their science units within the framework of the MySciLife's Edmodo platform, but also utilize many web-based tools to create digital media to include in posts. Such tools include Prezi, Glogster, GoAnimate, PhotoBabble, Animoto, Blabberize, GoogleDrive, and more. Google Drive is a very useful tool for MySciLife because it provides file storage and the ability to share and collaboratively edit documents, spreadsheets, and presentations.

Theoretical Framework

"In the STEM areas, all students, including the most talented, should have the opportunity to experience inquiry-based learning, peer collaboration, open-ended, real-world problem solving, hands-on training, and interactions with practicing scientists, engineers and other experts" (National Science Board, 2010). A STEM Case Study conducted by Kärkkäinen, K. and S. Vincent-Lancrin (2013) found that "collaboration can be an effective means to foster knowledge flows, new ideas and peer learning."

A report by the U.S. Department of Education (2012) quotes a study by Koedinger & Corbett (2006) showing that students taught by carefully designed (technology-based) systems used in combination with classroom teaching can learn more quickly and translate their learning into improved performance.

> **"Social media is not an easy task, and may require new ways of thinking"**
>
> **- Kaplan & Haenlein (2010)**

Youth in our society are increasingly exposed to social media technologies, such as Facebook, YouTube, Twitter, Instagram, Snapchat, and Vine, that focus on textual, graphical, and/or video-based sharing and transfer of ideas and information. This mode of communication is called social media, and it "plays a central and expanding role in the academic and social lives of today's adolescents" (Liu, M., Horton, L., Olmanson, J., Toprac, P., 2011, p.250). Social Media is defined as "a group of internet-based applications that build on the ideological and technological foundations of web 2.0, and that allow the creation and exchange of user generated content" (Kaplan & Haenlein, 2010). "Educators and schools that do not utilize these new media-based technologies run the risk of failing to leverage the digital literacies of their students" (Liu et al., 2011, p.250). Kaplan & Haenlein (2010) suggest that, "social media is not an easy task and may require new ways of thinking, but the potential gains are far from being negligible" (p. 67).

Numerous studies (Ketelhut, D. J., Nelson, B. C., Clarke, J. and Dede, C., 2010, Thompson, D. N., 2012, Hesterman, A. E. & Bozeman, M., 2012) have shown that involving technology integration in the science classroom increased student interest, increased student participation, increased science content knowledge, and increased technology skills. The National Science Foundation (NSF) recently funded a study (Ketelhut et al., 2010) of online technology-based learning within a standards-based biology course. The study showed that "students learned biology content, that students and teachers were highly engaged, that student attendance improved, that disruptive behavior dropped, that students were building 21st century skills in virtual communication and expression, and importantly, that using this type of technology in the classroom can facilitate good inquiry learning" (Ketelhut et al., 2010). A recent report by the U.S. Department of Education (2012) states that, "technology provides opportunities for educators, educational publishers, and developers to address new standards, such as common core state standards (CCSS), with high quality learning resources" (p.10).

Data Collection

Research Sample

Middle-level (6th-8th grade) science students (n=651) from fourteen different schools and seventeen teachers in ten states completed a MySciLife module (instructional unit) and took a post-survey. Convenience sampling was used as the MySciLife administrators selected and trained prospective teachers for the 2013-2014 school year. Numbers were assigned to each student in the study to protect identities and assure confidentiality.

In addition to the post survey, twelve of the seventeen teachers took part in a controlled experimental design that utilized a pre/post-test to compare content-knowledge test results between their MySciLife classes and their control group classes. Table 1 below shows the teachers who completed the controlled experiment and the corresponding modules that were used with their classes. There were a total of 25 experimental design data sets (modules).

Table 1: List of Teachers and Modules

Teacher	comments	module 1	module 2	module 3	module 4	module 5
AF	MSL vs. cntrl	human body	genetics			
DG	MSL vs. cntrl	Ecology	Chem	PSER		
EF	MSL vs. cntrl	Cells	genetics			
JM	MSL vs. cntrl	Ecology	Cells	Chem	light, sound	PSER
JP	MSL vs. cntrl	Biomes	body systems			
MH	MSL vs. cntrl	Cells				
OP	MSL vs. cntrl	atoms	Ecology	force/motion		
PA	MSL vs. cntrl	Matter	human body			
PC	MSL vs. cntrl	Universe	atoms			
SB	MSL vs. cntrl	Genetics	cells			
SG	MSL vs. cntrl	ecosystems				
SM	MSL vs. cntrl	atoms				
AS	no cntrl	Rocks				
BB	no cntrl	Ecology	earth			
KB	no cntrl	Weather	physics	inventions	ecology	
TS	no cntrl	Cells	waves			
MH	no cntrl	waves, energy				
CH	no cntrl	earth				
SM	no cntrl	energy				

Data Instruments

Instrument 1: Students (n=651) completed an online post-survey that focused on students' attitudes and perceptions of their understanding of science as facilitated by the MySciLife experience. Students completed the post-survey online with their teacher after completing at least one instructional module. The post-survey consisted of twelve Likert-scale multiple-choice questions (5 choices per question: strongly agree, agree, neutral, disagree, and strongly disagree) and 3 open-ended questions. The open-ended survey questions were designed via an a priori approach in which the author used "prior understandings of the phenomenon" in the investigation (Ryan & Bernard, 2003, p. 88).

Instrument 2: Twelve of the seventeen teachers took part in a controlled experimental design that compared content-knowledge pre/post test results between the MySciLife classes and the control group classes. The control group classes were taught using traditional methods while the variable group utilized the MySciLife inquiry-based learning model. Control and variable classes were made up of heterogeneously grouped students according to ability, and both control and variable classes ran for the same number of instructional days. Students (n=343) in both the control group and variable group took the same pre-test and post-test, which consisted of twenty multiple choice questions, with four choices per question. The same questions were used in both the pre-test and post-test, and the order of the questions and answer choices were shuffled for the post-test.

To assure a reliable and valid controlled experimental design (Saint-Germain, 2001) the following conditions were met:

1) randomly assigned subjects to treatment or control groups

2) administered the pre-test to all subjects in both groups

3) ensured that both groups experience the same conditions except that in addition the experimental group experiences the treatment

4) administered the post-test to all subjects in both groups

5) assessed the amount of change on the value of the dependent variable from the pre-test to the post-test for each group separately.

Instrument 3: Teachers were interviewed before starting their MySciLife module, and then again at the conclusion of their module(s) to get input on teachers' perceptions of student learning, and for the purpose of understanding what worked well and suggested areas for improvement.

Data Analysis

Instrument 1: This study calculated mean, standard deviation, and variance for each of the twelve post-survey questions, and used graphs to present the final results. These are located in the Findings section, which begins on p. 11. Analysis of the open-ended questions focused on the students' descriptive data concerning their views and perceptions of technology integration in science via MySciLife, as well as a comparison of MySciLife to traditional methods of science instruction. Common themes that emerged among the data and responses were coded according to these themes. Themes that only contained a few responses (less than 5% of total) were not reported in the results.

Instrument 2: The controlled experimental design utilized a pre/post- test content-knowledge test to compare results between the MySciLife classes and the control group classes. The study calculated average pre-test and post-test scores for both the control group and the variable (MySciLife) group, then compared the average percentage increase between the control and variable (MySciLife) group for each module taught. Quantitative analysis was used to compare the content pre-test and post-test results for each class to test for a statistically significant change. A one-tailed, independent t-test was used to compare each class's pre/post-test differences. Random sampling from respective populations was used to assure equal number of comparative participants for the t-test whenever the control group and variable group (MySciLife) had unequal numbers of students. The percentage increase between the pre- and post-tests for the control versus variable (MSL) groups is represented in graphical form (Graph 1) and the t-test data is represented in chart form in the Findings section below in Table 2.

Quantitative analysis was also used to measure the validity of the content knowledge pre/post-test. Each of the 20 content-knowledge multiple choice test questions was analyzed using repeated measures t-tests with one-tailed, dependent, paired means analysis and $p=.05$ significance level. The t-test results were analyzed for each question. This analysis provided information about each assessment instrument by calculating which questions scored significant increases from the pre to post test. The numbers listed in the t-test column (Table 2) in the Findings section below represent the number of questions which did not show a statistically significant increase from pre to post-test.

Instrument 3: The survey used teacher survey responses to confirm that the required aspects of the controlled experiment had been met. The survey was used to tally emergent themes, to further validate student post-survey data, and to provide insightful anecdotal evidence of the student experience with MySciLife.

Findings

Instrument 1: Student Post-Survey Results

Results from the student post-survey (n=651) consisting of twelve Likert-scale multiple-choice questions and three open-ended questions (questions #14,15,16) are represented graphically below.

Chart 2 • Student Survey Question 1:
(n=651; SD=1.03; mean=3.40; var=1.05)

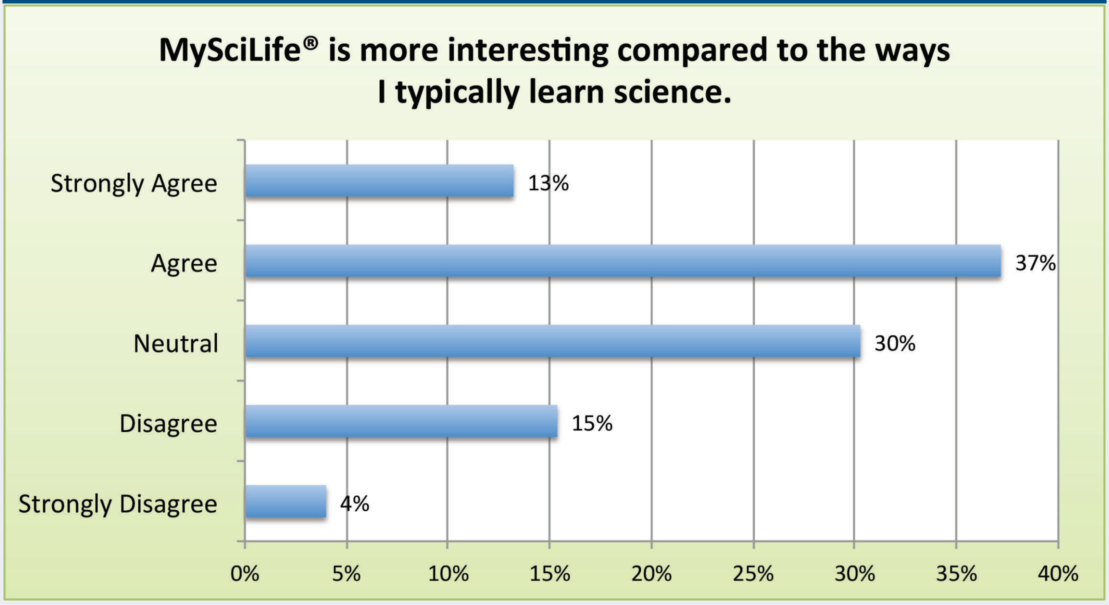


Chart 3 • Student Survey Question 2:
(n=651; SD=.99; mean=3.47; var=0.99)

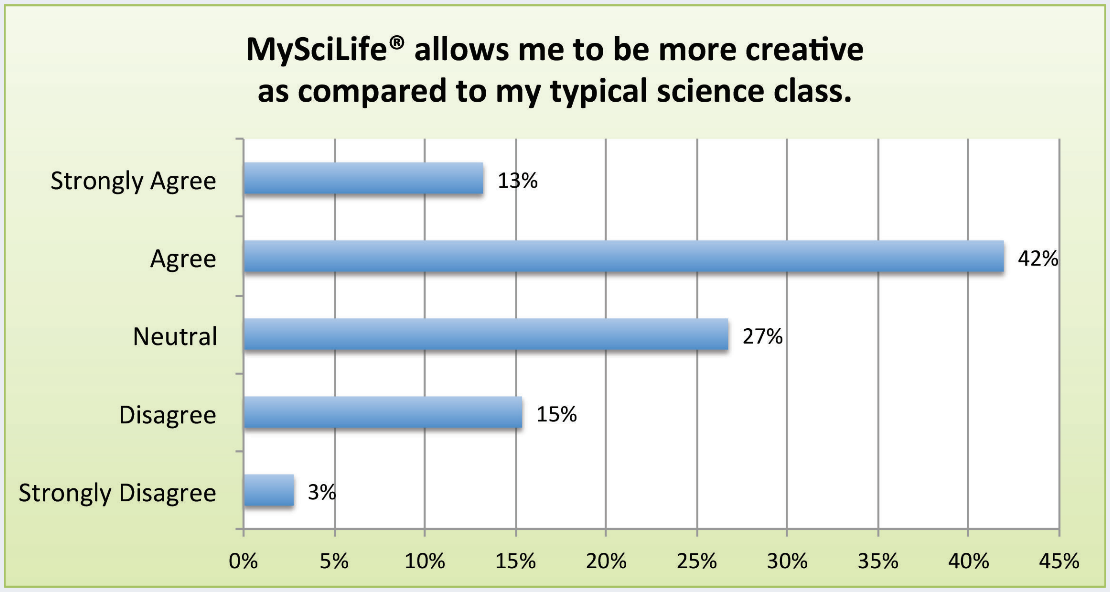


Chart 4 • Student Survey Question 3:
(n=651; SD=.99; mean=3.47; var=0.99)

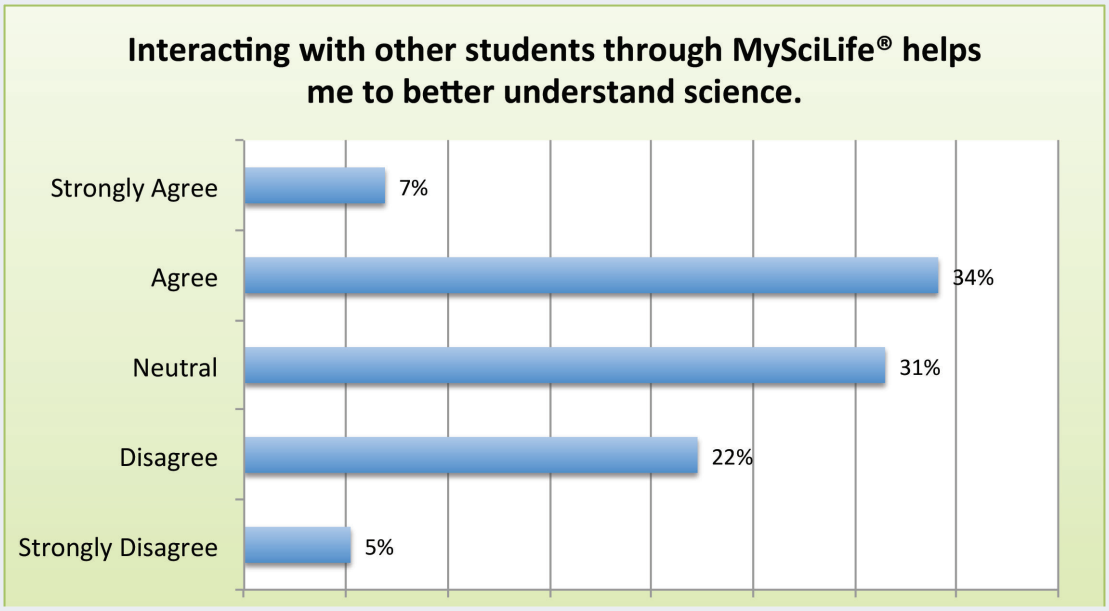


Chart 5 • Student Survey Question 4:
(n=651; SD=1.04; mean=3.24; var=1.07)

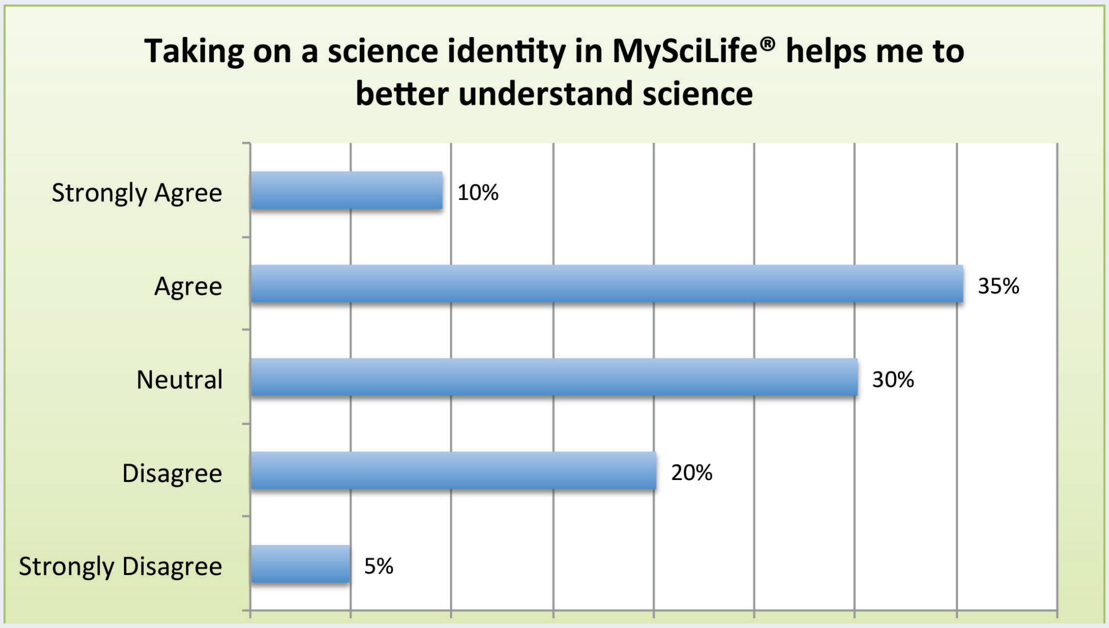


Chart 6 • Student Survey Question 5:
(n=651; SD=1.07; mean=2.94; var=1.15)

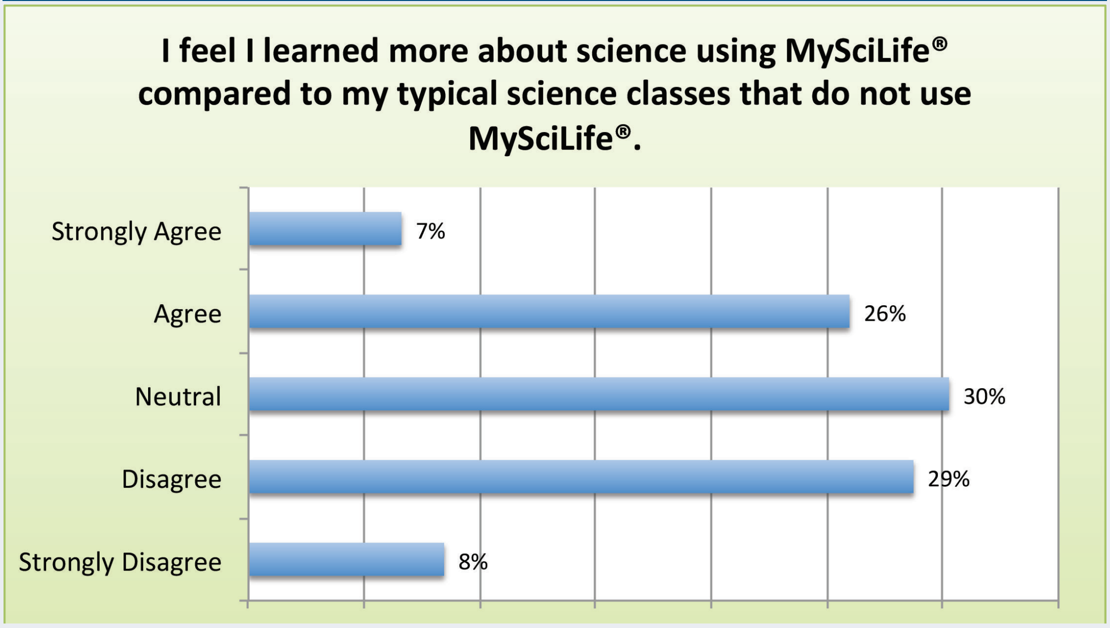


Chart 7 • Student Survey Question 6:
(n=651; SD=.94; mean=3.59; var=.88)

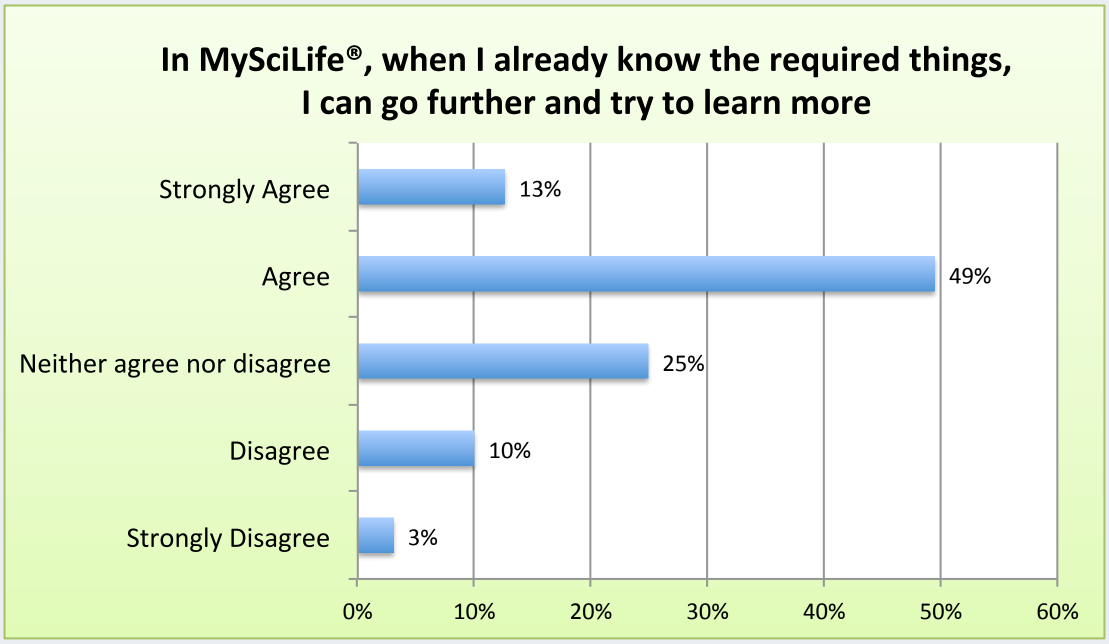


Chart 8 • Student Survey Question 7:
(n=651; SD=.98; mean=3.12; var=0.96)

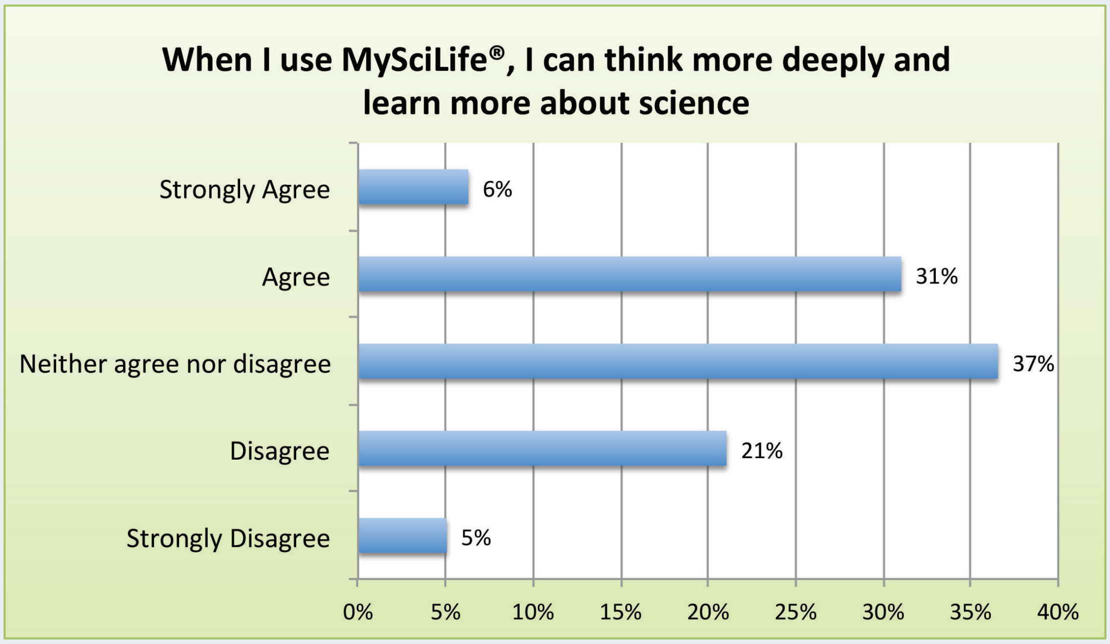


Chart 9 • Student Survey Question 8:
(n=651; SD=1.01; mean=3.51; var=1.03)

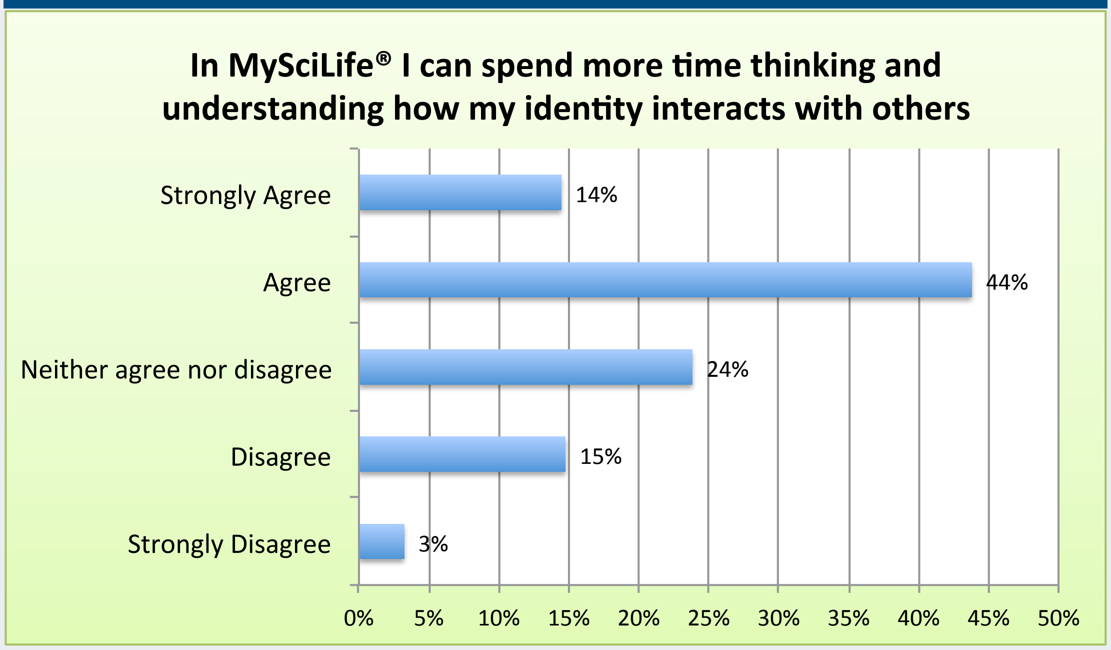


Chart 10 • Student Survey Question 9:
(n=651; SD=1.04; mean=4.09; var=1.08)

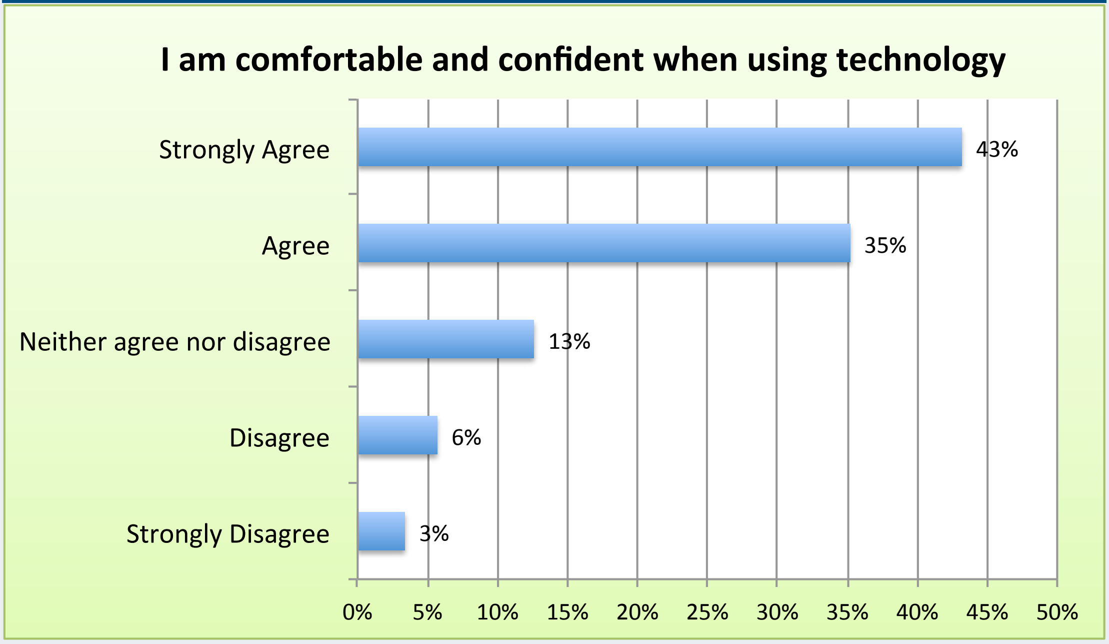


Chart 11 • Student Survey Question 10:
(n=651; SD=.80; mean=4.18; var=.64)

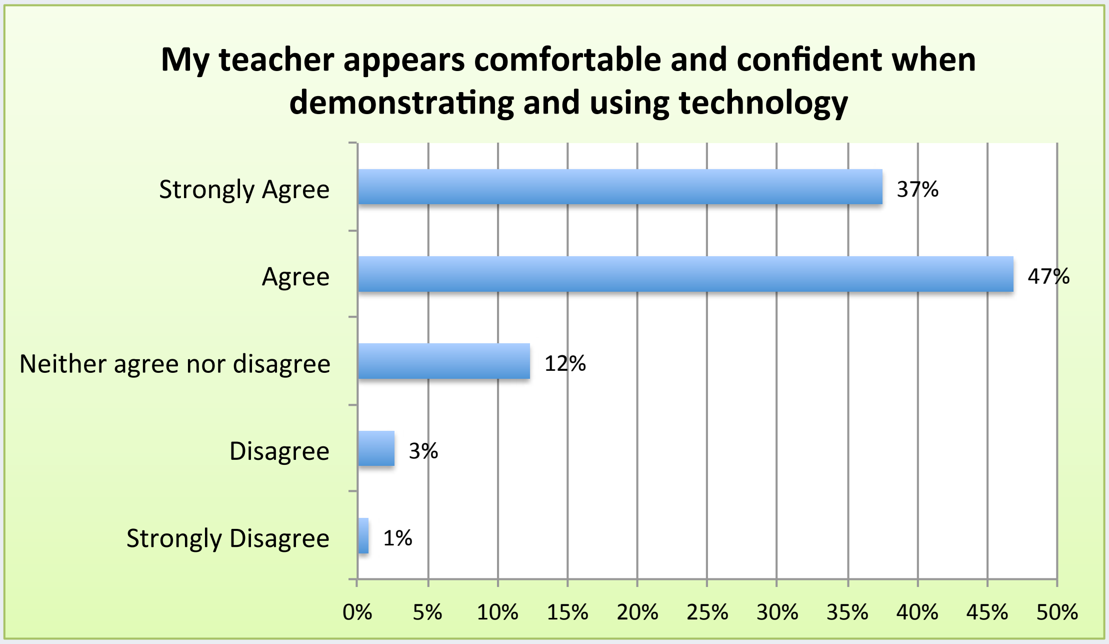


Chart 12 • Student Survey Question 11:
(n=651; SD=.82; mean=3.99; var=0.67)

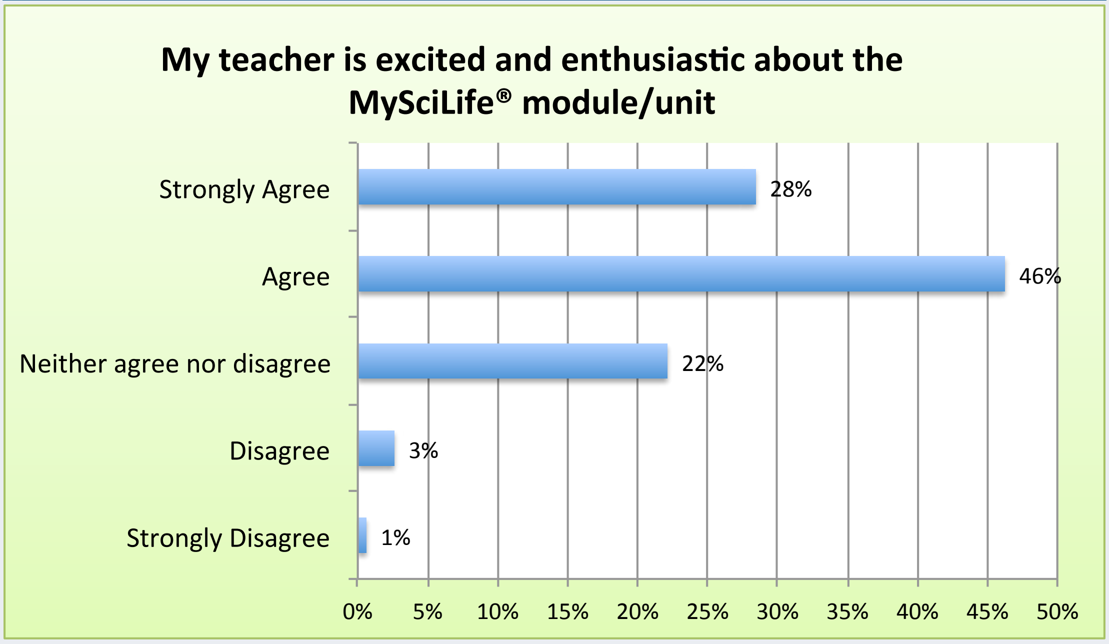


Chart 13 • Student Survey Question 12:
(n=651; SD=1.05; mean=3.29; var=1.11)

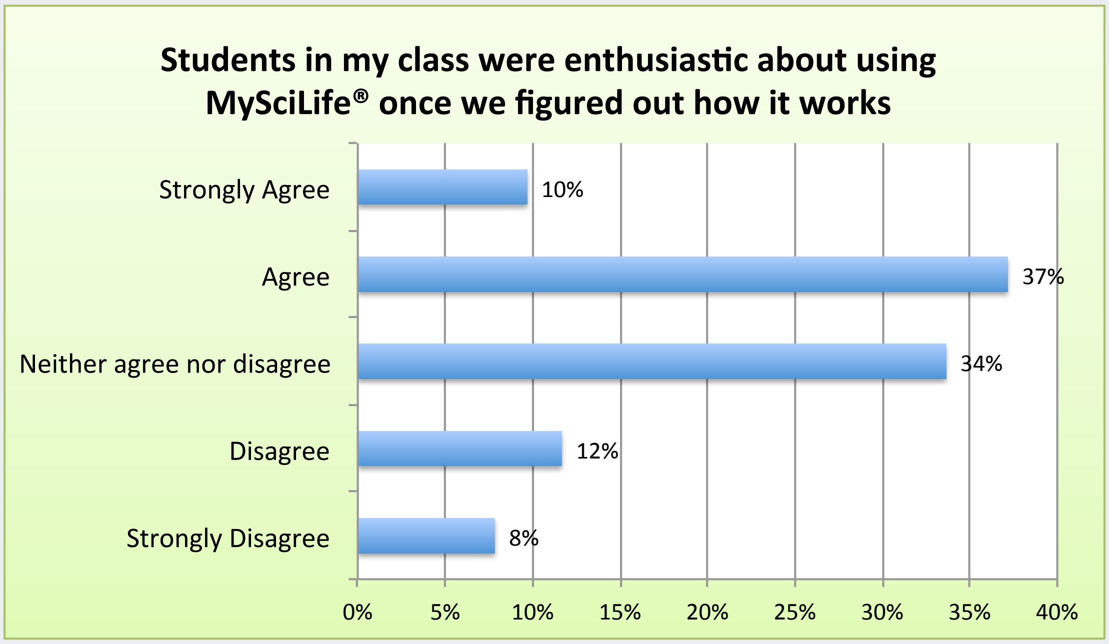


Chart 14 • Student Survey Question 13:

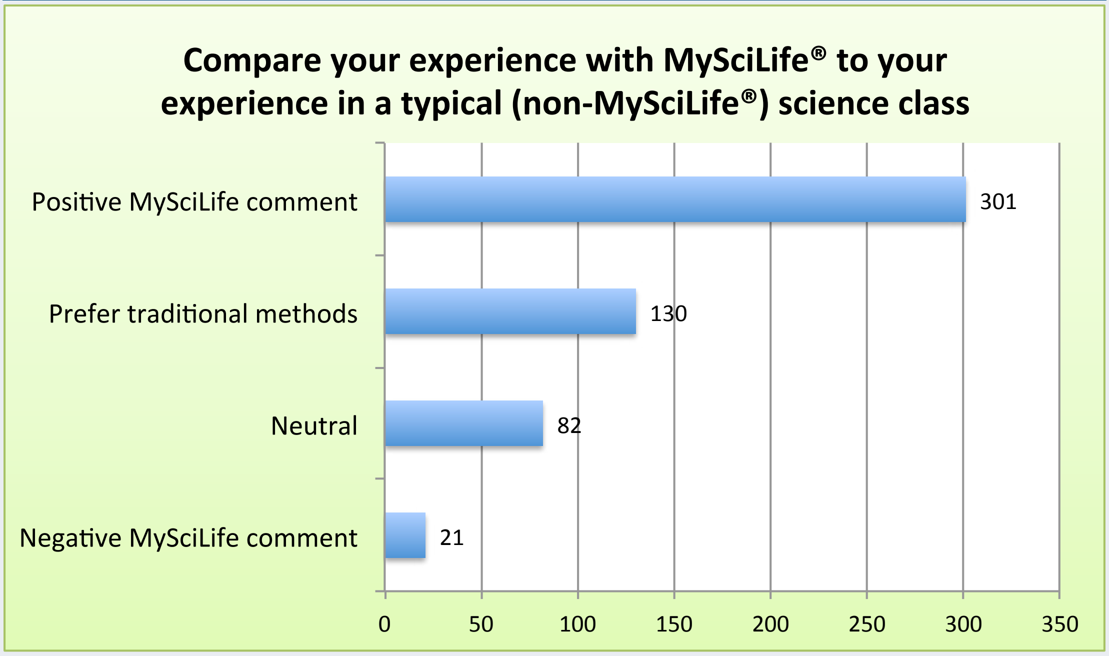


Chart 15 • Student Survey Question 14:

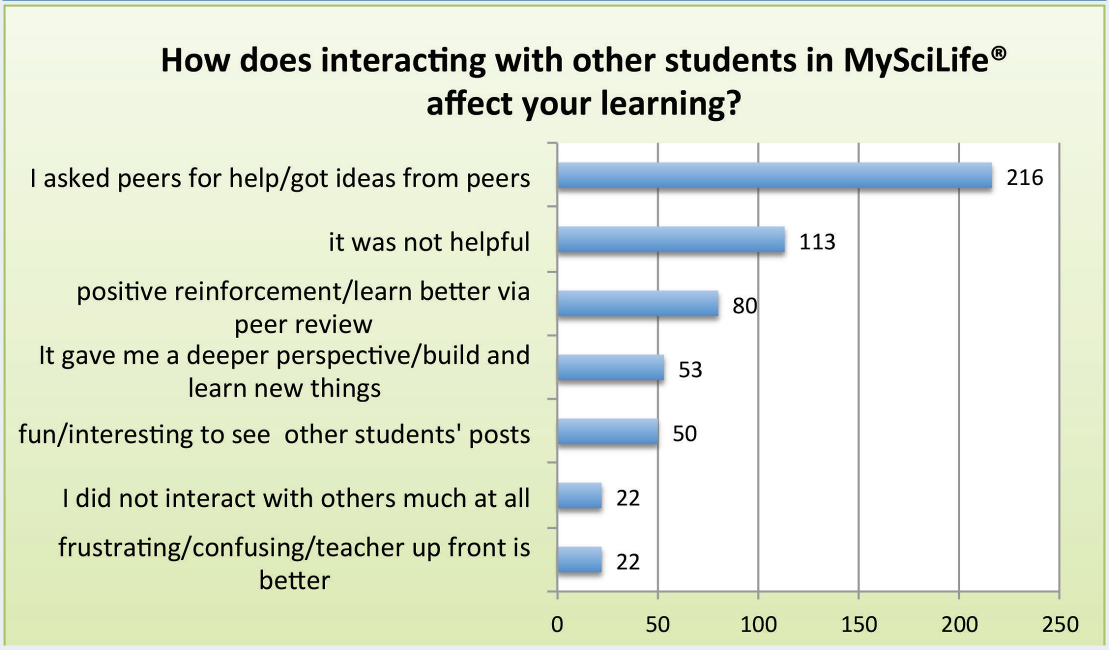
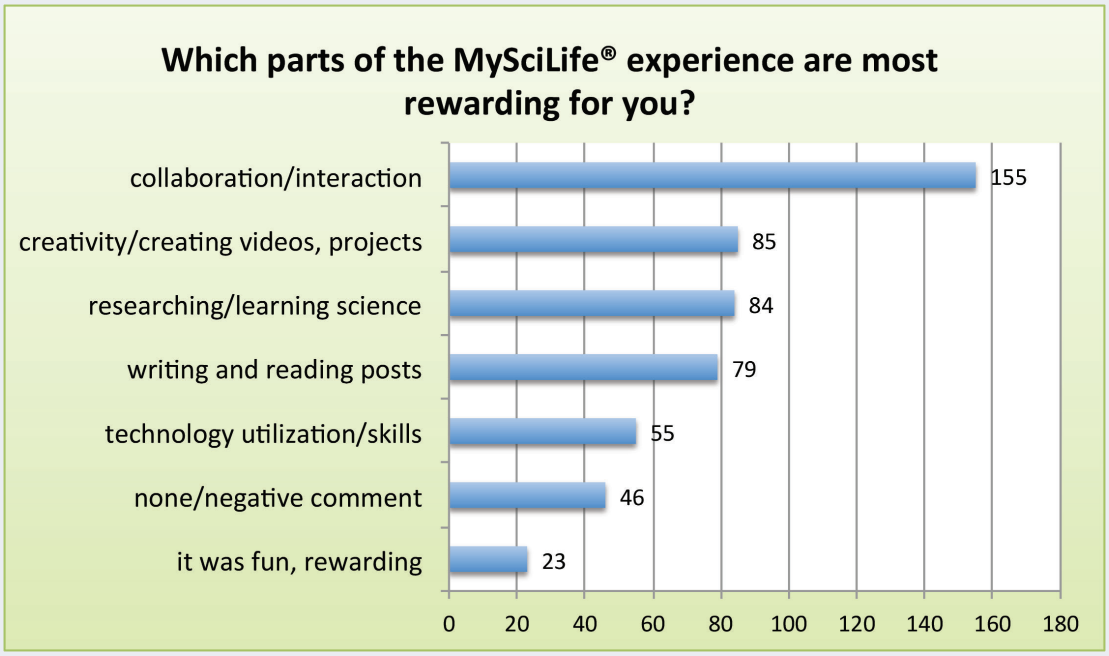


Chart 16 • Student Survey Question 15`:

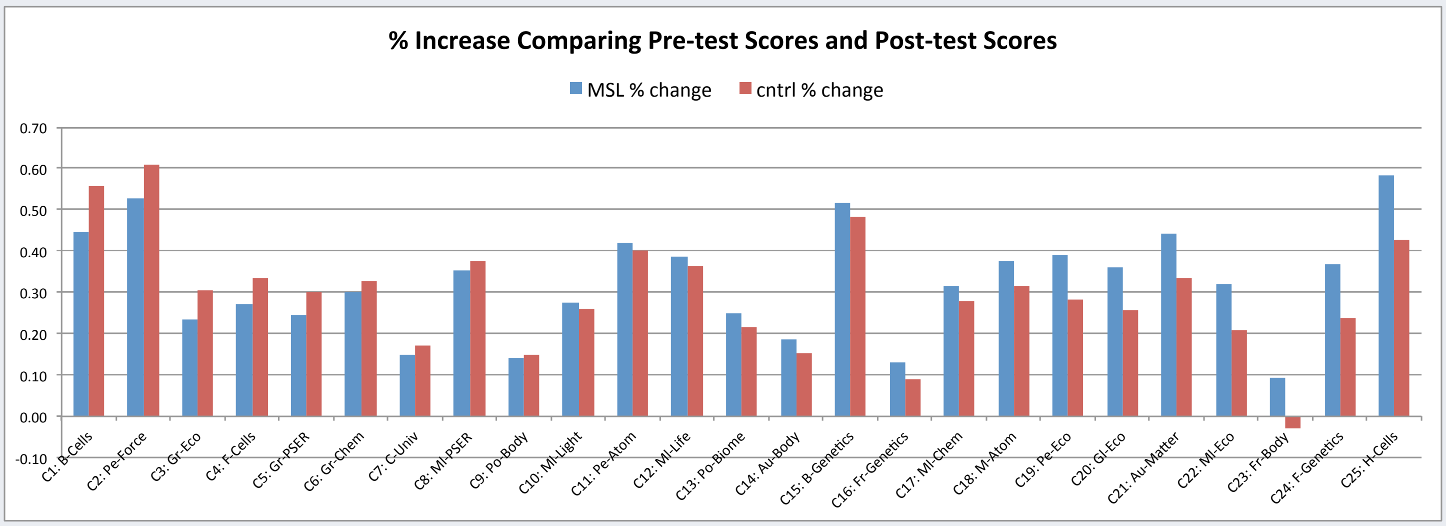


Instrument 2:

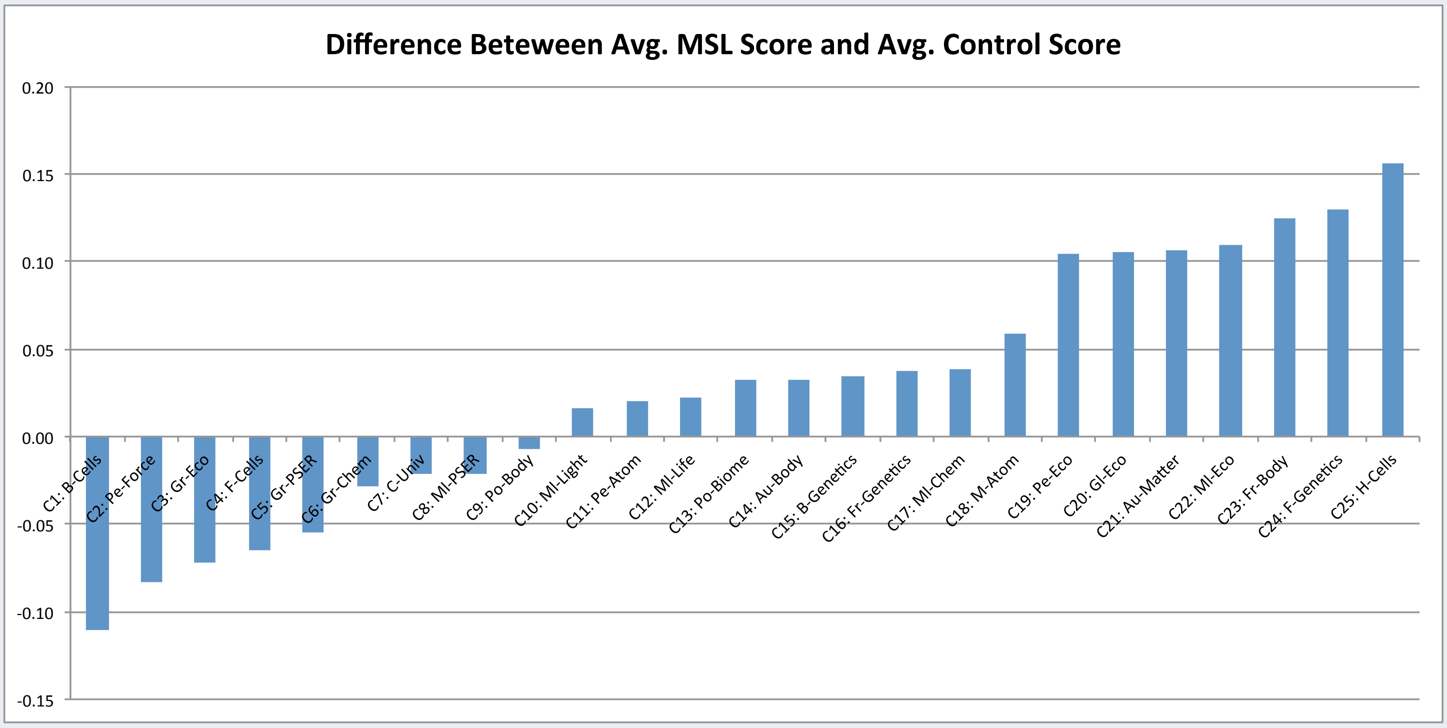
Twelve teachers took part in a controlled experimental design that utilized a pre/post-test to compare content-knowledge test results between the MySciLife classes and the control group classes. Quantitative analysis results of pre- and post-test scores and average differences are shown below in Table 2.

Teacher	n	MSL pre	MSL post	MSL ave diff	MSL % chg	cntrl pre	cntrl post	cntrl ave diff	cntrl % chg	MSL-cntrl diff	MSL std dev	cntrl std dev	t	p	df	signif.
Au-Body	11	9.90	13.64	3.74	0.19	8.82	11.91	3.09	0.15	0.03	2.30	4.93	0.89	0.195	14	N
Au-Matte	11	6.63	15.44	8.81	0.44	5.00	11.69	6.69	0.33	0.11	4.37	4.28	2.04	0.025	30	Y,MSL
B-Cells	20	4.95	13.90	8.95	0.45	3.75	14.90	11.15	0.56	-0.11	3.38	4.03	-1.87	0.035	37	Y,CNTRL
B-Gen	16	5.00	15.31	10.31	0.52	4.31	13.94	9.63	0.48	0.03	2.89	2.94	0.67	0.255	30	N
C-Univ	66	10.76	13.73	2.97	0.15	10.05	13.45	3.40	0.17	-0.02	2.61	2.88	0.89	0.188	129	N
C-atoms	65	10.11	16.37	6.26	0.31	7.74	16.06	8.32	0.42	-0.10	3.81	4.01	-3.00	0.002	128	Y,CNTRL
F-Cells	10	7.10	12.50	5.40	0.27	6.90	13.60	6.70	0.34	-0.06	4.53	3.02	-0.76	0.230	16	N
F-Gen	12	9.58	16.92	7.34	0.37	10.83	15.58	4.75	0.24	0.13	4.58	3.19	1.60	0.062	20	N
Fr-Gen	12	7.25	9.83	2.58	0.13	7.00	8.83	1.83	0.09	0.04	4.46	5.70	0.36	0.362	21	N
Fr-Body	10	10.00	11.90	1.90	0.10	11.00	10.40	-0.60	-0.03	0.13	4.46	1.95	1.62	0.065	12	N
Gl-Eco	10	6.60	13.80	7.20	0.36	7.10	12.20	5.10	0.26	0.11	2.86	1.84	1.49	0.079	15	N
Gr-Eco	48	7.92	12.60	4.68	0.23	6.90	13.02	6.12	0.31	-0.07	3.38	4.32	-1.82	0.036	89	Y,CNTRL
Gr-Chem	23	6.39	12.39	6.00	0.30	7.00	13.56	6.56	0.33	-0.03	4.06	2.94	-0.54	0.295	40	N
Gr-PSER	22	11.55	16.45	4.90	0.25	11.23	17.23	6.00	0.30	-0.06	2.78	3.93	-1.06	0.147	38	N
H-Cells	17	5.00	16.65	11.65	0.58	7.12	15.65	8.53	0.43	0.16	2.40	3.10	3.28	0.001	30	Y,MSL
M-Atom	24	6.04	13.54	7.50	0.38	6.21	12.54	6.33	0.32	0.06	1.64	2.46	1.93	0.030	40	Y,MSL
Ml-Eco	26	9.39	15.77	6.38	0.32	8.53	12.73	4.20	0.21	0.11	5.71	4.29	1.57	0.062	46	N
Ml-Life	24	6.88	14.58	7.70	0.39	6.79	14.04	7.25	0.36	0.02	4.49	4.88	0.34	0.368	46	N
Ml-Chem	25	9.04	15.36	6.32	0.32	7.88	13.44	5.56	0.28	0.04	3.21	3.66	2.83	0.003	47	Y,MSL
Ml-Light	21	8.29	13.81	5.52	0.28	7.38	12.57	5.19	0.26	0.02	3.75	4.74	0.25	0.401	38	N
Ml-PSER	23	12.78	19.87	7.09	0.35	10.13	17.65	7.52	0.38	-0.02	3.46	3.59	-0.42	0.339	44	N
Po-Body	7	7.57	10.43	2.86	0.14	6.00	9.00	3.00	0.15	-0.01	3.58	3.87	-0.07	0.477	12	N
Pe-Eco	48	7.23	15.00	7.77	0.39	7.94	13.63	5.69	0.28	0.10	3.35	3.71	2.88	0.002	93	Y,MSL
Pe-Atom	45	5.73	14.13	8.40	0.42	5.13	13.13	8.00	0.40	0.02	3.80	4.19	0.47	0.318	87	N
Pe-Force	44	5.39	15.93	10.54	0.53	1.75	13.95	12.20	0.61	-0.08	4.39	2.96	-2.80	0.020	75	Y,CNTRL
Po-Biome	42	11.48	16.43	4.95	0.25	11.79	16.10	4.31	0.22	0.03	3.79	3.18	0.84	0.201	80	N

Graph 1 below shows a comparison of percentage increase of MySciLife versus control groups for the 26 modules taught in the classic controlled experiment comparing pre and post scores on the content-knowledge tests.



Graph 2 below shows the pre/post-test differences between the control groups for each teacher of the twenty-six modules taught in the controlled experiment. The graph shows that cases 1 through 9 (c1,c2,..c9) had control groups that showed better improvement from pre to post-test as compared with the MySciLife group. Cases 10 through 25 show the sixteen cases where MySciLife groups showed greater improvement from pre- to post-test when compared to the control group.



Instrument 3:

When asked what teachers liked most about MySciLife, the most common responses were that teachers liked the collaboration, natural differentiation, creativity, and working with technology (digital learning experience). Teachers commented that the assignment prompts really made students think carefully about writing their responses. Teachers also liked that students had the opportunity "to immerse themselves in the topic they are studying."

Teachers appreciated the way MySciLife created a community in which students were engaged and could learn from each other as they asked and answered questions from peers in their own class and other classes.

When asked what really worked well with the MySciLife modules, teachers responded that they liked collaborating with other MySciLife teachers, they liked that students were excited about the tasks, and they liked seeing students enthused about taking charge of their own learning while writing in first person. Teachers felt that taking on a science identity worked well because most students were excited about the creativity aspect involved in this process. Teachers appreciated the way MySciLife created a community in which students were engaged and could learn from each other as they asked and answered questions from peers in their own class and other classes. Teachers appreciated the fact that posts had to be approved by the teacher before being officially posted (published), but this was also an overwhelming task for some other teachers.

When asked about students working beyond expectations in MySciLife, teachers had mixed responses. Some students created presentations when only a short answer was required, and some students who were typically quiet students became "team players." Some students included "deeper concepts than anticipated and really surprised me with the depth of their discussion and creativity." One teacher commented, "I had some students who would sit down next to others who were struggling and help them. This was a very different dynamic than I had observed with this group in the past."

"Collaborating with another teacher was indispensable in making it easier to teach the modules."

When asked how collaboration with other MySciLife teachers helped them with MySciLife, teachers responded that they particularly enjoyed the monthly online meetings to share ideas, get new ideas, ask questions, and learn from more experienced teachers. One teacher commented that it was nice to have a "support group" for when she needed help or had questions. Another teacher replied, "Collaborating with another teacher was indispensable in making it easier to teach the modules."

When asked about frustrations, teachers replied that students had difficulties changing their identities using the Edmodo platform, and that the chronological order of Edmodo postings made it difficult to search, organize, and find posts. Teachers said that the Edmodo platform made it difficult for students and teachers to follow conversation threads, and they wished that more classes were posting on the same topics at the same time. Students became frustrated when trying to find another student with whom they had previously started a dialogue. Some teachers were also frustrated by the lack of computer access in their schools.

When asked about recommendations for improvement, teachers agreed that although MySciLife is creative, collaborative, and fun, the software platform needs to improve by allowing better searching and filtering options for students and teachers to find what they are looking for. Teachers commented that they would like to see the Edmodo stream organized by topic rather than date/time.

Conclusions

The content knowledge pre/post-test data addressed the Outcome Question: "What effect does social media-based learning have on middle-level science performance?" These tests showed that MySciLife students had a statistically significant increase in content-knowledge test scores as compared to the control group in five out of twenty-five data sets. Control group students had a statistically significant increase in four data sets. In the remaining sixteen data sets, the MySciLife students' scores increased versus the control group students, but this difference was not statistically significant. (Table 2).

The multiple choice (Likert scale) student post-survey questions addressed the Process Question: "How does social media-based learning affect student attitudes and perceptions about learning science?" There were 12 questions with 5 answer choices (strongly agree, agree, neutral, disagree, and strongly disagree). The results showed that:

> 50% of students "agree" or "strongly agree" that MySciLife was more interesting as compared to the way they typically learn science (n=651, SD=1.03).
>
> 55% of students "agree" or "strongly agree" that the MySciLife unit allowed them to be more creative than was possible in their typical science class (n=651, SD=.99).
>
> 41% of students "agree" or "strongly agree" that interacting with other students through MySciLife helped them to better understand science (n=651, SD=1.01).
>
> 45% of students "agree" or "strongly agree" that taking on a science identity in MySciLife helped them to better understand science (n=651, SD=1.04).
>
> 33% of students "agree" or "strongly agree" that they learned more about science using MySciLife as compared to the typical science classes that did not use MySciLife (n=651, SD=1.07).
>
> 62% of students "agree" or "strongly agree" that MySciLife allows them to "go further and learn more" after they have learned the required concepts (n=651, SD=.94).
>
> 39% of students "agree" or "strongly agree" that they can think more deeply and learn more about science with MySciLife (n=651, SD=.98).
>
> 58% of students "agree" or "strongly agree" that they had the opportunity to spend more time thinking about their identity and understanding how their identity interacts with others (n=651,SD=1.01).
>
> 78% of students "agree" or "strongly agree" that they are comfortable and confident with using technology (n=651, SD=1.04).
>
> 84% of students "agree" or "strongly agree" that their teacher appears comfortable and confident with demonstrating and using technology (n=651, SD=.80).
>
> 74% of students "agree" or "strongly agree" that their teacher is excited and enthusiastic about the MySciLife module (n=651, SD=.82).
>
> 47% of students "agree" or "strongly agree" that students in their class were enthusiastic about using MySciLife once they figured out how it worked (n=651, SD=1.05).

The open-ended student survey questions also addressed the Process Question referring to student attitudes and perceptions about learning science. Student responses to the open-ended questions regarding their experience with MySciLife compared to traditional methods revealed more about student enthusiasm, creativity, collaboration, and/or frustration than the quantitative results. When asked how MySciLife compared to students' typical science experience, there was an overwhelming consensus that students enjoyed the MySciLife experience. There were 301 positive comments about MySciLife, compared to 130 responses that preferred traditional methods of science instruction and 21 negative comments about MySciLife.

When students were asked about how interacting with their peers via the MySciLife unit helped them learn science, the most frequent responses were: "others helped me with content" (216 responses), "it was not helpful" (113 responses), and "liked the positive reinforcement from peers and I could learn better" (80 responses).

"MySciLife helps me to know that we are not working alone! I really like it a lot!"

The most rewarding parts of the MySciLife experience were: "interacting and collaborating with peers" (155 responses), "creativity/creating videos and projects" (85 responses), and "researching/learning science" (84 responses).

The teacher surveys provided further data to support the findings from the pre/post content knowledge tests and student surveys. The teacher surveys revealed that teachers view MySciLife as an effective instructional model that improves students' experience in science. Students get excited about using social media to learn science. And, although students and teachers are sometimes frustrated with the Edmodo platform, students are motivated to produce and post high-quality work for peer review, and they enjoy learning from each other in a creative and collaborative process.

The results of this study are consistent with the STEM Case Study, conducted by Kärkkäinen, K. and S. Vincent-Lancrin (2013), which found that "collaboration can be an effective means to foster knowledge flows, new ideas and peer learning." Although content-knowledge test scores are an important measure of student success, the data show that MySciLife sets out to move beyond recall of facts and truly enhance STEM education so that students develop the sought after skills needed to succeed in STEM fields in the 21st century. MySciLife is not solely focused on content-knowledge and factual recall, but also on skills that employers all across the globe are looking for in their employees. Skills such as collaborative writing and publishing, peer review, creative problem-solving, team work, interaction, inter-personal skills, sharing and helping others, self-direction and initiative, flexibility, adaptability, and learning how to access and share information- all of which are arguably more important than the recall of fact-based information as measured by most standardized multiple choice tests (Fertig, 2013).

Limitations

Research suggests that there are numerous variables involved in studying the effects of a social networking model of instruction on students' perception, experience, and performance. These include students' attitudes and previous exposure to other modes of science instruction; students' background and comfort level with using technology in science; students' exposure to and experience with science-specific technology applications; teachers' experience with technology applications in science; and their attitudes and openness to utilizing technology, etc. (Gess-Newsome, 1999).

A carefully designed pre/post assessment is crucial for this study. Although all pre/post assessment instruments were peer edited before implementation, statistical analysis shows that some test questions need to be replaced/revised or better addressed in the curriculum. It is difficult to assess the open-ended learning that takes place in MySciLife using a pre-test/post-test based on each participating school's curriculum content. Some questions had extremely high scores on the pre-test. These questions were too easy and did not allow for significant improvement on the post-test. Some questions had very low scores on both pre and post-test. These questions were most likely either poorly worded, not adequately explained/addressed by the teacher, and/or not explored/experienced by the students. This problem was also present in the data we reviewed for the 2012-2013 semesters.

Teachers participating in MySciLife also had varying degrees of experience with both technology-enabled teaching and with MySciLife. Some teachers were trying MySciLife for the first time, while other teachers had more experience and had already worked out some of the kinks in their instructional methods, planning, student requirements, and expectations. Students may have had a better experience with their second MySciLife module as they become more comfortable with the technology and other aspects of MySciLife. Students may also have had a better experience as their teacher became more comfortable with managing MySciLife logistics while facilitating the student learning process. Finally, issues regarding uneven access to computers or mobile devices can increase the challenges for some classes using MySciLife.

Recommendations

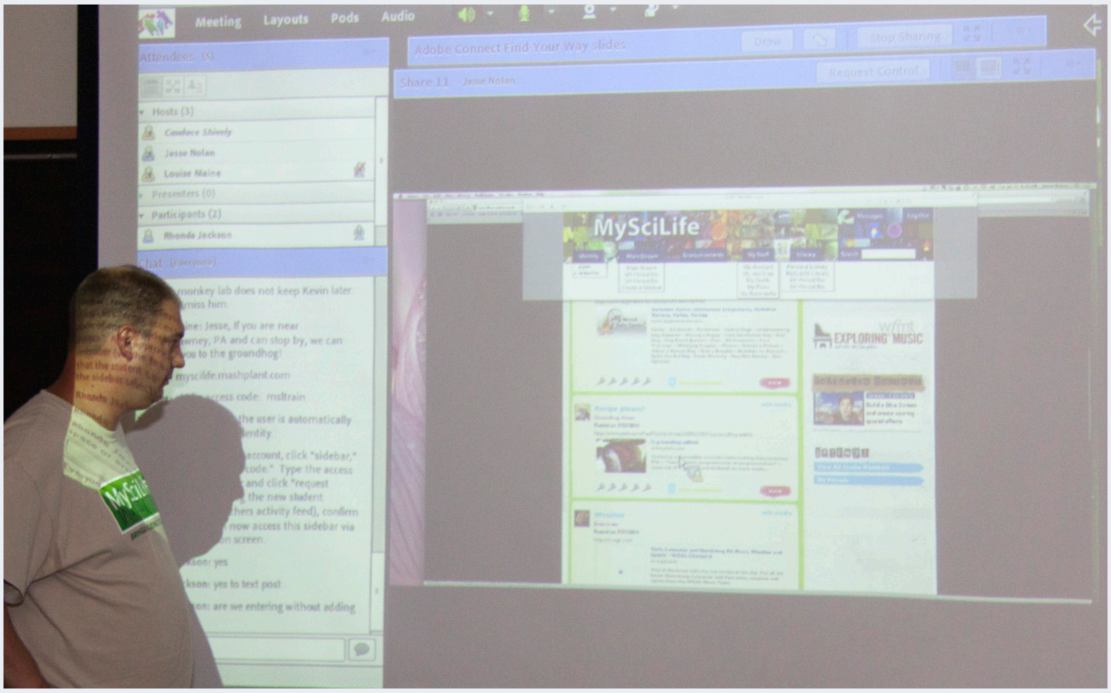
From its inception, MySciLife has used Edmodo as its primary social-media tool. However, other useful tools have emerged as both teachers and students have gained experience with MySciLife and worked around Edmodo's limitations. Teachers recommend using shared documents in Google Drive in conjunction with Edmodo. Some teachers commented that their students really liked having "student guides" provided in Google Drive because they could continue to work if the Edmodo site went down or they lost their Internet connection. These supplemental, teacher-created guides in Google Drive were also a positive factor for those classes because they allowed the teachers to grade more efficiently and collaborate more frequently with students. Teachers reported using Google Drive as a "sidebar" style online space to provide students with extra support, share assignments or files, and help students improve their posts before "publishing" them in MySciLife.

Other teacher recommendations were directly concerned with the Edmodo online interface. Edmodo should make it easier for students to reply to other students' replies. Edmodo should improve their search/sort capabilities. Edmodo should allow for students to access and modify their Identity profile(s) so they can transition to multiple units/modules. Having an online "sidebar" similar to what some teachers created in Google Drive but within the platform would make MySciLife even easier to implement. All of these considerations are being factored into the creation of the new MySciLife platform that will be used beginning in fall of 2014.

> **"Interacting with other students affects your learning by critiquing your work to make it the best."**

MySciLife teachers have consistently noted the benefits of ongoing collaboration with each other as they teach. As MySciLife expands, it will be important to provide well-crafted professional development paired with an environment that provides continuing opportunities for this peer collaboration.

Future research considerations for MySciLife should include investigating the impact of MySciLife on student science performance and on attitudes about learning science using the newly created, custom MySciLife platform. Other investigations might include assessing the impact of MySciLife for longer periods beyond initial learning modules (units) and the impact on student success after teachers gain more experience with this new way of teaching. Although more educational research on the effects of social media and learning is needed, "there is a clear correlation between a more intense use of digital media and educational performance" (OECD, 2012). MySciLife demonstrates this correlation and promise in leveraging the power of social media for science learning.



Afterward

At the conclusion of the 2013-14 academic year, The Source for Learning determined that reactions to MySciLife from students, teachers, and researchers were sufficiently positive that they warranted additional expenditures to improve the MySciLife experience. As a result, SFL contracted with Mashplant, Inc. for the development of a customized operating platform for MySciLife based on Mashplant's social interaction platform. The new MySciLife platform was developed during the spring and summer of 2014, and it is being tested and used with an expanded project during the 2014-15 academic year. SFL anticipates that the new platform will greatly reduce the number of instructional adaptations teachers had been forced to make because of the limitations of the Edmodo platform. SFL's investment in this platform represents an ongoing commitment to make MySciLife available at no cost as part of SFL's services to K-12 education.

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