Exploring Design Elements for Online STEM Courses: Active Learning, Engagement & Assessment Design

Baiyun Chen, Kathleen Bastedo, and Wendy Howard
Center for Distributed Learning, University of Central Florida

Abstract
The purpose of this study was to examine effective design elements for online courses in the science, technology, engineering, and mathematics (STEM) fields at a large four-year public university in southeastern United States. Our research questions addressed the influence of online design elements on students' perception of learning and learning satisfaction. An online survey was completed by 537 students from 15 online STEM courses in spring 2016. The survey results indicated that student perceptions of learning and satisfaction were correlated with their perceptions of the efficacy of specific design elements, such as integrated active learning activities, interactive engagement strategies, and robust assessment design. In particular, perception of assessment design efficacy was significantly correlated with students' self-perceived learning and learning satisfaction for students of all subpopulations. The findings inform instructors and instructional designers on how to design effective, inclusive, and engaging online STEM courses. Student survey responses were observed to support universal design for learning (UDL) and in light of this, online STEM instructors are also strongly encouraged to utilize UDL principles in course design, which benefit not only students with disabilities but all students.

Keywords: Active learning; assessment; online courses; online education; online interaction; online learning; online STEM courses; STEM education; student satisfaction, student perception; Universal Design for Learning; UDL

Chen, B., Bastedo, K., & Howard, W. (2018). Exploring design elements for online STEM courses: Active learning, engagement & assessment design. *Online Learning, 22*(2), 59-75. doi:10.24059/olj.v22i2.1369

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The number of enrollments in college courses taught using the Internet has soared over the last ten years and the increase in online courses continues. According to the 2017 report of the Digital Learning Compass, over six million higher education students are taking online courses and 30% of all higher education students now take at least one course online (Allen & Seaman, 2017). At the same time, STEM education has become a national priority (STEM Education Coalition, 2014) and in 2010 President Obama dedicated resources to the advancement of STEM education through the *Educate to Innovate* initiative and the *America COMPETES Reauthorization Act of 2010*. With the increase in online learning and a national focus on STEM education, there is a growing need for pedagogical best practices that address the unique challenges of delivering STEM instruction online (Chen, Howard, & Bastedo, 2015).

Review of Related Literature

We searched the EBSCOhost, Directory of Open Access Journals, Google Scholar, and Elsevier databases for key issues and design elements using the following keywords: STEM, science, technology, engineering, mathematics, online, e-learning, science education, distance education, online course activities, universal design for learning, UDL, student feedback, student satisfaction, and student engagement. While limited research was found on effective design elements specific for online STEM courses, ample research has been conducted on effective online course designs in general (Martin, Ahlgrim-Delzell, & Budhrani, 2017; Ralston-Berg, Buckenmeyer, Barczyk, & Hixon, 2015). This search revealed Bayraktar's (2001) meta-analysis which found that computer-assisted instruction increased student performance in science education as well as Schoenfeld-Tacher, McConnell, and Graham's (2001) study in which students in an online section of an upper level science course demonstrated a higher proportion of high-level interactions and outperformed their peers in the corresponding on-campus section. In addition, the articles returned in this search were broader than the specific design elements in our study, but the trends were focused on the use of active learning, student engagement, and assessment in STEM learning.

Design elements for online STEM courses

The current literature shows the efficacy of **active learning strategies** in STEM courses (Aji & Khan, 2015; Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014; Haak, HilleRisLamers, Pitre, & Freeman, 2011; McConnell, Steers, & Owens, 2003; Prince, 2004). Felder & Brent (2009) defined active learning as "anything course-related that all students in a class session are called upon to do other than simply watching, listening and taking notes" (p. 2). Prior studies (Aji & Khan, 2015; Freeman et al., 2014; Haak, et al., 2011; McConnell, et al., 2003; Prince, 2004) show that active learning leads to increased student performance and success rates in STEM learning. In fact, Freeman et al. (2014) conducted a meta-analysis of 225 studies that revealed that active learning led to an increase in exam scores and lower failure rates compared to traditional lecture. Most of the research in this area is independent of delivery modality, but these core pedagogical principles and strategies which allow students to actively engage with instructional content over passively listening to lectures can be applied in the online environment as well as the classroom.

Though we were only able to locate limited information related to online STEM education, **student engagement** has been shown to be a factor in student retention in the STEM fields (Watkins & Mazur E., 2013). For example, Hegeman (2015) found increased student success in an online college algebra course when replacing publisher materials with *instructor-generated videos and guided note-taking sheets* for these videos to increase student engagement with content and the instructor. Tibi (2018) also reported success with student-student engagement using structured discussions in an online computer science course. Another engagement practice noted in literature on STEM education is the effective implementation of *peer mentoring or peer instruction* (Sithole et al., 2017; Vajravelu & Muhs, 2017). Specifically, Vajravelu and Muhs (2016) documented their success using a combination of homework and skills tests online with small group problem-solving sessions in the classroom in a large undergraduate calculus course.

In the limited literature we found on online STEM learning, we noticed a movement that is beginning to incorporate the Universal Design for Learning (UDL) principles into postsecondary STEM education with some basic online components for student engagement. UDL is a set of principles designed to provide all students with equal opportunities to learn (Izzo & Bauer, 2015). In fact, one of UDL's driving principles, multiple means of engagement, has shown that students learn in different ways (e.g., some students prefer to work alone while others thrive in a group setting) and need to be motivated to actively participate in their own learning (Rose & Myer, Eds., 2011). For example, in 2011, a group from the Georgia Institute of Technology implemented a program called SciTrain University, a project funded by the National Science Foundation that was specifically designed to provide training for STEM faculty on how to implement UDL into STEM environments (Moon, Utschig, Todd, & Bozzorg, 2011). The focus was on students with disabilities and though the numbers of students in the study were low, outcomes were promising and feedback from students stated there was an improvement in more inclusive teaching methods. There was also a reported increase in course completion by these students (Moon, et al., 2011). Another study provided instructors with UDL training and students were provided with pre- and post-tests, the results of which indicated that the small amount of UDL training instructors received made a positive difference, especially in the area of engagement, on student experiences in the STEM courses (Davies, Schelly, Spooner, 2012). Neither of these studies mentioned actual student success rates in these courses.

Assessment strategies were another design element that was reviewed. According to John Wells (2005) in the 100-year history of the Mississippi Valley Technology Teacher Education Conference (MVTTEC) annual meeting, pedagogical issues rose to be a dominant topic starting around the year 2000, and in recent decades the dominant subtopic has become assessment. Prior studies have shown that the use of *online formative assessments*, such as short online quizzes, is particularly effective in STEM education (Nicol & Macfarlane-Dick, 2006; Felin, 2016). For instance, online assessments have been shown to be useful for gaining, refocusing, and extending student attention during lengthy science lectures. This is particularly useful, as lectures are a predominant pedagogical approach in STEM instruction. Additionally, recent studies, such as those conducted by Gobert, Baker, and Wixon (2015), deOliveira Neto and Nascimento (2012), and Kruger, Inman, Ding, Kan, Kuna, Liu, Lu, Oro, and Wang (2015) which implemented intelligent tutoring strategies or similar types of strategies, stress the importance of *providing timely, high-quality, individualized assessment and feedback* to students while enhancing and maintaining student engagement.

Research Questions

The purpose of this study is to further explore design elements for online education in the STEM fields. Most of the literature in this area consists of either broad meta-analyses of pedagogical best practices for STEM education in general or case studies based on specific online courses or online course components. This study is a unique large-scale survey research of many online courses across multiple STEM disciplines.

Based on the literature review above, specific research questions were derived.

- Which design elements appear most frequently in online STEM courses?
- Which design elements (activity, interactivity, assessment) impact student perceptions of learning?
- Which design elements (activity, interactivity, assessment) impact student learning satisfaction?

Methods

To identify and evaluate effective design elements in online STEM learning, we conducted a survey research study in spring 2016 at a large four-year public university in the southeastern United States.

Participants

With instructors' permission, 2,949 students from 15 online and five blended STEM courses were contacted to participate in the online survey in spring 2016 through an online course announcement. A total of 1,767 complete and valid responses were collected with a 60% response rate. For this article, we selected only the responses (n=537) from the fully online courses for analysis. Among those participants (aged 18-60, M=23.50, SD=6.14), 41% (n=221) were males, 49% (n=265) were females and 10% (n=51) were unidentified. Forty-five percent of the participants were (n=240) non-Hispanic white, 17% (n=91) Hispanic, 11% (n=58) two or more races, 8% (n=41) African-American, and 5% (n=25) Asian. They came from 12 different colleges within the university with the majority of students coming from the College of Engineering and Computer Science (36%, n=194), the College of Sciences (14%, n=73), and the College of Health and Public Affairs (11%, n=60). Thirty-two percent (n=169) of the participants were seniors, 23% (n=125) juniors, 22% (n=120) freshmen, 11% (n=61) sophomores, and 2% (n=9) graduate students. The majority (76%) of the participants were full time (n=409). The remainder were part-time 12% (n=64), 2% (n=10) overload (more than 12 credit hours), and less than part-time students 1% (n=3). Less than 1% (n=29) of the participants reported one or more disabilities, such as a learning disability (n=14), visual disability (n=7), hearing disability (n=5), and physical disability (n=3). Nineteen percent (n=102) of the participants reported being the first-generation college students. Table 1 presents a brief summary of the demographic information of the survey sample.

Table 1.
Demographics of the survey samples

Survey sample	n=537
Courses	15 online
Colleges	12
Age	Range:18-60, M=23.50, SD=6.14
Undergraduates	56%
Full time	76%
Gender	49% female
Ethnicity	45% non-Hispanic Caucasian
Disabilities	Less than 1%
First-generation	19%

Instrumentation

The survey instrument was constructed using the distance education research toolkit developed by the National Research Center for Distance Education and Technological Advancements (DETA, 2015). The survey included 13 demographic questions, three open-ended questions, and six ranking question sets, which addressed learner characteristics, students' online activities and interactivities, and their perceptions of learning outcomes and satisfaction (see Appendix: Survey Instrument). We invited expert reviewers and student volunteers to test the survey's validity before administration. The instrument was then modified based on feedback from experts and students.

Measures

Summary statistics and definitions for each of the measures are reported in Table 2. Respondents were asked to rate the set of items measuring each variable on a 5-point Likert-type scale ranging from *1=not at all* to *5=very frequently* or *1=strongly disagree* to *5=strongly agree*.

Table 2.

Measures of the Survey

Measures	Definition	N of Item	Cronbach's alpha
Course Activity	Frequency of course activities, e.g. reading, utilizing websites, etc.	19	.819
Interactivity	Frequency of interactions with instructor and students	8	.896
Assessment and Evaluation	Perception of grading system	3	.850
Learn	Perception of learning in this course	3	.916
Satisfaction	Satisfaction with this online course	7	.914

Procedures

The Institutional Review Board approved the survey research in October 2015. We contacted course instructors, department chairs, and college deans in the STEM disciplines at the institution in January and February of 2016 to seek permission for their students to participate in the online survey. With permission from these individuals, students were notified of this survey opportunity through an announcement in the Learning Management System (LMS) during mid-semester. The online survey was hosted in *Qualtrics*, which is a secured survey construction and hosting website. Respondents were able to skip any part of the survey, including demographic-related questions, if they preferred not to answer.

Data analysis

The data collection ended in May 2016. The data were cleaned, and all identifiable information was removed using a coding system within 30 days after collection. Frequencies and percentages were calculated to measure students' perceptions, course activities and interactivities, and general learner characteristics. Chi-square and multiple regression statistics were used to detect if course design practices were correlated with students' online course experience among diverse students. Additionally, the responses from the three open-ended questions were analyzed and coded, and statements were classified into themes to answer the research questions.

Results

The results of the survey research are presented in this section to answer the three research questions most related to learning activities, interactivities, and assessments. In brief, the most frequently student-cited design elements of the surveyed courses included major projects/assignments, readings, website/slide resources, exams, special software applications, real-world problems, and case studies. Assessment design was the most significant factor that was correlated with students' self-perceived learning and learning satisfaction for students of all populations.

RQ1: Which design elements appear most frequently in online STEM courses?

Students reported that the top five required activities in their STEM courses included completing major projects, reading, utilizing websites, taking quizzes/exams, and examining slideshows (Table 3).

Table 3.

Top required activities in online STEM courses

	N	*Mean*	*SD*
Completing major projects and assignments	506	4.12	1.19
Reading	503	3.76	1.27
Utilizing websites	506	3.5	1.26
Taking quizzes/exams	505	3.46	1.30
Examining slideshows	503	3.15	1.30

Of these most frequently reported required activities, the top three **active learning activities** that students reported participating in, included using special software or applications relevant to the course, solving a real-world problem, and analyzing scenarios or case studies (Table 4).

Table 4.
Top active learning activities in online STEM courses

	N	*M*	*SD*
Use special software or applications relevant to the course.	504	3.57	1.51
Solve a real-world problem.	506	3.29	1.40
Analyze scenarios or case studies.	504	3.00	1.47

The top two interaction activities reported by students included reading course news or announcements (M=3.65, SD=1.28) and receiving emails from the instructor (M=3.07, SD=1.19). It appears that students in the surveyed courses engaged more frequently in passive interactions rather than initiating interactions.

The overall attitudes toward assessment methods were positive. The majority of the participants agreed or strongly agreed that the assessment and evaluation methods in the online STEM courses were clear and appropriate (Table 5).

Table 5.
Perception of Assessment Methods in Online STEM Courses

	N	*M*	*SD*
Graded assignments were appropriately timed within the length of the course, varied, and appropriate to the content being assessed.	483	4.15	0.98
Clear standards were set for the instructor's posting of grade, activities, and resources.	482	3.94	1.11
The method of grading my performance was clear.	484	3.89	1.19
My overall course grade was not based solely on exams and quizzes.	482	3.68	1.34

RQ2: Which design elements (activity, interactivity, assessment) impact student perceptions of learning?

The overall perceptions toward learning in the surveyed courses were positive (Table 6). The students perceived that the online activities in which they participated in the online courses helped them learn and achieve a better grade.

Table 6.

Perception of Learning in Online STEM Courses

	N	*M*	*SD*
The online activities allowed me to better understand concepts.	483	3.77	1.06
The online activities helped me get a better grade.	484	3.74	1.06
The online activities helped me think more deeply about course materials.	484	3.69	1.05

Students' perception of learning was correlated with their perception of the efficacy of assessment methods, $F(1, 475) = 241.31$, $p=.000$. Approximately 34% of the variance (adjusted $R^2 = 0.34$) in students' perceived learning was accounted for by learners' perception of assessment. Course activity or interactivity was not a significant factor that correlated with students' self-perceived learning in this study.

These results applied to all students, including underrepresented minorities. For instance, students' perception of assessment methods was the only factor that was correlated to students' perception of learning for students with disabilities, $F(1, 23)= 13.64$, $p=0.001$. *Adjusted* $R^2=0.35$, first-generation college students $F(1, 97)= 189.84$, $p=0.000$. *Adjusted* $R^2=.66$, and female students $F(1, 255)= 144.93$, $p=0.000$. *Adjusted* $R^2=0.36$.

In the open-ended questions, students offered additional insights regarding practices that an instructor and a STEM program can implement and strategies that they have used to help them succeed in an online STEM course. The most highly-demanded instructor practices included offering more resources, sending reminders, and being clear and concise. Students suggested a STEM program should invest resources to create online videos, offer face-to-face opportunities for them to meet their online instructors, TAs and tutors, and offer face-to-face lab activities. Additionally, the responses show that the success strategies that students have used include collaborating with other people, managing time effectively and taking good notes.

RQ3: Which design elements (activity, interactivity, assessment) impact student learning satisfaction?

The overall attitudes toward the surveyed courses were positive (Table 7). Students reported that the courses were easy to access, and they enjoyed the learning experience.

Table 7.
Satisfaction of Online STEM Courses

	N	*M*	*SD*
Getting online to access the course was easy.	485	4.32	0.82
Participating in this online course was a useful experience.	486	3.80	1.16
I would recommend this course to a friend.	485	3.80	1.29
I liked this course delivered online.	486	3.76	1.34

Students' learning satisfaction was correlated with their perception of the efficacy of assessment methods, $F(1, 475) = 337.43$, $p=.000$. Approximately 41% of the variance (*adjusted* $R^2 = 0.41$) in students' learning satisfaction was accounted for by learners' perception of assessment methods.

Again, these results applied to all male students and underrepresented minorities regardless of gender. For instance, perception of assessment methods efficacy was the only factor that was correlated to learning satisfaction for students with disabilities, $F(1, 23)= 16.01$, $p=0.001$. *Adjusted* $R^2=0.39$ and first-generation college students, $F(1, 97)= 104.84$, $p=0.000$. *Adjusted* $R^2=.51$. For female students, however, both perception of assessment methods efficacy and perception of interactivity correlated to their learning satisfaction, $F(2, 255)= 92.72$, $p=0.000$. *Adjusted* $R^2=0.42$.

Discussion & Conclusion

The findings of this study have significant implications for designing effective online courses in the STEM disciplines. All students, including underrepresented minorities, could benefit from well-designed online courses that improve access and learning. As discussed in the literature review, effective design elements for STEM learning include active learning (Aji & Khan, 2015; Freeman et al., 2014; McConnell et al., 2003; Prince, 2004), multiple means of student engagement (Rose & Myer, 2011), and robust assessment strategies (Nicol & Macfarlane-Dick, 2006; Felin, 2016). Our survey findings echoed prior research in the three design elements related to activities, interactivities, and assessment methods.

Design elements

In the surveyed courses, **active learning activities**, such as the implementation of special software, real-world problems, and case studies, were utilized and reported by students (Table 4).

The surveyed students welcomed projects that apply to the real world and real-life problems/examples/scenarios and include a thorough explanation. They reported better understanding when the instructor related the course content to real life situations. Real-world active learning was an integral part of the online STEM courses included in the survey, and students reported high satisfaction with these activities.

While **interaction strategies** only had a small but statistically significant correlation with learning satisfaction for female students, all participants reported that they paid close attention to course news/announcements and emails from the instructor. Our survey results indicated that online STEM instructors should be clear, concise, and consistent about instructions, assignments, assessments, due dates, course pages, and office hours and make every effort to improve communication with students. In the open-ended comments, students reported their use of peer-mentoring strategies for learning, such as using discussion forums as resources and forming online and in-person study groups via social media, e.g., Facebook, Google Hangouts, Groupme, and Google Drive. All these interaction and communication strategies might especially benefit female students, who, as studies demonstrate, tend to interact and communicate more in the online environment (Sullivan, 2001; Young & Norgard, 2006; Caspi, Chajut, & Saporta, 2010) which may increase their overall online participation in STEM learning.

Aligned with the literature review, perception of **assessment method** efficacy is the most significant factor that was correlated with students' perception of learning and learning satisfaction for all student demographic categories. In the open-ended question responses, students asked for frequent short practice tests and quizzes that provided them with immediate feedback and explanations. Students saw frequent formative quizzes as a practice that would improve their grades on final exams. Additionally, they would like their instructors to be very clear on due dates and grading methods, update grades frequently, and provide samples that are tied to the assignments and exams.

Universal Design for Learning

Within this study, although not intended to address UDL, a pattern emerged within student answers to our survey questions that supports the inclusion of UDL principles. For instance, in the open responses, students recommended practices that instructors should include to help them succeed in the online STEM courses. The recommendations include that instructors should provide a variety of communication methods with students (e.g., using LMS tools beyond discussion to communicate, announcements, posting office hours online). These answers support the UDL principle of Action and Expression, which is also supported in research that implements UDL into online courses in higher education by Rao, Smith, and Wailehua (2015) and Black, Weinberg, and Brodwin (2015), and Burgstahler and Cory, (2008). Additional student responses reported under the same question included statements that they really enjoyed course-related videos, which helped them understand course content better than just having a text representation of a concept. This answer directly supports the UDL principle of Representation, which appears in a UDL research paper published by Rao, et al. (2015) and Fidaldo and Thormann (2017).

In another open question, students recommended a number of resources in which their STEM programs should invest to better serve them as online students. Student responses overwhelmingly included the recommendation that instructors should provide timely feedback and grade information (e.g., update grades frequently, makes grades more available in the learning management system). These answers support the inclusion of the UDL principle of Engagement also mentioned in research conducted by Black, et al. (2015) and Rao and Tanners (2011). This type of feedback from students, supported by UDL research in the field, should serve to encourage instructors to create and include a variety of additional course components that utilize UDL principles, which benefit all students, not just students with disabilities. The goal is to provide all learners with equal access to learning with the intention of decreasing barriers for differently-abled students currently built into instructional techniques (e.g., passive lectures versus using videos, graphical representations, and text that appeals to a variety of learning preferences).

In addition to the UDL components that are mentioned above, and although not described in this study's results, additional UDL practices that benefit students include the following suggestions for faculty:

- Provide students with a variety of ways to submit assignments (Fidaldo & Thormann, 2017; Burgstahler & Cory, 2008)
- Consider that students have various learning preferences and construct online classes with this in mind (Fidaldo & Thormann, 2017; Burgstahler & Cory, 2008)

For more information, and examples of additional best practices, please visit the UDL on Campus website.

Limitations and Directions for Future Research

There are limitations that should be acknowledged in this survey research method and sample. The major limitation is the self-selection bias as participants volunteered for the study. Even though we have a large sample size (N=537), the data only includes volunteer students at one southeastern university in the United States where online learning has been established as a norm for almost 20 years. Thus, it is unclear whether the current findings would generalize to college students engaged in other universities or countries. Future research could focus on students in other universities and possibly from other countries. Some additional areas of future research might focus on correlations between the online course design elements students prefer and measures of learning and persistence, in addition to student self-reported data on learning. This survey research is exploratory in nature. Each of these design practices can be established through experimental or other research design to gain better understanding of what works and in what contexts. The following summarizes some of the current best practices drawn from this study:

- Engage students with real-life problems and active experiences.
- Provide students with a variety of additional instructional resources, such as simulations, case studies, videos, and demonstrations.
- Provide online and face-to-face opportunities for students to collaborate with others, such as peers and teaching assistants.
- Faculty should be clear, concise and consistent about instructions, assignments, assessments, due dates, course pages, and office hours, and improve communications with students.
- Use Universal Design for Learning principles to design online experiences to benefit all students, not just students with disabilities.

Developing quality online courses in the STEM disciplines has the potential to increase access for all populations and engage diverse students, especially underrepresented minorities and students with disabilities. This study has attempted to elucidate and explain the design elements of online STEM courses that students perceive as beneficial for learning for all students. Instructors and instructional designers need to focus on integrated active learning, interactive engagement strategies, robust assessment design, and UDL principles in designing effective, inclusive, and engaging online STEM courses.

Acknowledgements

We would like to acknowledge that the National Research Center for Distance Education and Technological Advancements (DETA) and the U.S. Department of Education Fund for the Improvement of Postsecondary Education funded our project.

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Appendix A: Survey Instrument

Course Activity

How much of each of the following tasks were required in your course? (Virtually None/Very Little; Little; Some; Good Amount; Constant/Significant Amount)

1. Reading
2. Listening to audio
3. Watching videos
4. Examining slideshows
5. Taking notes
6. Utilizing websites
7. Taking quizzes/exams
8. Writing short papers or responses
9. Writing academic papers or essays
10. Completing major projects and assignments
11. Creating and delivering presentations
12. Completing group projects
13. Communicating with other students
14. Communicating with the instructor
15. Utilizing social media
16. Require students to solve a real-world problem
17. Require students to analyze scenarios or case studies
18. Require students to complete a simulation or role-play
19. Require students to use special software or applications relevant to the course

Interactivity

How often do you…? (Never; Little; Somewhat; Often; Very Often)

1. Send email to your instructor
2. Receive emails from your instructor
3. Participate in class discussions
4. Read course news or announcements
5. Participate in group activities
6. Discuss course topics or information with the instructor or other students using social media
7. Discuss course topics or information with the instructor or other students using web conferencing tools
8. Discuss course topics or information with the instructor or other students using tools outside of the course

Assessment and Evaluation

Please rate the degree to which you agree with the following statements regarding the grading of this course. (Strongly Disagree; Disagree; Neither Agree nor Disagree; Agree; Strongly Agree)

1. The method of grading my performance was clear
2. Clear standards were set for the instructor's posting of grade, activities, and resources
3. Graded assignments were appropriately timed within the length of the course, varied, and appropriate to the content being assessed

Learn

Please rate the degree to which you agree with the following statements regarding the performance of this course. (Strongly Disagree; Disagree; Neither Agree nor Disagree; Agree; Strongly Agree)

1. The online activities helped me get a better grade
2. The online activities allowed me to better understand concepts
3. The online activities helped me think more deeply about course materials

Satisfaction

Please rate the degree to which you agree with the following statements regarding the satisfaction of this course. (Strongly Disagree; Disagree; Neither Agree nor Disagree; Agree; Strongly Agree)

1. I would take another online course in the STEM disciplines
2. I would recommend that the instructor continue teaching this course online
3. I liked this course delivered online
4. I would recommend this course to a friend
5. Participating in this online course was a useful experience
6. Getting online to access the course was easy
7. Technical support was available when I needed it

Open-ended Questions

1. What practices can an instructor implement in order to help you succeed in an online or mixed-mode STEM course?
2. What strategies did you use to help yourself succeed in the online/mixed-mode STEM course?
3. Where would you recommend a STEM program invest resources to better serve you as a student taking online/mixed-mode courses? Why?