



SCIENCE NEWS IN HIGH SCHOOLS

Community College Formative Evaluation

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This evaluation was conducted by Ji Su Lee, Ola Jachtorowicz, and Allison Williams, students at Harvard Graduate School of Education, as part of T523: Formative Evaluation for Educational Product Development.

Executive Summary

Evaluation Description, Purpose, and Questions

Science News in High Schools (SNHS) is an educational program by the Society for Science that provides educators with classroom resources and professional development opportunities. As part of a five-year expansion plan, SNHS seeks to understand the landscape in community colleges. Our evaluation entails three questions:

1. What are the curriculum needs of community college STEM faculty and learners?
2. In what way, if any, is institutional/structural support necessary to obtain and implement new resources, including SNHS, in community colleges?
3. What is the fit and what are the gaps between SNHS and community colleges?

Methodology: Data Collection and Analysis

A mixed-methods approach allowed us to obtain both standardized conclusions available from quantitative methods and the flexibility and sensitivity of qualitative methods. We first conducted informational interviews which were reviewed using a quick-method, inductive, thematic analysis with affinity-diagramming techniques. This analysis informed an online survey and structured interviews with a think-aloud protocol. We inspected our survey data with exploratory data analysis (EDA), while using a deductive, thematic analysis with affinity-diagramming techniques for the structured interview, which was captured in a matrix of resource features and inductive themes.

Findings¹

Informational Interviews	<ul style="list-style-type: none"> • Unique demographics that face time constraints • Open education resources are used and sought after • Faculty have autonomy of resource integration, • Wide-ranging learning outcomes exist
Online Survey	<ul style="list-style-type: none"> • All traditionally underserved communities are represented • Career preparedness and DEI are "extremely important" goals • Cost is an important factor when selecting resources for courses • Faculty find new resources by word of mouth, mostly. • Faculty members have authority to include new resources in curricula • Recent scientific news is included in lessons some of the time • YouTube videos are highly popular • Instructional ideas are the most sought-after resource type
Structured Interviews with Think-Aloud	<ul style="list-style-type: none"> • Positive comments exceeded both neutral and negative comments • Resources are overall well-aligned with the pedagogies of faculty. • A wide range of needs for rigor exists

Discussion and Recommendations

Overall, we determined that *Science News* programming and resources are a great fit for community colleges in terms of pedagogy and usability. However, some modifications to content specificity and rigor may be needed for a successful entry into the community college space. We recommend that the Society for Science pursue expansion. We found (1) potential to meet existing curricular needs for free instructional resources that align with existing learning objectives, (2) a lack of institutional/structural barriers, and (3) an overall good fit in terms of usability and pedagogy, with some specific recommendations for overcoming gaps, such as in content specificity, rigor, connections to lab skills, and use of multimedia.

¹ Findings are representative of evaluation participants only

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Introduction

SCIENCE NEWS IN HIGH SCHOOLS DESCRIPTION

Science News in High Schools (SNHS) is an educational program from the Society for Science, centered around a 100-year-old publication, *Science News*. *Science News* provides high quality print and online news on scientific research at a high school reading level. The organization also issues *Science News for Students* with a reading level of grade 5 and up (Society for Science, n.d. c).

Enrollment in SNHS provides educators with multiple resources and opportunities. First, educators receive free print editions of *Science News* for use in the classroom. Second, educators receive weekly newsletters, lesson plans, student worksheets, and activities that are tied to the published article content (Society of Science, n.d. c). Finally, SNHS provides professional development opportunities such as webinars and a virtual educator community.

Science News in High Schools has the following objectives:

- Improve students' science literacy (A. Rhymes, personal communication, February 2, 2022)
- Provide high quality science related news that educators can incorporate into their classroom (A. Rhymes, personal communication, February 2, 2022).
- Thus, students can understand how science is applied in the current world, why they need to learn science, (A. Rhymes, R. Van Duym, personal communication, February 4, 2022) and gain higher interest towards STEM content and careers (Society for Science, n.d. a).

SNHS is currently used by 5,400 high schools in 95 full U.S. districts, reaching 17,000 educators and 5 million students (Society for Science, n.d. b). The program hopes to expand its reach to new audiences such as community colleges, which is the focus of this evaluation.

EVALUATION PURPOSE

SNHS has the potential for greater impact on a broader audience, from middle schools to community colleges. With a five-year expansion plan, *SNHS* has already begun evaluating the middle school space, and now seeks to understand the landscape in community colleges. (A. Rhymes, R. Van Duym, personal communication, February 4, 2022)

The first phase of the evaluation entailed identifying STEM stakeholders and decision makers at the community college level. Next, the evaluation aimed to determine fit and identify gaps between the needs of community colleges STEM faculty/students and the services that *SNHS* provides.

EVALUATION QUESTIONS

Our evaluation was guided by the following questions:

1. What are the curriculum/classroom learning needs of community college STEM faculty and learners?
2. In what way, if any, is institutional or structural support necessary to obtain and implement new resources, including *SNHS*, in community colleges?
3. What is the fit and what are the gaps between *SNHS* and community colleges?
 - a. In what ways, if any, do the existing *SNHS* educational materials and program schedule support community college STEM faculty and learners?
 - b. In what ways, if any, could existing *SNHS* materials and program schedule be modified or expanded to support community college STEM faculty and learners?

Methodology

EVALUATION DESIGN

To determine appropriate evaluation questions, we met with the Society for Science’s director of STEM Literacy & Curriculum, Anna Rhymes, and the program specialist for *Science News* in High Schools, Raina van Duym. We found that since the Society of Science was in the very early stages of exploring expansion of *SNHS* into the community college space, our questions had to look at the context of community college STEM education as well as the specific features of the program under evaluation in order to give our stakeholders actionable findings.

To investigate the questions, we settled on a mixed methods approach. This allowed us to obtain both generalizable conclusions available from quantitative methods (although our insights were limited because sample size was quite small) *and* the “flexibility, sensitivity and meaningful conclusions about specific problems” afforded by qualitative methods. (Oliver, 2000)

DATA COLLECTION

First, we conducted informational interviews to understand the community college landscape, including key stakeholders, existing pedagogies and products used by educators, organizational structure, educational goals and policy, and institutional culture (n=5). We used snowball or chain sampling as well as reaching out to faculty we identified using the AACC community college finder. (Diamond et al., 2016) These interviews informed the next stages of the evaluation: an online survey (n=19) to identify common needs, and standardized interviews with a think-aloud protocol where we gathered faculty responses to specific features of the *SNHS* program (n=6). We used the survey to recruit participants for the think-aloud / structured interviews.

Figure 2.1 *Evaluation Methods*



We designed three instruments for data collection:

(1) Informational interview checklist to ensure broad themes were addressed. Both we (the evaluators) and the *SNHS* team were unfamiliar with the community college setting. While we had some “known unknowns,” we also realized we had many “unknown unknowns.” The informal interview guide allowed us to focus the conversation while providing considerable flexibility for participants to surface their perspectives and experiences. According to Patton, “other topics might still emerge during the interview, topics of importance to the respondent that are not listed explicitly in the guide and therefore would not normally be explored.” The checklist had 6 categories of topic: general (participant background and student demographics), STEM program goals, existing resources for STEM courses, organizational structure and institutional culture, needs and challenges, and logistics and next steps. (See *Appendix C: Instruments* for full checklist and other instruments)

(2) Online survey (administered via Qualtrics) to validate information gathered from informational interviews, to uncover common conditions, goals, and characteristics across community college STEM education, and to identify the level of existing awareness/use of *Science News* among community college faculty and determine relevant useful educational features. The survey had three sections: demographics, STEM education, and *Science News*. Unfortunately, due to the small sample size (n=19), we were not able to investigate relationships between institution location, institution size, faculty domain, and participant educational strategies / views on *Science News*. However, many of the questions got to core of our evaluation, such as what faculty are looking for when incorporating resources into their curricula and how decisions about resources are made.

(3) Structured interview (with think-aloud protocol) to elicit feedback on specific features of *SNHS* educator resources and perform a gap analysis by directly asking participants how the reviewed features met their current needs and how the resources could be modified to increase the likelihood of adoption at community colleges.

The instrument was divided into three sections: think-aloud protocol, feature description and questions, and overall questions.

We first prompted participants to think aloud while using the *SNHS* educator resource search function as if they were looking for resources to incorporate into their curriculum. Think-aloud protocols allow “the evaluation of the thought processes or decision making of someone performing a specific task .” (Cotton and Gretszy, 2006) While we understand that the think-aloud protocol can seem unnatural as “most people don’t sit and talk to themselves,” we hoped this will most closely capture the process faculty go through when selecting educational resources. (Nielsen, 2012)

We were not certain that participants would discover all features while using the search function in the time provided. We followed up with a domain-specific exemplar educator guide where we could prompt participants to react to specific features, such as readability score. This guide was also emailed prior to the scheduled meetings to provide participants with additional time to review.

Since participants would not be able to interact directly with certain features provided by *SMHS* (such as the Edmodo online community or program schedule) we next described those features and asked for feedback.

Finally, we asked overarching questions at the end of the scheduled time. These were structured to standardize participant responses across interviews.

DATA ANALYSIS

For our quantitative data, we used exploratory data analysis (EDA) to foundationally inspect our data. According to Diamond (2016), “the goal of EDA is to learn about the data through the construction of charts, tables, figures, or lists.” The EDA was followed by a descriptive analysis, which can be “used to summarize the distribution of scores for a single variable or can be used to summarize the relationship among variables (Odwyer & Bernauer, 2014). Our data presentations displayed a univariate distribution, showing “a distribution of scores on only one variable” (Odwyer & Bernauer, 2014).

The team carefully discussed the proper ways to visualize our survey data. We aimed to keep our representations simple, but not be simple-minded (Patton 2008). According to Diamond (2016), “graphing data should be an iterative, experimental process”; our team embraced this and modified our displays upon discussing interpretations and distortions.

Our methodology for analyzing our qualitative data was a thematic analysis using affinity diagramming techniques (ADT). Using this method “renders important aspects of qualitative data visible and makes uncovering themes easier” (Rosala, 2019). ADT includes other benefits including being done collaboratively, quickly, visually, inexpensively, flexibly, and in a way that is supportive of an iterative-analysis process (Rosala, 2019). We specifically used the quick method, where we first grouped segments of text, then assigned codes to those groups. This is an inductive approach: according to Diamond (2016), “an inductive approach is more open ended, allowing codes to emerge from the data at hand, and assuming a more context-sensitive process”.

To carry out this method, we followed Bodgan and Bilkins’s (2007) outline for data analysis. First, each of us organized our notes and created a clean copy of all the data, then we took undisturbed periods to carefully read through the data. After reading our data, we began the data reduction process of “selecting, focusing, simplifying, abstracting, and transforming the data that appear in written-up field notes or transcriptions” (Diamond, 2016). As we found patterns, we coded these units of data and aimed to limit our codes to between thirty and fifty (Bodgan & Bilkin, 2007).

We resonated with Bodgan & Bilkins’s (2007) posit: “you may experience indecision at this point”. Our team questioned and supported each other about the appropriateness and granularity, or lack thereof, of our coding system. “Member checks can also be useful ways of verifying qualitative data and involve asking participants themselves to review and comment on your interpretations of the data.” (Diamond, 2016). We aimed for our data to be reliable and consistent. As our codes turned into themes, we took breaks, evaluated our themes for good fit, and iterated as necessary (Rosala, 2019). Our team made sure to agree on definitions for all terms, including “open education resources”, “skills”, and “research” to ensure clarity and validity: “Developing reliable codes is often challenging,

but it is important that all coders agree as closely as possible. The evaluator should develop clear definitions of each code” (Diamond, 2016).

While we conducted thematic analysis with ADT for data collected from both the informational and structured interviews, our methods also differed in the following ways:

For the qualitative data from the informational interviews, we drew on the cross-case analysis method. We decided to preserve the uniqueness of our interviewees’ personal histories and contexts rather than code them for thematic analysis. Cross-case analysis is a “research method that facilitates the comparison of commonalities and difference in the events, activities, and processes that are the units of analyses in case studies.” (Khan & Van Wynsberghe, 2008) Moving from the contextualized origins of each case, our thematic analysis closely followed cross-case analysis which can be described as a process of “‘decontextualization and recontextualization’...data are separated into units of meaning (decontextualized because they are separated from the individual cases) and then recontextualized as they are later integrated and clustered into themes.” (Khan & Van Wynsberghe, 2008)

For the data from our structured interviews with think-aloud protocol, we originally attempted to follow the same cross-case protocol, but soon realized that the data required a different approach. We noticed that if we coded per interviewee, we would miss out on where a feature of the *Science News* resource was mentioned in relationship with the themes that developed. The technique was modified, and we created a grid of features and themes. By doing this, we could look across one feature and see the themes or look at one theme and see which distinct features it existed in.

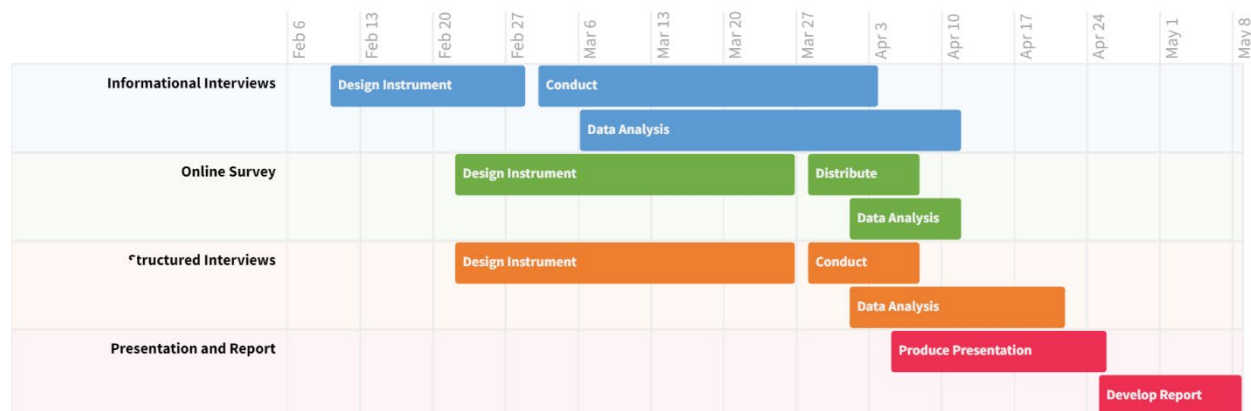
Due to nature of the think-aloud protocol and asking for participants’ reaction to certain features, we gathered qualitative attitudinal data, which includes "people's thoughts, beliefs, and self-reported needs obtained from user interviews "(Rosala, 2019). We therefore performed a sentiment

analysis to reveal this attitudinal data across our thematic/feature grid. We coded participants responses as either positive, neutral, or negative regarding the resources they reviewed. Although new innovations were attempted, Wouter et al. (2021) found that human coding provides the best results and is more reliable than automated methods.

TIMELINE

We began outreach for informational interviews on March 2nd, 2022 and conducted informational interviews until April 4th, 2022. We began distributing the online survey and scheduling structured interviews on March 28th, 2022. Data analysis was finalized by April 22nd, 2022. The stakeholder presentation was delivered on April 26th, 2022 and the final report will be delivered May 9th, 2022.

Figure 2.2 *SNHS Evaluation Timeline*



ETHICAL AND HUMAN SUBJECT CONSIDERATIONS

We provided information on how feedback would be used to all participants as well as communicating that they could opt in and out of the study as they wished without any consequence.

Identifying information was kept confidential from everyone except the evaluators. To avoid undue burden, we provided flexibility for interview time and duration based on participant availability (using the scheduling tool Calendly) and we offered incentives (Amazon gift cards provided by the Society for Science) to compensate participants in the more time-consuming structured interview / think-aloud protocol.

We tried to avoid any possibility of bias based on gender, race, and region. However, we admit that there are some limitations as snowball sampling can lead to systematic bias. Also, our data collection focused on deans, faculty, librarians, and other stakeholders with considerable power. We acknowledge that “those in the least powerful positions can be the most affected by the results of an educational evaluation ...[s]tudents, for example.” (Frierson, et al., 2002) Due to the time constraints, we were unable to include community college students in our evaluation. However, we strongly recommend that any further study or pilot include the voices of students as well as a more representational sample of faculty.

Finally, community colleges must face the stigmatizing misperceptions that they "serve only low-performing students or hire faculty who are unable to secure a position at a 4-year institution.” (Boggs, 2010) As evaluators, we reflected on how our own position – coming not only from a traditional four-year university, but one that is viewed as extremely prestigious in public opinion – may affect our interactions with participants throughout the evaluation process. (Newport, 2003)

Findings

INFORMATIONAL INTERVIEWS

From our thematic analysis using quick method, inductive affinity diagramming techniques, four themes emerged: unique demographics, open education resources, decision making process/procurement, and learning outcomes. Each theme is supported by example quotes.

Theme 1: Unique Demographics & Time Constraints

To obtain general idea on the characteristics of the students in community colleges, we asked about student demographics. Interviewees mentioned about having large proportion of first-generation college students, serving minority populations, and having large age diversity. Racial diversity was high for the urban community colleges, but rural community college had mostly white students.

Table 3.1 Example quotes on student demographics

Subcodes of Student Demographic		
Sub-codes	Number of indicators	Example Quotes
First Generation College Students	4	“Students are unique: [some are] first generation students; working students and/or have families.” (I4) “Lots of students are first generation college students.” (I3)
Serving Minority	3	“The college is designated as MSI (Minority Serving Institution) and gets federal funding for Hispanic and Latin X, African American.” (I2) “The retention rate is low for underrepresented students and [the college] is pursuing a grant to work on that.” (I4)
Age Diversity	3	“Some are high school graduates; some are retired people trying to learn new skills.” (I2)
Racial Diversity	3	“[Students are from] 70-90 different countries.” (I2) “[Students are] mostly white. [There is] not much diversity in terms of race/culture.” (I3)

Time constraints of students due to students' background and environment was note worthy. Reasons for the time constraints were diverse. One reason was that “[Students] often need to spend more time [studying] due to developmental issues in math & English (I2). Another interviewee mentioned that students “are taking 15 credits and trying to meet [the] requirements of transfer programs” (I4). Also, interviewee 5 mentioned that "students are working, established, [and] many have families"(I5).

Community colleges used various methods to help the students to learn efficiently. However, faculties, also, had time constraints for preparing and teaching. They mentioned that faculties in community colleges, especially the adjunct professors, are remarkably busy. Interviewee 2 suggested how Science News can be utilized for busy professors. She said “professors who write their own lab want to include background information or extension. Science News can be helpful for these parts. [It can be used as] additional resource for students on what they are learning [in the lab].”

Table 3.2 Example quotes stating the time constraints of faculties

Example quotes stating the time constraints of faculties
“Some professors work in three different colleges. [I am] not sure if they have time to participate in professional development.” (I2)
"I want to write [a case study] myself but have no time.” (I2)
“As adjunct [it is] very common to have other jobs at other community colleges or [have] another career.” (I1)

Lastly, interviewee 2 mentioned extensively the stigma attached to community colleges.

[People think that professors at community colleges] have no funding and do not do things. But they do more than other people's thoughts. Sometimes when other organizations give grants they say,

“We will come into the college and show you how to teach.” This is insulting. So oftentimes, we do not engage in these grants. [A better approach is to say] “you are struggling with lack of time; we can send you teaching assistants and resources that can [support you].”

This interviewee continuously emphasized not to use deficit language when approaching community college faculties. When giving the evaluators tips for recruiting more community college faculties for interviews, she said, “rephrase [how you talk to faculties. Say] we want to get consulted instead of we want to learn more about how to fix you.”

Interpretation

Community colleges have unique student and faculty demographics. They often have time constraints due to several reasons. There is a need to help these students to progress through the curriculum efficiently and a need for resources that faculties can easily implement.

In addition, it is important not to stigmatize the community college. There are various needs in community colleges and when approaching the colleges, help community colleges fulfill these specific needs. Do not assume their needs and approach with a deficit mindset.

Theme 2: Open Education Resources

We defined Open Education Resources as well-designed, customizable, openly licensed materials that have the potential to engage students and energize educators in ways that enable more responsive teaching and better learning (Hewlett).

Four out of five interviewees referred to open educator resources (OER) during the interview. Some specific examples of OER used are TedTalks and NPR podcasts. One interviewee described

OER's importance at their institution and stated "OER has taken off, especially in basic bio and chemistry" (15).

Table 3.3 Example quotes referencing OER

Subcodes of references to OER during informational interviews		
Sub-codes	Number of indicators	Example Quotes
Financial Hardship/Cost	4	"[Students are] working, they are not from privileged backgrounds, they need scholarships" "Paying \$300 for a textbook or more money for another website is not good"
Accessibility	7	"Podcasts and TedTalks close the gap to access to scientific talks" "Some journals are behind a paywall and hard to access" "They have a lot going on... a quick 4-minute podcast is accessible"
Engagement	11	"Non-STEM students are more difficult to engage when teaching science. Need to think about how to motivate and retain these students" "Faculty are struggling with student engagement; they are interested in streaming videos"

Interpretations

Through our discussion, we interpreted this overarching theme to umbrella three sub-themes: cost, accessibility, and engagement.

Interviewees described the financial need of students and the negative aspect of paying for books and resources. More specifically, one interviewee commented "88% of our students are Pell-eligible" after mentioning why their institution leans toward OER. According to USDOE, Pell grants are awards distributed to "undergraduate students who display exceptional financial need and have not earned a bachelor's, graduate, or professional degree."

Another interpretation for why community colleges are prioritizing OER is to address accessibility. Three of five interviewees discussed accessibility in their responses to interview questions, with subjects spanning age, homelessness, paywalls, hardware, and internet access. One interviewee suggested that OER helps to bridge the gap to access to scientific talks.

A turn to OER may be a result of faculties attempt to engage learners. Four out of five interviewees discussed engagement regarding their students, of those four, three indicated some relationship between engagement and virtual learning. Since being online, one interviewee indicated that faculty are struggling with student engagement, and they may be interested in “streaming videos” (5). The overall sense is that faculty want their classes to be more engaging but are struggling with how to do that in an online environment.

Theme 3: Decision-Making Process and Sources of Resources

Decision-Making Process: Scope and Constraints

Decision making process had several constraints and caveats, such as the scope of the curriculum change, budgetary concerns, consistency across multiple sections of the same course, and alignment with existing course goals, descriptions, and topics. However, all of the interviewees stated that they have the freedom to choose resources, especially at the granular level. For example, “while large-scale curriculum changes require a more involved process, granular decision about case studies and course resources are at each professor’s discretion.” (15). Also, unless the course has several sections that need alignment in the resources used, “for textbooks, or particular resources, there is freedom for the instructor.”

Sources of Resources

Three out of the five interviewees mentioned professional development as a potential source of new resources for curricula, with interviewee 1 saying “professional development opportunities help [me] learn how to incorporate new things,” and Interviewee 2 calling professional development a “pathway for educators to learn about new resources.”

Interviewee 5 had a unique perspective. First, he described that external “organizations do outreach to faculty” with some success, citing the institution’s subscription to the *Journal of Visualized Experiments (JoVE)* as an example. Second, he described his institution’s library liaison program as two-way street for new resources: faculty bring up new resources they are interested in with their departmental liaisons, but the liaisons also independently research new resources and bring them to faculty. While the liaison program has been established for multiple academic programs, he described that “STEM has had specific success” and that “faculty come to us and ask for certain resources.”

Role of Libraries

While we do not know how widespread such liaison programs are at community colleges, Interviewee 2 brought forward how useful libraries can be for student access to resources. The interviewee described the creation of library guides for specific courses and projects and suggested this as a fruitful pathway for *Science News* to pursue: “Librarians help students to find the resources. For a renewable energy project, they made database search list. It will be good for *Science News* if they can go into these kinds of database lists. If a lib-guide is created, it will be helpful in bringing *Science News* [to students].”

Interpretations

Science News resources fall under the more granular decision-making process and would not be subject to curriculum committee, dean, or department approval for integration into community college courses. Outreach at the faculty level is appropriate for raising awareness and increasing participation in *Science News* programming.

Theme 4: Learning Outcomes

All our interviewees addressed learning outcomes of their students, however, learning outcomes took on many forms: laboratory skills, academic/communication skills, scientific literacy, meaning making/connection, and learning/career pathways.

Three interviewees indicated their courses emphasize laboratory techniques, mentioning experiences such as research, reports, and working through the scientific method.

Understanding that many of their students are non-majors, three of five interviewees expressed a need to build skills outside of a laboratory setting. These skills include public speaking, critical thinking, metacognition, and finding scientific sources.

Regardless of discussing core content or other academic skills, what emerged as important is that the content is meaningful to students; students should be able to find connection to what they are learning. One interviewee stated “Students will understand the connection between biological precepts and modern development. I teach how what they are learning in biology is connected to the current world.”

Four of five interviewees pointed out that the learning outcomes of students varied depending on their pathway. Students at community college may be seeking associates degrees or certifications or preparing for four-year programs or the workforce. Community colleges are serving students with a wide variety of end goals.

Table 3.4. Example quotes referencing learning outcomes

Subcodes of references to Learning Outcomes during informational interviews		
Sub-codes	Number of indicators	Example Quotes
Laboratory Skills	4	<p>“Heavy emphasis on lab” (I2)</p> <p>“Trying to improve science education...through giving research experience.”(I3)</p>
Academic skills	5	<p>“I want them to express their thinking; small groups and share outs build confidence in [public speaking] skills.” (I1)</p> <p>“First generation college students are underprepared for college. We need to teach basic study skills and metacognition skills.” (I3)</p>
Connection and Meaning-Making	7	<p>“Personal connection and interaction is a big important part” (I1)</p> <p>“I am trying to make education meaningful” (I3)</p> <p>“Students will understand the connection between biological precepts and modern development. I teach how what they are learning in biology is connected to the current world.” (I3)</p>
Pathways	9	<p>““[We] introduced career resources into courses (throughout the college) for vocational opportunities.” (I1)</p> <p>“[I am] preparing them for four-year program transfer” (I5)</p> <p>“[We] have technical programs and associates degrees” (I4)</p> <p>“Strong internship program to simulate workforce skills” (I2)</p>

Interpretation

Faculty are attempting to target these varied learning outcomes with their pedagogies. While pedagogies arose as its own theme through our analysis, our interpretation is that the approach to

pedagogy by community college educators exists to meeting this array of learning outcomes and expectations of their students.

Online Survey

Through the survey, we continued to gain information on the goal and needs of STEM education and started gaining insights on faculties' receptiveness and thoughts on Science News educational resources.

STEM EDUCATION

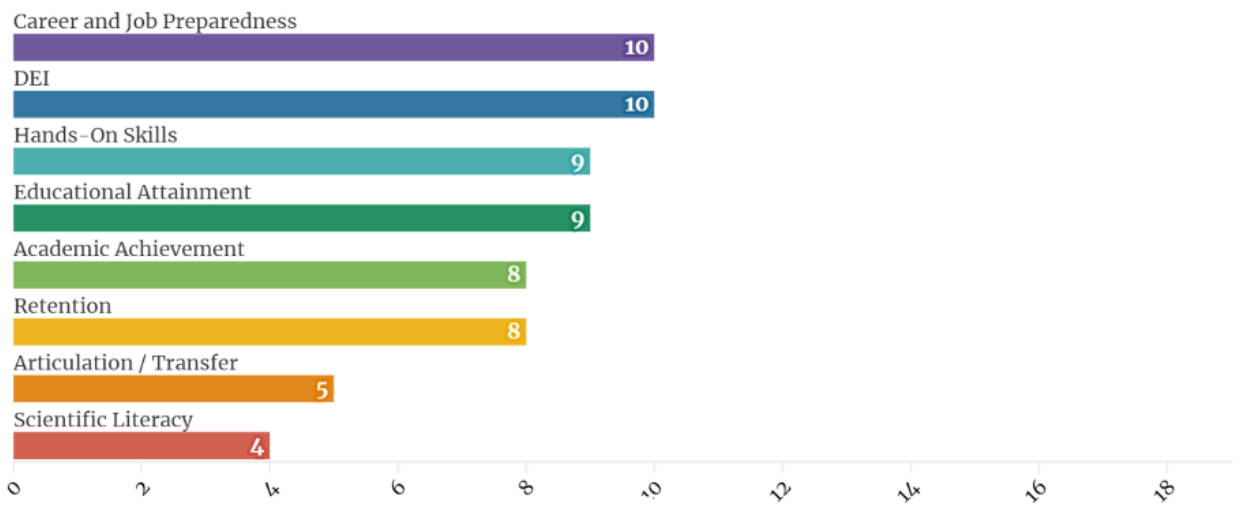
STEM Program Goals

Based on our informational interviews, we identified eight potential goals for STEM programing at community colleges. For all the goals, at least 74% of the people said the goal is either extremely or very important.

<p>100% said Hands-On Skills were Extremely or Very Important 100% said Academic Achievement was Extremely or Very Important 100% said Retention was Extremely or Very Important 95% said Educational Attainment was Extremely or Very Important 90% said Career and Job Preparedness were Extremely or Very Important 90% said Scientific Literacy was Extremely or Very Important 74% said DEI was Extremely or Very Important 74% said Articulation / Transfer was Extremely or Very Important</p>
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However, when looking only at the goals ranked “extremely” important, career and job preparedness and DEI came out on top (10 out of 19 participants), followed closely by hands-on skills and educational attainment (9 out of 19 participants). Scientific literacy was the lowest, with only 4 out of 19 participants indicating it was “extremely” important.

Figure 3.1. STEM Programming Goals Ranked “Extremely” Important



Interpretation

Three of the top goals marked as “extremely important” refer to very practical and tangible outcomes: being prepared for a career, having hands-on skills, and having a certificate or degree to back up those skills. The other important goal is Diversity, Equity, and Inclusion (DEI), which reflects the unique demographics of community college students.

While scientific literacy is part of the Society for Science’s mission, it did not resonate as a critical goal for our respondents (although still acknowledged as “very” important by 14 out of 19 respondents.)

New Resource Selection Criterion

When asked to rank which criteria they considered most important when selecting resources for their courses, 53% (9 and out of 17) of participants ranked cost as their #1 selection criteria. 35% (6 out of 17) ranked alignment with existing curricula as their #1 selection criteria. Ease of access was the third most important and flexibility (customization or the ability to be modified) was the least important out of the four options.

Figure 3.2. New Resource Selection Criteria Ranking



Interpretation

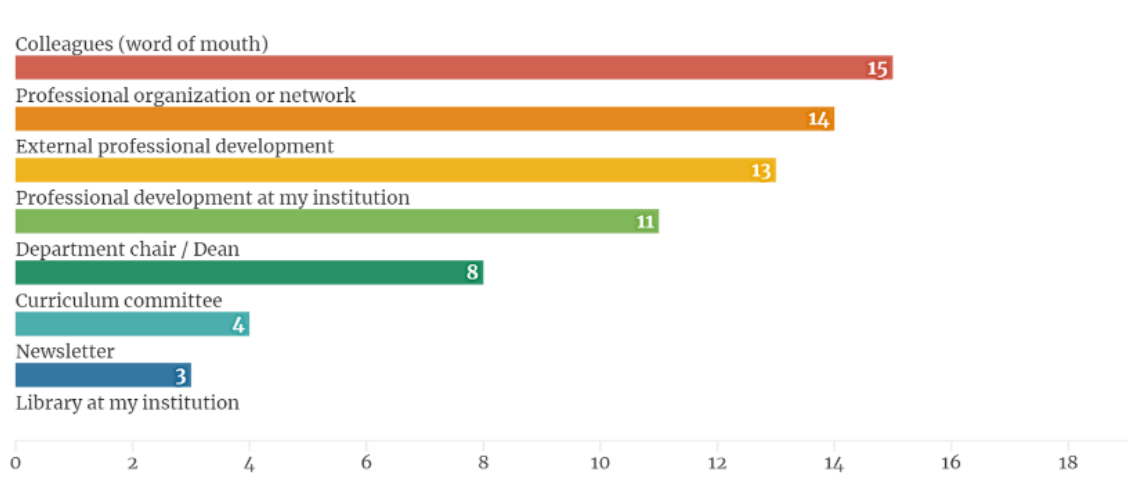
Cost is a key factor for community college faculty when selecting resources for their courses. This is good news for *Science News* because participation in *Science News* for High Schools is free. *Science News* should make sure to emphasize that resources come at no cost in outreach to community colleges.

Resource Sources

When asked how they learned of new resources to integrate into their curriculum, 84% of respondents (15 out of 19) indicated that they learn of new resources from colleagues (word of mouth). 74% of respondents learn of new resources from a professional organization or network, 68% of respondents learn of new resources from external professional development, and 58% of respondents learn of new resources from professional development at their institution.

None of the respondents indicated that they learn of new resources from the library at their institution.

Figure 3.3. New Resource Sources



While no respondents learn of new resources from their institution's library, a majority (78%, n=19) indicated that they encourage their students to use library guides and databases.

Interpretation

Word of mouth, professional network and professional development are important sources for obtaining new resources.

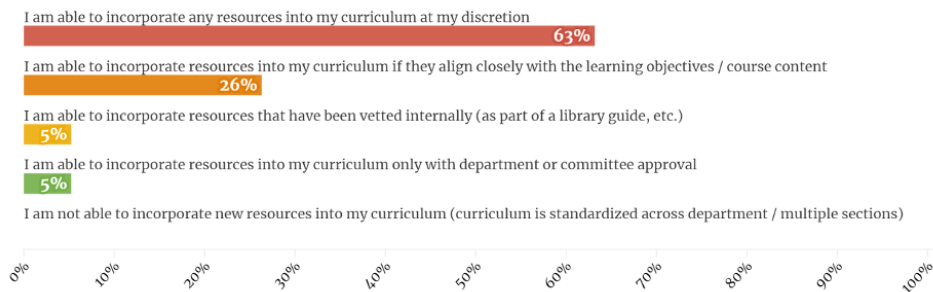
Finally, while faculty do not learn about new resources from the library, they do direct students to use library guides and databases. Therefore, while libraries may not be an effective avenue for outreach to faculty, it will be helpful for Science News to be in the library list.

Decision-Making Process

A majority of respondents (12 out of 19) indicated that they are able to incorporate any resources into their curricula at their discretion. 5 out of 19 respondents indicated that they are able to incorporate resources if they align closely with learning objectives / course content.

No respondents indicated that they were completely unable to incorporate new resources into their curricula due to standardization across the department / multiple sections.

Figure 3.4. Decision-Making Process



Interpretation

Individual faculty have the decision-making authority to include new resources such as *Science News* in their curricula. Outreach at faculty level rather than the department level is appropriate.

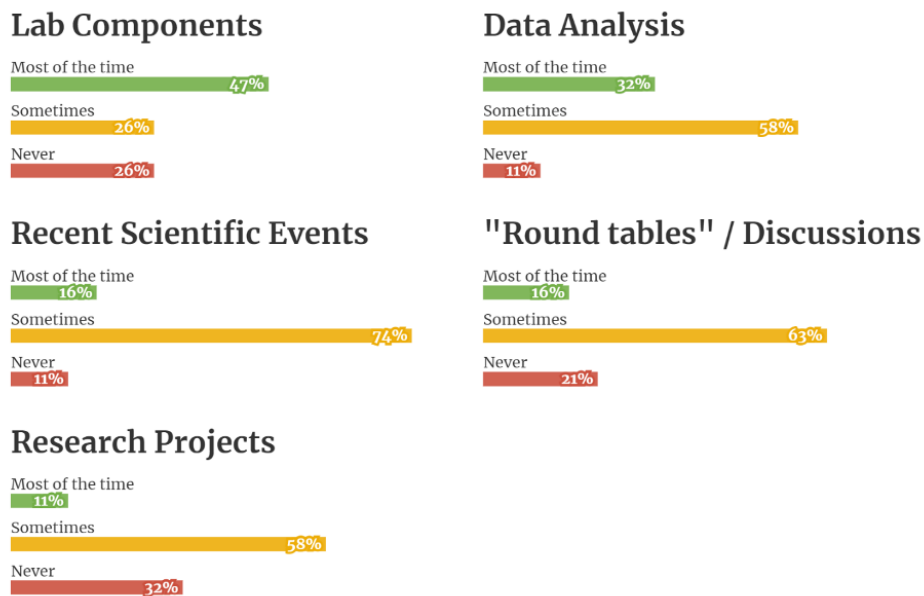
However, resources are more likely to be adopted if faculty see alignment with their existing learning objectives and course content. *Science News* should make sure that resources are aligned in many subject areas (especially ones that may not be taught at the high school level) and emphasize this alignment in communication for community college outreach.

Pedagogy

When asked how frequently they engaged students in certain activities, 47% of participants indicated that they engage in lab components “most of the time,” followed by data analysis at 32%, then round tables or discussions at 16%, and finally research projects at 11%.

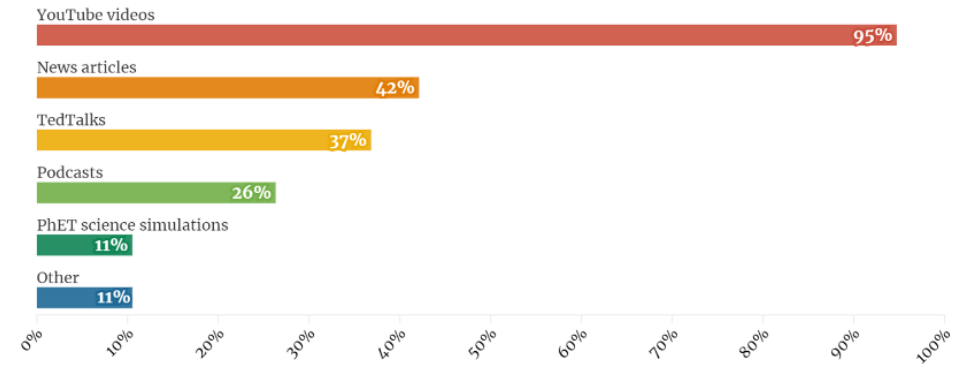
Participants were also asked how often they include recent scientific events in their curriculum. Most respondents indicated that they include recent scientific events some of the time (74%), with only 16% including scientific events most of time, and 11% never including recent scientific events.

Figure 3.5. Frequency of Course Activities



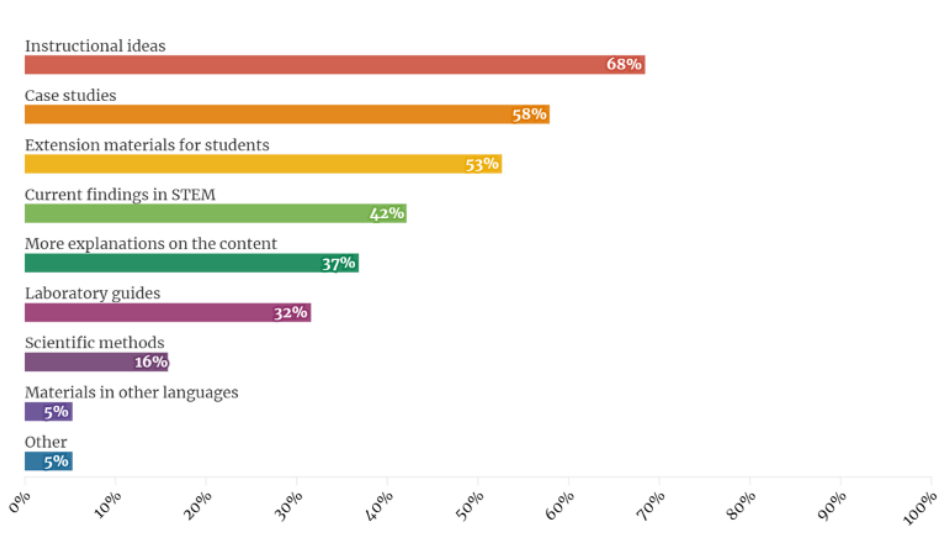
Next, participants were asked how often they included certain open educational resources and multimedia in their curriculum. Almost all participants (18 out of 19) indicated that they include YouTube videos, with the next highest resource type being news articles with 8 out of 19 participants.

Figure 3.6. Open Educational Resources and Multimedia



Finally, participants were asked what kind of resources they were seeking. The most common type of resource sought were instructional ideas, with 13 out of 19 participants. Case studies (11 out of 19), extension materials for students (10 out of 19), and current findings in STEM (8 out of 19) were the next highest categories.

Figure 3.7. Resources Sought Out by Faculty



Interpretation

Overall, the existing pedagogies of community college faculty are a good fit for *Science News* educator resources, with most faculty already using recent scientific events, discussions, data analysis, YouTube videos and news articles at least some of the time.

Additionally, with faculty overwhelmingly seeking instructional ideas, *Science News* discussion guides and activities may be well-positioned to fill this need. Instrument 3 will provide more insight into whether the existing resources provide the kinds of instructional ideas that faculty are interested in.

There are some gaps between what *Science News* offers and what faculty prioritize for inclusion in their curricula. For instance, lab components were most frequently marked as incorporated into curricula “most of the time”. Another gap is that although *Science News* has a YouTube channel, it is not well advertised nor linked with the educational resources. So it may be hard for the users to find the YouTube channel.

SCIENCE NEWS

In this section, we looked at respondents’ familiarity with *Science News* and how they might use the resources in their classroom.

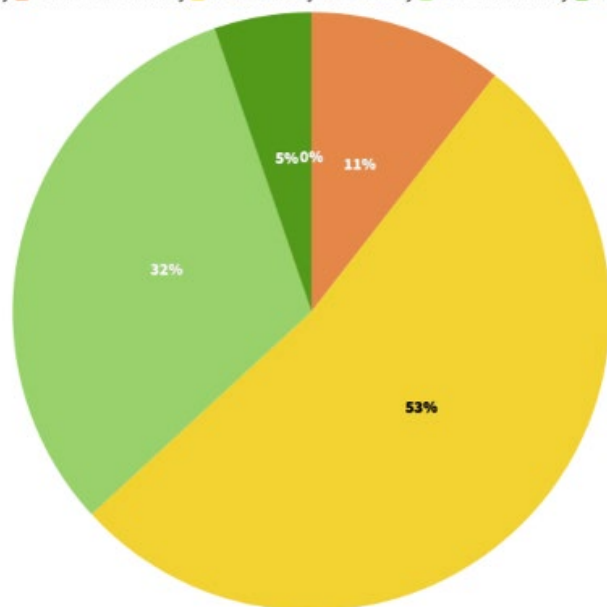
Familiarity and Impression of Science News

Out of 19 respondents, six have heard of *Science News*. One of them has used *Science News* in his curriculum as “supplementary optional text for students to see the real-world applications of what they’ve learned about biology.”

When asked about the likeliness of including Science News in their curriculum, none of the respondents answered they are extremely unlikely and only 11% of the respondents answered they are somewhat unlikely. The majority of the respondents had neutral response and answered they are neither likely nor unlikely. 37% of the respondents answered they are either somewhat likely or extremely likely to use it.

Figure 3.8. Likeliness to include Science News materials in the curriculum

Extremely unlikely Somewhat unlikely Neither likely nor unlikely Somewhat likely Extremely likely



Interpretation

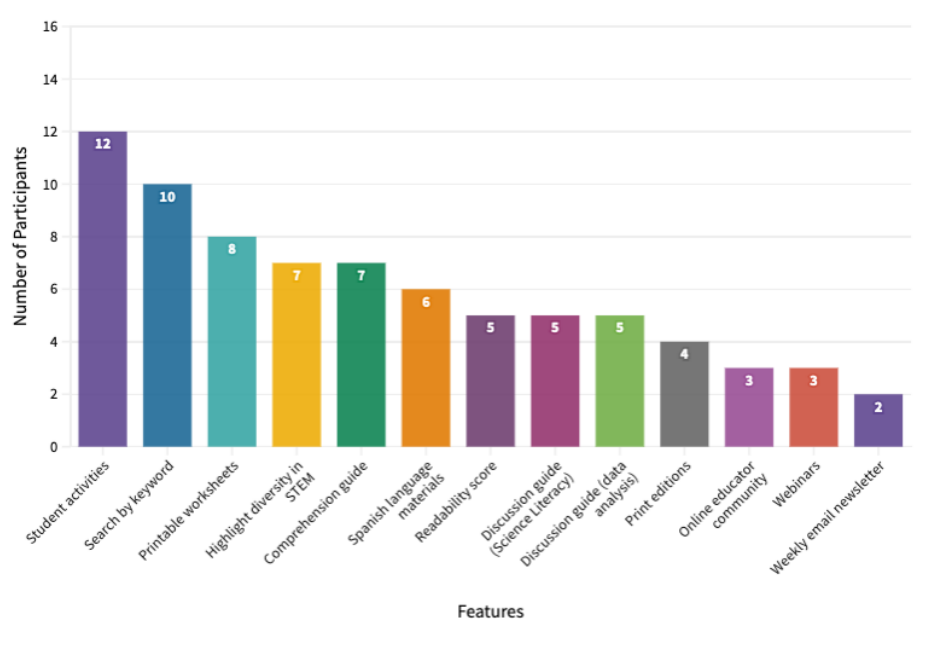
There are many community college faculties who have not heard of Science News. One thing to note is that the question for likeliness of including the Science News in their curriculum (Fig. 2.19) was answered by respondents without having a closer look at Science News educational resources. However, it still shows respondents' quick impression on Science News and that they are not resistant

to it. Two respondents who answered neither likely nor unlikely even signed up for a structured interview showing more interest in learning it.

Useful Features

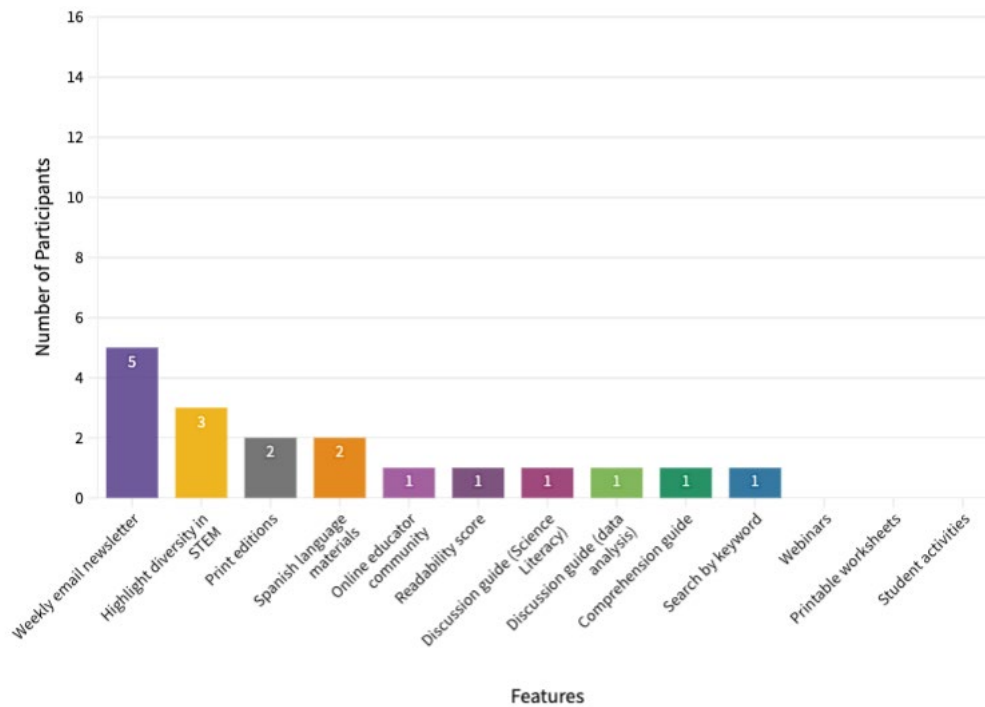
Among the 13 features, student activity was rated highest in terms of usefulness. 12 out of 16 respondents answered it is either very useful or extremely useful. Search by keywords was rated second highest with 10 out of 16 respondents rating it as either very useful or extremely useful. Printable worksheets (8 out of 16), highlighting diversity in STEM (7 out of 16), and comprehension guide (7 out of 16) followed.

Figure 3.9. Number of participants who answered very useful or extremely useful for the features



Interestingly, highlighting diversity in STEM was rated second highest for being not at all useful (3 out of 16). Also, weekly emails was rated the least useful with 5 respondents rating it as not at all useful.

Figure 3.10. Number of participants who answered not at all useful for the features



Interpretation

Student activities, printed worksheets, and comprehension guides were ranked high for being either very or extremely useful. This result aligns with the result from figure 3.7 that the faculties are looking for instructional ideas. Alignment of curriculum was indicated important in figure 3.2, therefore, these resources might need to be modified to align with the community college curriculum.

Highlighting diversity in STEM was rated high for both being useful and not useful. This might be because of the different environment of the community colleges. However, due to our small sample size ($n=19$), we could not find any pattern. In the future evaluation, this might be worth looking at more closely.

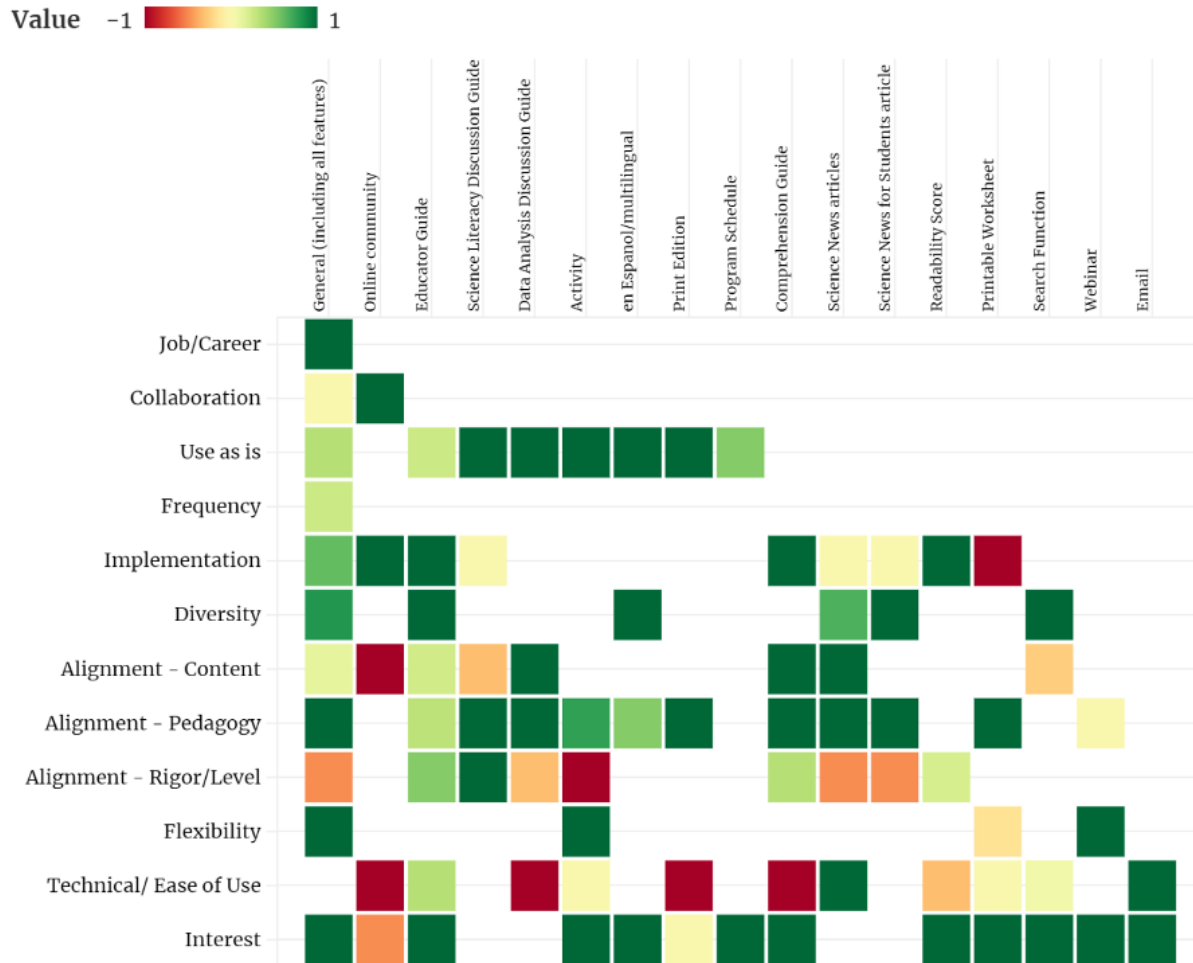
STRUCTURED INTERVIEWS

While the survey asked for participants' quick impression on Science News resources, structured interviews were conducted to get feedback on specific features and resources after the faculties have careful look on them. This instrument was designed to answer the third question specifically.

Overall Receptiveness and Fit

Looking across all features and themes of our thematic analysis, positive comments exceeded both neutral and negative comments. There was a total of 154 positive comments, compared to 58 neutral comments and 63 negative comments.

Furthermore, when participants were directly asked if they would use the *Science News* educator resources “as is,” four out of six indicated that they would, while the remaining two indicated they would use parts “as is” with some pruning or modification. In fact, upon being informed that the *SNHS* educator guides were already freely available, interviewee 5 said, “then I am going to start looking at it a little more. And maybe I will integrate it into some of my lessons.”

Figure 3.11. Sentiment Heat Map¹

Interpretation

Based on the positivity of the comments and that finding that all participants indicated that they could begin using educator resources “as is” or with minor adjustments, community college faculty appear to be receptive to *Science News* resources, with some faculty even coming across as enthusiastic or eager.

Alignment

Content

All six interviewees mentioned about the alignment of the resources with the class content. We identified three main sub-themes: content alignment, resource availability, and skills alignment.

- (1) Content Alignment.** All six interviewees mentioned whether specific resources align with the courses that they or their colleagues teach. 18 out of 22 references were positive, stating that they think the resources are applicable in their courses. Two of the references, which were made by one interviewee, were negative. This interviewee had clicked several resources because they seemed applicable to her classes, but after skimming through them, she realized that they are not pertinent.
- (2) Resource Availability.** Four interviewees mentioned about number of resources that aligned with their courses. All four interviewees mentioned that there are not enough materials for what they teach. Interviewee 5 commented that she "[sees] a lot of stuff that can be good for general sciences, but not particularly for nursing classes." Interviewee 6 also mentioned that to improve the resources, it needs "more emergency medicine [specific resources]." However, she also showed some trust in Science News stating, "I think [Science News] has a ton of knowledge in it, so [for] improvement, keep...going."
- (3) Skills Alignment.** There were six references on the skills that community college students need to learn. Four references were related to data analysis, which fits well with Science News as it has lots of data analysis discussion guides. Interviewee 4 pointed out that it would be beneficial if Science News would write new articles that show how technical skills can be used in the real world.

Table 3.5. Example quotes of content alignment

Alignment of Content for Selected Features			
Sub Themes	Number of indicators	Example Quotes	
Content alignment	22	Positive	"We deal with lots of concussions so we can tie it into classes. And it will make a huge difference. Some of them (students) do belong to hospitals, so they will look more on blood [biomarkers]." (I6) "This activity will be appropriate for them in their second-year nursing when we are looking at research" (I5)
		Negative	"Biodiversity in trees, that's pertinent to science but not really to nursing." (I5) Read the discussion guide questions. "That's not really applicable for nursing students." (I5)
Resource availability	4	Positive	"To improve, [have] more of emergency medicine (content specific). I think [Science News] has a ton of knowledge in it, so [for] improvement, keep on going." (I6)
		Negative	"I see a lot of stuff that can be good for general sciences, but not particularly for nursing classes. Because they are pretty much done with sciences and now, they are focusing on nursing. I can see how probably even for science majors that this has lots of activities that will be good. But there is only a couple of things that will be useful for nursing students." (I5) "As I'm looking through these activity comprehension discussion collections um yeah I'm not seeing anything you know engineering specific or manufacturing" (I4)
Skills	6	Positive	But it also gives them a chance to get practice in reading graphs and becoming familiar with interpreting data. So this would definitely be something that I might explore and continue."(I1) "I do find exposing students to data and graphs has been a really important skill and something that all of my students should be doing somewhat frequently. So, I like that we have them sort of thinking critically about a resource and analyzing it." (I3) "I teach classes in the first semester to get students introduced to the concept of problem solving and systematic problem solving - I could use this as an example"(I4)
		Negative	"One thing I always try to do is give our students real world examples of the skills – why should you be learning this and how can you see this in industry, so it would be nice if there were some new articles that you could develop specifically for the community/technical college community – it would be great to have something like that added" (I4)

Interpretation

There are lots of resources that align well with the content and data analysis skills that are taught in community colleges. Interviewees commonly mentioned the need of teaching data analysis to students, and this fits strongly with Science News educational resources, as it has many data analysis discussion guides.

However, there was a gap in terms of the availability of the resources. There are lots of resources related to general sciences but only a few resources can be found for higher-education-specific fields such as nursing, and engineering. This was made worse by the search function as important keywords in STEM field did not work well for finding relevant resources.

Pedagogy

When commenting on *Science News* resources, participants referenced pedagogy 39 times. Pedagogy refers to the methods faculty use to guide learning, for example: direct instruction, discussions, flipped classrooms, hands-on activities, worksheets, research projects, lab components, time allocation, and so on.

When analyzed for sentiment, 30 of the 39 references were positive (indicating the resources being discussed were a good fit in terms of pedagogy), 3 were neutral, and 6 were negative.

The main gap was voiced by Interviewee 3, who indicated that the combined *scope* and *time required* of the resources in the educator guide seemed designed for high school where teachers must “fill the time.” Based on this initial impression, the interviewee suggested that the resources be “tightened up” for community colleges because “the pace in college, of course, is much quicker.” However, upon further reflection, Interviewee 3 went on to say, “but at the same time, it's like, because

it's so thorough, it gives me ideas for new questions to ask students. I guess I never really thought about maybe having a discussion with students about these topics. But just the fact that this sort of exists, and it's linked to that article with the graph is neat.” (I3)

Table 3.6. Example quotes of pedagogy alignment

Alignment of Pedagogy for Selected Features		
Feature	Number of references	Example Quotes
Educator Guide	16	<p>"It helps teachers [know] how and where to direct students when reading the article. I am very busy as I am making up for my previous colleague who quit. These help people like us who are very busy." (I6)</p> <p>"In terms of like, how extensive it is... I wouldn't spend two class periods, for example, on a relatively short article... It's a little disproportionate with how much time I'd want to spend on this topic." (I3)</p> <p>"This might be cool. For food and hunger, we don't have a lot of lab[s] and round table discussion so this might be definitely something that students can relate to." (I1)</p> <p>"Maybe not the entire portion, the entire guide, but certain parts of it, could be very applicable to what we do to allow students to learn." (I4)</p>
Discussion Guide (Science Literacy)	2	<p>"I like the questions [about] underlying issues that we don't actually realize...[I] like how it ask students figure out what biomarkers actually are...[I] like questions [about] 'what will you do different?' [and] 'Why you do certain things?'" (I6)</p>
Activity	8	<p>"[The activity is] similar [to] things [I] do with students and looks fun." (I2)</p> <p>"This is a good activity too because nurses are kinetic learners so anything they can get up and move is good for them." (I5)</p> <p><i>After reading that 'students should partner up':</i> "That's good. That always keeps the level of engagement and accountability there when students have to partner." (I1)</p>
Printable Worksheets	3	<p>"I like them. Because lots of the assignments we give them as display. They fill it out and return back to us. So it aligns well with how we already give assignments." (I5)</p>
Print Editions of <i>Science News</i>	2	<p>"Some people will need that book at hand to read. So it is beneficial." (I6)</p> <p>"Part of my class is wanting students to look up articles and magazines so in class I always have hard copies of those available... So, I would prefer hard copies of the magazine or some kind of combination for students to look at and check out and browse through." (I4)</p>

Interpretation

The various educator resources (educator guides consolidating resources and teacher background, activities, discussion guides, printable worksheets, etc.) are overall well-aligned with the pedagogies of community college faculty.

In order to bring the resources into even closer alignment, *Science News* may want to consider the length and time required for various resources, perhaps making some more “bite-size” for community colleges. However, this recommendation requires further investigation as it is based on the feedback of one interviewee.

Rigor/Levels

When commenting on Science News resources, participants referenced the level of rigor twenty-six times. Level of rigor refers to the degree of difficulty or exhaustiveness of the resource for the participants' students. Figure 2 shows the distribution of those instances.

Of those twenty-six references, nine suggested that the resources would be too rigorous. Interviewee 6 implied that, as a professor, one cannot assume their students are reading at the college level – even if they are enrolled in college. Interviewee suggested “to have an article(or popup) on how to read the article, find context, read author’s thesis...[and] help with reading comprehension in general.” Another professor described using class time to do that activity together: “For the data analysis part of it, I don't know that I would be able to get students to get to the answers on their own ... And that's just because with the classes I teach, I have some people who this will be their first science course - so they've never had a practice with interpreting data. ...So, this might be something that we'd have to work through together just to make sure that everybody can get it.” (1)

Eleven of twenty-six references were pleased regarding the level of difficulty of the resources and suggested they were just right for their population of students. One interviewee stated "I think [the resources] are quite good because they will make the students think. I don't like giving questions that students can just answer from the textbook" (I5). Considering her diverse group of students, another professor said that "the questions [are] really laid out to help students...questions [are] nice and clear for international students" (I2).

Finally, six references suggested that the level of the resources was not rigorous enough for their community college students. One interviewee thought "some of the contents were [a] little simplified. The students we teach do college courses in high school, so they are close to associate degree when they come to us. My nursing students-they've done AP courses, so they are more advanced than other students" (I5). Regarding the readability level, one interviewee felt strongly: "I probably wouldn't use that... I've never really thought about readability scores before for college students because it is presumed that they have taken certain levels of...English classes.... I'm assuming that they can read at a freshman college level." (I3).

The participants responses existed along a spectrum of how they see Science News resources aligning to the level of rigor they use and/or expect in their community college classes. Consider the juxtaposition of these two interviewees: (1) "Oh, no, I would use a higher level [article]. I would feel like I'd be cheating my students on the opportunity to participate in a rigorous course" and (2) "I would look at that and ... assign the easier one to my students". Overall, this interviewee describes the situation well: "these resources right now are definitely developed for high school...it's not like the questions are bad or too easy or anything...I've found that I've been able to take resources for high

school and put it in use it with my college students, and they find it challenging because of this huge range of sort of how prepared students are for college" (I3).

Figure 3.12. Level of rigor of Science News resources according to interviewees.

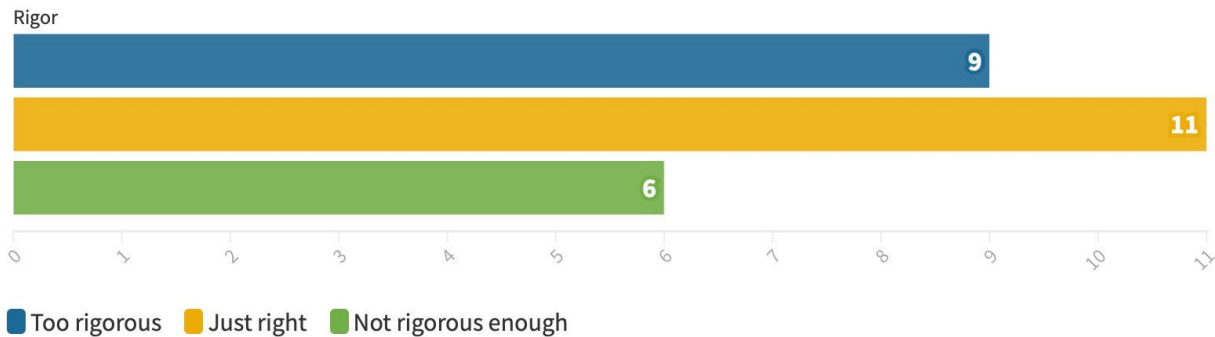


Table 3.7. Example quotes of rigor alignment

Alignment of Rigor for Selected Features		
Feature	Number of references	Example Quotes
Educator Guide	2	"It was it's very extensive and thorough, which is good." (I3)
Comprehension Guide	3	"I think the introductory questions are good...'What are the basics?' ...So I think those are totally appropriate." (I3)
Discussion Guide	3	"[I] like the 'building better brains' discussion. I think we can apply to college level and tie it in physiology class in my class. I believe students (at every level) can benefit from it." (I6)
Data Analysis	3	"Again, the least appealing would be the lesson plans that incorporated the graphing materials that like went above and beyond. Knowing my student population, that might be intimidating for some of them." (I1)
Activity	1	"For what I know about my students, the graph papers and graphing software, might be where lots of them (students) get caught up because some of them haven't had experience using graphing software. So that can take an entire class period to even introduce using that as a part of it. So I would probably not do something like this." (I1)
Science News article	3	"Students [may] struggle with reading the articles. [It would be helpful] to have an article on how to read an article (how to skim, scan, what the title tells you). Or [a] pop up on how you read it, find context, read author's thesis...especially for higher level reading. [You can] design help with reading comprehension in general." (I2) "The articles that are written for the magazine are totally appropriate for my college students." (I3)

<i>Science News for Students</i> article	4	"They are pretty much the same, but one is more concise than the other one ... I would be more interested in reading this (harder) one, but the other one, I think it will be better for the students. Because it catches your eyes with the [first sentence]." (I5)
Readability Score	5	"I teach out of 9th grade MT book. Some students lack [reading skills] to comprehend things. Concussion stuff requires higher readability I like that it has an article with lower readability score so that it can help students who struggle." (I6) "But for readability...even if they don't understand it, or don't make it through it, at least I want them to try reading some of the higher level articles." (1)

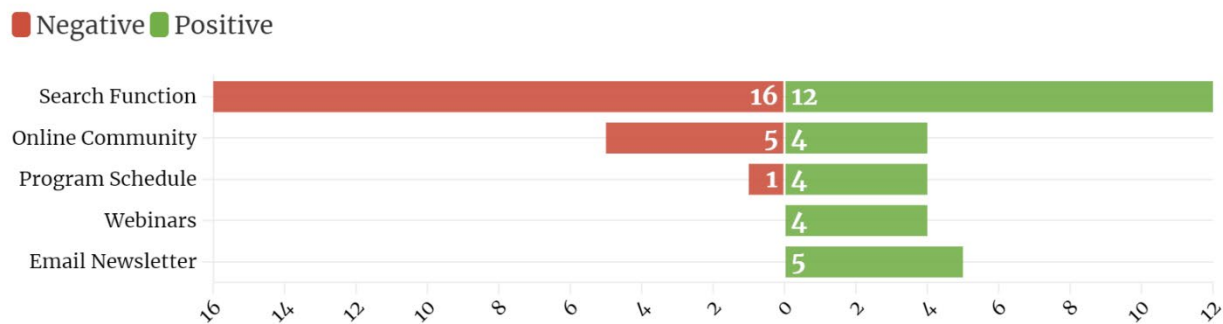
Interpretation

As indicated by the variety in instances above, a range of needs for rigor exist at community college. Based on our data, current resources are a good fit for some students, according to their professors; however, there does seem to be a wider range of needs that would need to be considered for the lower and higher ends of a rigor spectrum.

Educator Support Features

In addition to using the *SNHS* search function while thinking aloud, participants were given a description and/or demonstration of four other ways that *SNHS* supports educators who participate in the program: email newsletters, webinars, the online educator community (Edmodo), and the program schedule (early August to late May).

Figure 3.13. Positive to Negative Sentiment Ratio for Educator Support Features



- I. **Email newsletters** were met with universally positive feedback. For emails, respondents indicated it was useful to receive reminders and notifications of new resources, even if they were unlikely to read every newsletter.
- II. **Webinars** were likewise met with a generally positive response, with respondents referring to their convenience and flexibility, such as being able to “access past webinars, a repository to know how to work with different resources,” (I2). Several respondents indicated elements that would make webinars even more appealing for them, such as continuing education units (I5), lunch and learns (I1), or topics on innovative instructional methods (I3) beyond simple tutorials of how to find *Science News* resources:
- III. **The existing program schedule** aligned well for four out of five interviewees,² with comments that “we start in September and end in May, so [it] fits perfectly,” (I6) and “that’s perfect. We start late August usually and we graduate middle of May.” (I5). Interviewee 3 indicated that the academic calendar on the West Coast was “a little bit different where our terms [are] from late September to mid-June.”
- IV. **The online community** had more mixed reception. Some interviewees responded positively to the potential for collaboration with other educators, especially if it allowed them to connect

with faculty who taught similar subjects. While Interviewee 3 stated that he is “ the only full-time science faculty... and so sometimes feel pretty lonely. Having these sort of online networks can be important ... to feel connected.” However, other participants indicated they were unlikely to participate in the community because it was not specific to their content area (I5) or because they were too busy (I1). Interviewee 2 indicated that the community “look[ed] nice” but they were unlikely to use a new platform, explaining that “if it was a Facebook group, [I] would probably use [it] more as it will be in [my] feed. But not this website.”

- V. **The search function** received both negative and positive feedback from participants. Many of the negative comments were related to the content alignment (or rather, lack thereof) that using the search function uncovered. For example, Interviewee 5’s search for “nursing,” Interviewee 4’s search for “industrial automation,” and Interviewee 3’s searches for “photoreceptor” and “ocular” did not return any results. Interviewee 5 suggested that *Science News* should “have more tags so it’s more specific to what we teach. Like psychology, biology, general sciences tags... [currently,] search is not optimal.” Similarly, interviewees indicated that Next Generation Science Standards (NGSS) were either irrelevant to them (I3) or they did not know what they were (I4).

Positive comments focused on the ease of use and general utility of having a search function available. Interviewees 2 and 6 said that using the search function was “very easy,” with Interviewee 2 elaborating, “[I] like [that it's] user friendly.” Interviewees 3 and 4 appreciated the different filter options, with Interviewee 3 noting, “you can search by feature [or] you can break it down by topic.”

Interpretation

Based on the findings, *Science News* should absolutely continue to provide email newsletters and webinars if expanding programming into the community college space. *Science News* should consider topics and features of special interest to community college faculty for webinars, such as offering CEUs or instructional ideas. There is also no need to modify the program schedule.

However, *Science News* may not want to expand the Edmodo network to community colleges but instead consider facilitating other ways for faculty to connect with each other and collaborate.

If expanding content to better align with community college domains, *Science News* should consider adjusting the search function to reflect this expansion. Alternatively, *Science News* might consider offering a separate search function specific to community colleges with a more granular subject breakdown and omitting irrelevant filters such as NGSS.

Other areas of note

Two other areas were noteworthy: printable worksheets, and diversity and representation

Printable Worksheets

Several interviewees stated the usefulness of printable worksheets.

Table 3.8. Example quotes on printable worksheets

Printable Worksheets
Example Quotes
<p>"I like them. Because lots of the assignments we give them as display. They fill it out and return back to us. So it aligns well with how we already give assignments." (I5)</p> <p>"Awesome. We don't need to tell them where to go. And [we] can just print them out and distribute." (I6)</p>

However, three of the interviewees emphasized the worksheets to be provided in modifiable format such as word documents. Interviewee 2 stated "If it was a word document, it would be better so that it is editable. [For example, to] make it longer, shorter activity, add more questions or remove." Interviewee 3 explained that "[community colleges] have instructors with graduate degrees... and so [instructors] are ...fairly well verse on a lot of these topics. ... They'll probably want to definitely edit or use their own questions." Interviewee 1, also, explained that she will have the "worksheet ...online...where [students] can enter their responses ...and respond to one another." She added "I provide a PDF and a Word document. And Some students have trouble depending on whether they use Mac or PC." On the other hand, interviewee 5 stated "PDF version is fine for us."

Additionally, interviewee 2 pointed out that it will be beneficial if the graphs referenced in the worksheet are drawn in the worksheet, so that students do not need to go back to the articles to see them: "[The] article has great visuals. For some student guides, worksheets [should] have charts and graphs in them." (I2)

Diversity and representations

While doing a think-a-loud on search functions, several interviewees encountered articles and resources that included people of color. When asked about whether students will feel represented with the resources, many of them appreciated those articles.

Some interviewees also mentioned diversity in terms of opinions, language and social-economic status. They pointed out that having articles with different readability levels and translations makes learning more accessible.

Table 3.9. Example quotes on diversity and representation

Diversity and Representation	
Sub-theme	Example Quotes
Racial Diversity	<p>"They would feel represented with the article with the gym, the Spanish gentleman, the scientists. Scientists that look like them. Showing diversity in the lesson and in things that we teach, I think it's crucial." (I1)</p> <p>"Having articles that are translated into different languages is super helpful." (I1)</p>
Socio-economic Diversity	"Community college is geared to more lower income socio-economical level. Having two levels of articles is very beneficial." (I6)
Diversity in Opinions	Looked at Vaccine article "We have diverse opinions. It's good for students to look at those diverse opinions and analyze them." (I6)

Interpretation

Community college faculties appreciate pre-made questions and worksheets. However, with their expertise, they want to be able to modify the worksheets. Therefore, consider providing the worksheet in easily modifiable format such as a word document.

Faculties think there are resources that their students can feel represented in terms of race. Still, consider adding more resources that can include diversity in other areas such as between rural and urban areas.

Discussion

In this section, we answered the following evaluation questions using the findings previously discussed.

1. 1. What are the curriculum/classroom learning needs of community college STEM faculty and learners?
2. 2. In what way, if any, is institutional or structural support necessary to obtain and implement new resources, including SNHS, in community colleges?
3. 3. What is the fit and what are the gaps between SNHS and community colleges?
 - a. a. In what ways, if any, do the existing SNHS educational materials and program schedule support community college STEM faculty and learners?
 - b. b. In what ways, if any, could existing SNHS materials and program schedule be modified or expanded to support community college STEM faculty and learners?

Questions 1 and 3 are discussed together and question 2 is discussed separately.

GENERAL NEED AND THE FIT

According to the informational interview, students and faculties have time constraints due to their unique demographics and setting. Students need resources that can help them progress through the curriculum efficiently, and faculties need resources that can be easily implementable. In addition, faculties favor using open educational resources because they are free, accessible and engaging.

Based on it, Science News for High School fits well with the need of community colleges. Educational guides, and worksheets can allow faculties to easily implement the resources providing

students with lots of facilitation. Science News for High School is free and makes it more accessible to students and faculties.

FITS AND GAPS BETWEEN SCIENCE NEWS IN HIGH SCHOOL AND COMMUNITY COLLEGES

Alignment

Importance of alignment of the resources to the curriculum was stressed in both informational interview and the survey. We divided alignment into three subthemes: alignment of content, alignment of pedagogy, and alignment of rigor.

Alignment of Content

Alignment of content and skills were continuously mentioned as being important in informational interview and the survey when the faculties are choosing resources. Most references in the structured interview showed that the Science News in High School has good alignment in terms of content. However, four interviewees in the structured interview mentioned that there are not many resources for more advanced field such as nursing and mechanical engineering, while there are lots of resources for general sciences. Therefore, for the college specific fields, there was a gap in terms of the number of resources available that aligned with the content.

Laboratory skills, scientific literacy (including data analysis), and communication skills were identified to be important in both informational interview and the survey. In the structured interview, discussion guides, and comprehension guides were mentioned for being well aligned for teaching data analysis and communication skills. However, not many resources in Science News included laboratory

skills, although it was taught most frequently in the classroom according to the survey. Therefore, making connections between laboratory skills and the articles may be valuable.

Alignment of Pedagogy

Overall, Science News in High School aligned well with the existing pedagogy and educational methods used in community colleges. According to the survey, 74% of the faculties already used recent scientific events some of the time and 16% included it most of the time. Also, 18 out of 19 participants answered they use YouTube videos and 8 out of 19 answered they use news article in their classes. Science News provide news article on recent scientific events and has a YouTube channel. Therefore, it match well with the resources that the faculties are already using. In fact, in the structured interview there was overall positivity on how the resources match students' learning style and existing teaching methods.

However, there were also some comments on the educational guide being too extensive. One interviewee stated that “the pace in college, of course, is much quicker” so the guide needs to be “tightened up.” Also, Science News YouTube channel was not well linked with the other resources and even the evaluators did not realize the existence of the channel, until the stakeholder has mentioned in our meeting. Therefore, utilizing the YouTube channel and making better connection with other resources may be useful.

Alignment of Level of Rigor

As mentioned in the findings, there were mixture of opinions on the level of rigor. This was normal as community colleges serve diverse students and the range of their academic ability was high, with some students not being able to read in college level (I6), while some students have already “done

AP courses... and are more advanced than other students” (I5). In fact, majority of the references (11 out of 26) said the difficulty level was just right. In average, the level of rigor aligned with the level of community college students. However, it may be helpful for Science News to develop resources that can facilitate all ranges of students.

Educator Support Features

Through the survey and structured interview, we obtained participants’ thoughts on educator support features such as email newsletter, webinars, existing program schedules, the online community, and the search function.

There was contradiction findings for email newsletters. In the survey, email was ranked highest for being not at all useful. However, in the structured interview five out of 6 interviewees gave positive feedback. One way to understand this discrepancy is looking at interviewees’ responses during structured interview.

Table 4.1. Example quotes of referencing email newsletters

Email Newsletters
Example Quotes
[I] don’t read lots of things in [my] inbox to be honest. But if [I] know that they are updating, [I] will probably take a quick look on whether there is something interesting for [me].” (I2)
“We get so many emails. I definitely have to be on the lookout for them, but I would appreciate you know, receiving them so I am in the know.” (1)

Two interviewees mentioned that they don’t necessarily read all the emails. However, they also mentioned that they can be useful as an update for new resources. Therefore, we interpreted that the faculties will not necessarily read all the emails sent by Science News, but they still prefer receiving them as a reminder and update on new resources available.

Webinars received positive response from the structured interview and was identified to be useful for community college faculties. However, some suggested to focus the webinars less on how to use the resources but more on content specifics.

The existing program schedule aligned well for four out of five interviewees except for one interviewee in the west coast. To check whether the program schedules fit colleges in other states, we did additional search on the school calendar of community colleges and the result are as table 4.2. The current program schedule fitted well with most of the regions but Science News may consider accommodating for western region with slightly slower start.

Table 4.2. College Academic Schedules

<i>Region</i>	<i>College Academic Schedule</i>
<i>West</i>	<i>Mid August – mid May</i> <i>Late September – mid June</i>
Midwest	Mid August – mid May (College of Lake County, n.d.) Late August – early May (Iowa Central Community College, n.d.)
Northeast	Early September – mid May
South	Late August – mid May (Coastal Alabama Community College, n.d.) Mid August – early May (South Florida State College, n.d.)

The online community had more mixed opinion in the structured interview and seemed it was not necessary to keep the community. If Science News decides to keep the online community, dividing the community by similar fields, or using more familiar platform instead of Edmodo should be considered.

Search function was identified to be important feature in the survey (2nd in rank). It also received positive comments from structured interview for having filters and being user-friendly.

However, there was a major gap. Content specific key words such as “photoreceptor,” “ocular,” and “nursing,” did not return any results.

IMPLEMENTING SNHS IN COMMUNITY COLLEGES

Based on the survey and informational interview, we found that Science News is granular enough to be incorporated individually by faculties on their own discretion. It is also free, making the resources more accessible to faculties and students. Therefore, doing an outreach directly in faculty level may be more appropriate than outreach in departmental level.

Through the survey and informational interview, we identified word of mouth, professional network and professional development as the three most frequent ways that the faculties find out about new resources. However, in the survey, only 6 out of 19 participants have heard of Science News showing that it is not yet well known to the faculties in community colleges. Therefore, using word of mouth strategy from the beginning may not be appropriate. Advertising through networks and professional developments may be an effective method. However, as seen in the structured interview, webinars that just teach how to find certain resources may not be useful. Having webinars that have more content-specific information and how to teach them effectively might attract more faculties. Once there are more people who use Science News educational resources, using brand champions to reach more faculties through word of mouth may be effective.

In addition, the role library play in the outreach is not clear as the two instruments show contradicting result. In the survey, none of the participants answered they learn about new resources from the library, interviewee 5 in the informational interview stated that faculties sometimes do learn

about new resources from libraries. Nonetheless, it is still good for the Science News to be included in the library database, so that when students need specific articles and resources, they can be easily accessible.

Lastly, we highlight interviewee 2's claim on stigma attached to community colleges. It is important for Science News to not use deficit language and mindset when approaching colleges, but make sure Science News is helping with true needs of the community colleges while acknowledging expertise of the professors and their autonomy.

Conclusion and Recommendations

We recommend that the Society for Science pursue expanding their *Science News* for High School education program into the community college space. We found that *SNHS*:

- 1.) Has the potential to meet existing curricular needs for free instructional resources that align with existing learning objectives and can help a unique population of learners meet a variety of goals, from job preparedness to transfer to 4-year institutions,
- 2.) Does not need significant institutional/structural support for integration as a new resource in community college curricula, and
- 3.) Is overall a good fit in terms of usability and pedagogy, with some gaps of note in content specificity, rigor, connections to lab skills, and use of multimedia.

Specific recommendations follow.

DECISION-MAKING PROCESS AND OUTREACH TO COMMUNITY COLLEGES

We found that *Science News* resources fall under a more granular decision-making process of curriculum development and would not be subject to curriculum committee, dean, or department approval for integration into community college courses. Outreach at the faculty level is appropriate for raising awareness and increasing participation in *Science News* programming.

When conducting outreach, we recommend the following approaches:

- Do not use **deficit language** when approaching community college. Be thoughtful in what features to emphasize and how to phrase the sentences so that it resonates with the needs of the community colleges while preserving instructors' autonomy.
- Consider recruiting **faculty champions** to promote *Science News* resources at their institution. We noted how new initiatives often started from an individual faculty member or administrator's passion in our informational interviews. Among our survey respondents, the most frequently selected source of new resources was from colleagues (word of mouth), followed by professional organizations or networks. We suggest *Science News* find ways to identify and support faculty who use *Science News* educator resources and could potentially become "brand evangelists"² or champions for the program. *Science News* is already familiar with harnessing social and professional networks in high schools through their existing referral program.; a similar program could be implemented at community colleges.
- Consider **professional development** as a way to introduce faculty to *Science News* resources. The next most common sources of new resources (after word of mouth and networks) identified in our survey was professional development, whether external or at the respondents' institution. This could be as simple as expanding the existing webinar series to include topics specific to community colleges or perhaps even offering in-person workshops at community colleges.

- Consider that **libraries** may be a good entry point for *Science News*, especially if there is an established liaison program as described in our informational interviews. However, libraries may be more useful for ensuring student usage than introducing resources to faculty. Our survey respondents indicated that they do not learn about new resources from the library, although they do encourage students to use databases. Furthermore, some community colleges (e.g., small or rural colleges) may not have the same level of library resources and funding.

SPECIFIC OUTREACH APPROACHES BASED ON COMMUNITY COLLEGE STEM NEEDS

While scientific literacy is central to the Society for Science’s mission, we found it did not resonate as a critical goal for our respondents (although still acknowledged as “very” important by 14 out of 19 respondents in our survey).

Instead, *Science News* should emphasize the following features when conducting outreach:

- Emphasize that *Science News* is **free**. All three of our instruments indicated that SNHS’s no-cost programming is a significant opportunity for *Science News*. Our informational interviews indicated that budgets and grant-funding are a part of the decision-making process at community colleges and that community college faculty and staff actively use and look for resources that are free (such as OER). This reduces stress on the school and the unique students who attend. In fact, our survey found that cost was the number one selection criteria for new resources among our respondents. *Science News* should make sure to emphasize that resources come at no cost in outreach to community colleges.

- Emphasize that *Science News* resources **support and align with** existing student learning goals rather than being an additional or extraneous element. While individual faculty have the decision-making authority to include new resources such as *Science News* in their curricula, resources are more likely to be adopted if faculty see alignment with their existing learning objectives and course content. *Science News* should make sure that resources are aligned in many subject areas (especially ones that may not be taught at the high school level, see next section) and emphasize this alignment in communication for community college outreach.
- Emphasize **learner-centered pedagogy** and emphasize the **practical aspects** of *Science News* resources for community college students' education. This approach acknowledges the unique population of community college learners and the diverse spread of learning needs and outcomes identified in our informational interviews.

POTENTIAL PROGRAM MODIFICATIONS BASED ON NEEDS AND CURRENT FIT VS. GAPS

Overall, we found that the existing pedagogies of community college faculty are a good fit for *Science News* educator resources, with most faculty who participated in our survey already using recent scientific events, discussions, data analysis, and news articles at least some of the time. Additionally, with survey respondents overwhelmingly seeking instructional ideas, *Science News* discussion guides and activities may be well-positioned to fill this need.

We also found that participants who directly reviewed existing *Science News* resources in our structured interview / think-aloud protocol to be very receptive, with four out of six participants indicating they would use *Science News* resources “as is” and the remaining two indicating they would use them with slight modifications.

However, there are some gaps between what *Science News* offers and what faculty prioritize for inclusion in their curricula. Our high-level program recommendations are:

- Consider increasing **multi-media** interactions. Current connections to existing *Science News* YouTube videos are not apparent when using the *SNHS* resource search function as none of our interviewees found them. More multimedia opportunities would impact many areas discussed by community college stakeholders, such as engagement, time, and access. In fact, we found that faculty surveyed choose to include streaming videos (e.g. YouTube) in their curricula above other types of resources. *Science News* may want to consider ways to link or incorporate related video content to their journalism and educator resources.
- Consider expanding materials that reference and connect to **laboratory techniques**. Lab components were most frequently marked as incorporated into curricula “most of the time” by our survey participants. *Science News* may want to modify materials to highlight lab equipment and techniques more explicitly so that students can make connections between their coursework and their lab work
- Create more resources for **higher education-specific fields and content**. Alignment of curriculum was indicated second most important in survey after cost. However, several participants in our structured interview were not able to find resources related to their search terms during the think-aloud.
- Related to this, *Science News* should consider **refining the search function** so that tags and categories include important keywords for STEM fields in community colleges. Based on our

survey, the ability to search by keyword is an attractive feature for faculty that *Science News* should continue providing. If expanding content to better align with community college subject domains, *Science News* should consider adjusting the search function to reflect this expansion. Alternatively, *Science News* might consider offering a separate search function specific to community colleges with a more granular subject breakdown and omitting irrelevant filters such as Next Generation Science Standards (NGSS).

- Create **more rigorous** materials *and* continue scaffolding **metacognitive and basic skills** into readings, activities, and discussions. Our structured interviews revealed that a range of needs for rigor exist at community college. Based on our data, current resources are a good fit for some students, according to their professors; however, there does seem to be a wider range of needs that would need to be considered for the lower and higher ends of a rigor spectrum. Three interviewees offered specific comments referencing scaffolding. *Science News* should continue building in supports for various levels, especially increasing the rigor ceiling to match college-level standards, so that students may improve upon the level of material they can complete.
- Highlight where **personal connections** can be made and increase opportunities for personal connections, for example, conveying how community colleges alumni are working in STEM fields through *Science News* articles and/or educational resources (as suggested by participants in out informational interviews.)

- Consider expanding content on **STEM careers**. *Science News* already has lots of resources that show real-world application of STEM concepts. This is a good fit with community college. However, there are only few resources that show career opportunities in STEM field or at least they are not easily searchable, based on our structured interviews. Therefore, consider adding more resources that highlight diverse career opportunities in STEM field and ensure that they are easily searchable.
- Continue to highlight different types of **diversity in STEM**. Among our survey respondents, “diversity in STEM” was rated high for both being useful and not useful as a feature even though Diversity, Equity, and Inclusion (DEI) was tied with career preparedness as the most frequently ranked “extremely important” goal for STEM programming. This might be because of the different environment of the community colleges. For example, whether they are rural or urban, and whether they have high racial diversity or not might affect the respondents’ responses. Due to our small sample size (n=19), we could not find any pattern, but this might be worth looking at more closely in future studies. In our structured interviews, faculty expressed that their students would feel represented in terms of race in *Science News* resources. Still, other expressed the important of including diversity in other areas such as between rural and urban areas. Finally, as we did not interview students directly, they may feel differently about the representation than their professors.

For recommendations about specific resources, the various types of resource (educator guides consolidating resources and teacher background, activities, discussion guides, printable worksheets,

etc.) are overall well-aligned with the pedagogies of community college faculty according to our structured interviews.

Student activities, printed worksheets, and comprehension guides should continue to be provided as they were rated as being useful by a substantial number of respondents in our survey. This result aligns with the result from our survey that faculty are looking for instructional ideas.

There is also no need to modify the program schedule, and *Science News* should continue to provide email newsletters and webinars if expanding programming into the community college space.

To bring the resources into even closer alignment, *Science News* may want to:

- Consider the **length and time required** for resources such as discussion guides and student activities, perhaps making some more “bite-size” for community colleges. However, this recommendation requires further investigation as it is based on the feedback of one interviewee during the structured interviews.
- Consider **webinar topics and features of special interest** to community college faculty, such as offering continuing education unit credits (CEUs) or instructional ideas.
- Consider facilitating **other ways for faculty to collaborate** and connect with each other, based on the lukewarm response of our interview participants to the Edmodo platform.
- Community college faculties appreciate pre-made questions and worksheets. However, with their expertise, they want to be able to **modify the worksheets**. Therefore, consider providing the worksheet in easily modifiable format such as a word document, as both informational interviews and the online survey indicated that faculty enjoy less static, remixable/modifiable materials (such as OER).

LESSONS LEARNED ABOUT THE EVALUATION PROCESS

We had several learnings that emerged as a result of conducting this specific evaluation. First, qualitative data may not be analyzed in the same way each time, as we learned when we tried to replicate our methods from instrument 1 with the data from instrument 3. Data analysis methods may be modified several times to find the best analysis method.

Second, when naming themes for thematic analysis of qualitative data, we learned not to use terms that convey evaluator interpretations but instead to use terms that are representations of what the interviewees explicitly said. Third, we learned the important of grounding Likert scales, something we thought we had already learned from the readings but only truly understood when beginning data analysis and had trouble understanding how respondents distinguished “very” from “extremely.” Finally, we learned not to post survey links on social networking platforms without ensuring a system that blocks fraudulent results (eg. ReCAPTCHA).

One aspect that we returned to again and again throughout different stages of the evaluation was both cultural awareness and maintain a consciousness of the mindsets we were bringing in as evaluators. We frequently discussed this together as team, especially before conducting data analysis.

We hope that this report serves as some evidence of how much we have learned about the evaluation process overall, something none of had experience with before this class. However, when discussing this reflection portion of this report, we realized there is no way to capture the true breadth (and depth!) of what we have learned, from ethically working with human subjects, to different data collection and sampling techniques that were not a good fit for our specific evaluation,

to bringing “evaluative thinking” forward with us as a mindset in our careers. It has truly been an incredible learning experience (and massive undertaking!) and we are grateful to the teaching team for all their support throughout the process.

References

- Bogdan, R. C., and S. K. Bilken (2007). *Qualitative research for education: An introduction to theories and methods*. Boston, MA, Pearson Education, Inc. (Chapter 5) pp. 159-197.
- Boggs, G. R. (2010). Growing roles for science education in community colleges. *Science (American Association for the Advancement of Science)*, 329(5996), 1151–1152.
<https://doi.org/10.1126/science.1194214>
- Coastal Alabama Community College (n.d.). *Events*. Coastal Alabama Community College.
https://www.coastalalabama.edu/events/?event_type=Academics
- College of Lake County. (n.d.) *Academic calendar*. College of Lake County.
<https://www.clcillinois.edu/programs-and-classes/academic-calendar>
- Cotton, D. and K. Gresty (2006). Reflecting on the think-aloud method for evaluating e-learning. *British Journal of Educational Technology*, 37(1): 45-54.
- Diamond, J., Horn, M., & Uttal, D. H. (2016). *Practical evaluation guide: Tools for museums and other informal educational settings* (Third edition.). Rowman & Littlefield.
- Dillman, D. A., J. D. Smyth, et al. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*. John Wiley & Sons, Inc. (Chapter 4) pp. 65-106
- Federal Student Aid. (2022). *Federal Pell Grants are usually awarded only to undergraduate students*. U.S. Department of Education, Office of Federal Student Aid.
<https://studentaid.gov/understand-aid/types/grants/pell>

- Frierson, H.T., Hood, S., & Hughes, G.B. (2002). Strategies that address culturally-responsive evaluation. In J.F. Westat, *The 2002 user friendly handbook for project evaluation* (pp. 63-73). Arlington, VA: National Science Foundation.
- Hewlett Foundation. (2022). *Open Education*. William & Flora Hewlett Foundation.
<https://hewlett.org/strategy/open-education/>
- Iowa Central Community College. (n.d.). *2021-2022 Academic calendar*. Iowa Central.
https://www.iowacentral.edu/student_calendar.asp
- Khan, S. & VanWynsberghe, R. (2008). *Cultivating the Under-Mined: Cross-Case Analysis as Knowledge Mobilization*. Forum Qualitative Sozialforschung / Forum: Qualitative Social Research, 9(1), Art. 34, <http://nbn-resolving.de/urn:nbn:de:0114-fqs0801348>.
- Nielsen, Jakob (2012). Thinking Aloud: The #1 Usability Tool. Nielsen Norman Group. Retrieved March 16, 2022, from <https://www.nngroup.com/articles/thinking-aloud-the-1-usability-tool/>
- Newport, F. (2003, August 26). Harvard Number One University in Eyes of Public. *Gallup*.
<https://news.gallup.com/poll/9109/Harvard-Number-One-University-Eyes-Public.aspx>
- Oliver, M. (2000). An introduction to the Evaluation of Learning Technology. *Educational Technology & Society*, 3(4), 20–30.
- Patton, M. Q. (2002). Qualitative research and evaluation methods. Sage Publications, Inc. pp. 339-391.

Rosala, M. (2019). How to analyze qualitative data from UX research: Thematic analysis.
from <https://www.nngroup.com/articles/thematic-analysis/Links to an external site.>

Society for Science. (n.d. a). *High School Program Logic Model.*

Society for Science. (n.d. b). *Science News in High School.* Society for Science.

<https://www.societyforscience.org/outreach-and-equity/science-news-in-high-schools/>

Society for Science. (n.d. c). *Science News in High Schools – What you need to know.*

<https://sspcdn.blob.core.windows.net/files/ScienceNewsinHighSchools.pdf>

South Florida State College (n.d.). *Calendars.* South Florida State College.

<https://www.southflorida.edu/college/calendar>

Wouter van Atteveldt, Mariken A. C. G. van der Velden & Mark Boukes (2021) *The Validity of Sentiment Analysis: Comparing Manual Annotation, Crowd-Coding, Dictionary Approaches, and Machine Learning Algorithms, Communication Methods and Measures*, 15:2, 121-140, DOI: 10.1080/19312458.2020.1869198

Appendices

APPENDIX A: SNHS LOGIC MODEL

ScienceNewsinHighSchools

High School Program Logic Model

Inputs	Activities	Participation	Reactions	Short-term Outcomes (KASA*)	Practice Changes	Impact
Using these inputs...	and these Society activities...	we engage these audiences.	Participants react to the activities in these ways,	which yield these short-term outcomes...	and these practice and behavior changes.	We hope these changes eventually lead to these benefits to society.
<ul style="list-style-type: none"> Funding & Sponsorships Staff time Staff expertise in education Staff expertise in STEM journalism Science News print magazine Science News media group online article archives, Science News, & Science News for Students Relational databases of educator contact information Online platforms for communication & collaboration Partnering organizations 	<ul style="list-style-type: none"> Develop & provide STEM educational content Provide a searchable database of SNHS resources Collaborate with Science News staff Develop, distribute, & communicate SNHS program resources & PD opportunities Regularly communicate with educators Recruit educators Orient educators to the SNHS resources Create a sense of community among enrolled educators Recruit & support STEM coordinators & district curriculum developers 	<ul style="list-style-type: none"> Schools Districts Enrolled educators STEM coordinators & curriculum developers High school students of enrolled educators 	<p>Educator reactions:</p> <ul style="list-style-type: none"> Increase their interest in STEM topics Experience curiosity related to STEM topics Enjoy resources related to their STEM passions Share SN as further reading material to students Share SN as further reading material to colleagues Highly engage with resources Want to reenroll for the following year Enhance their curriculum with SNHS resources Add cross-curricular examples of core concepts to curricula <p>STEM Coordinators:</p> <ul style="list-style-type: none"> Encourage educators to use SNHS resources Engage with program staff to learn more about the resources <p>Student reactions:</p> <ul style="list-style-type: none"> Enjoy reading articles Find Science News-related resources engaging Increase their interest in STEM Experience curiosity related to STEM topics Enhance learning of scientific concepts Enjoy reading articles during free time 	<p>Educators:</p> <ul style="list-style-type: none"> K- Gain understanding of current STEM research & developments to share with their students K- Keep up with STEM content & related real-world connections K- Gain practical and age/ability appropriate ways to use STEM Journalism resources in their classrooms K- Increase awareness of SNHS resources K- Increase awareness of where to locate resources on digital platforms AT- Enjoy seeing students benefit from the resources S- Utilize STEM journalism in their classrooms S- Use & build on SNHS classroom resources S- Introduce STEM topics to engage students A- Aspire to continue to use SNHS resources to facilitate student learning A- Share classroom ideas with other educators <p>STEM Coordinators:</p> <ul style="list-style-type: none"> K- Increase their awareness of SNHS resources A- Share classroom ideas & program resources with educators S- Develop, build, and/or share lesson plans & articles with educators <p>Students:</p> <ul style="list-style-type: none"> K- Gain exposure to new ideas and STEM content K- Understand and retain content K- Understand that STEM is constantly changing & progressing K- Begin to see intersections between STEM and other school subjects and the real-world applications of them AT- See STEM as interesting and even exciting AT- See that STEM connects to their lives & the real-world AT- Choose to read SN during free time or free reading time in school S- Apply concepts S- Able to distinguish between trustworthy and untrustworthy sources about STEM topics A- Aspire to ask their own questions and find their own answers 	<p>Educators:</p> <ul style="list-style-type: none"> Regularly access & use reliable STEM journalism Access and implement lesson plans that achieve STEM and literacy standards Apply the most recent advances in STEM to curricular concepts Participate in the program by collaborating or giving feedback <p>STEM Coordinators:</p> <ul style="list-style-type: none"> Share resources with educators and encourage their use Integrate SNHS resources into curricula <p>Students:</p> <ul style="list-style-type: none"> Access & use reliable STEM journalism as a resource Some develop STEM research projects based on SN resources 	<ul style="list-style-type: none"> Increased STEM literacy Increased interest in STEM content Increased interest in STEM careers More scientifically informed citizens <p>Assumptions:</p> <ul style="list-style-type: none"> Enrolled educators utilize resources in a wide range of ways & levels of frequency Students vary widely in their utilization of program resources <p>External Factors:</p> <ul style="list-style-type: none"> Level of access to technology and online resources by educators and students Distribution of resources by educators and STEM coordinators Availability of funding for additional schools Pandemics, natural disasters, social unrest, and other factors affecting schools, educators, and students Limited ways of communicating with program educators & no direct access to students

* KASA = Knowledge and awareness (what they know), ATitudes (how they feel), Skills (what they can do), and Aspirations (what they want)

APPENDIX B: INFORMATIONAL INTERVIEW INSTRUMENT

Informational Interview Checklist

1. What are the curriculum/classroom learning needs of community college STEM faculty and learners?
2. In what way, if any, is institutional or structural support necessary to obtain and implement new resources, including *SNHS*, in community colleges?

General

- Role/connection to community college
- Student demographics
- STEM student demographics

STEM Program goals

- Transfer to 4-year institutions
- Associate degree / career-readiness
- Scientific literacy and information literacy
- State and national policies
- Current science vs. core basic principles
- Learning experiences they are trying to foster
- Trends in STEM education

Existing Resources for STEM Courses

- Existing pedagogies and products used by educators
 - How do they support the stated program goals?
 - Procurement (how were they introduced/acquired?)
- What is the most successful new thing you have implemented in the last few years?
- Do any resources include recent scientific findings (news)?

Organizational Structure and Institutional Culture

- Who makes decisions on curriculum / resources?
 - Dean of STEM?
 - Other Dean?
 - Professor?
 - Librarians?
- How much is the curriculum standardized?
- Professional organizations or networks

Needs and Challenges

- | | |
|---|---|
| <ul style="list-style-type: none"> • Challenges of STEM Faculty <ul style="list-style-type: none"> ◦ Academic ◦ SEL ◦ Logistical ◦ Cultural / context | <ul style="list-style-type: none"> • Needs of students <ul style="list-style-type: none"> ◦ Academic ◦ SEL ◦ Self-efficacy ◦ Cultural / context |
|---|---|

Logistics and Next Steps

- Incentives
- What are good channels to distribute our survey?
- Would you be willing to distribute our follow-up survey to colleagues?
- **WHO SHOULD WE SPEAK TO NEXT?**

APPENDIX C: ONLINE SURVEY INSTRUMENT

Survey Questions

Demographics

(1) In which region of the US do you teach?

Northeast (CT, ME, MA, NH, NJ, NY, PA, MD, RI, VT)

South (DE, FL, GA, MD, NC, SC, VA, WV, AL, KY, MS, TN, AR, LA, OK, TX)

West (AZ, CO, ID, MT, NV, NM, UT, WY, AK, CA, HI, OR, WA)

Midwest (IL, IN, MI, OH, WI, IA, KS, MN, MO, NE, ND, SD)

(2) What is the size of your institution?

<1000 students

1000-5000 students

5000-10000 students

>10000 students

(3) How would you categorize your institution?

Rural

Urban

Suburban

(4) One of the goals of the Society for Science is to reach students who are traditionally underserved in STEM education and careers (African American, Black, Latino, Native Alaskan/American/Hawaiian, Pacific Islander, low income,). Approximately what percentage of your students would you consider underserved?

100%, all my students are underserved audiences in STEM

About 75%

About 50%

About 25%

Less than 25%

None of my students are underserved audiences in STEM

(5) Which of the traditionally underserved communities are represented in your students? (Select all that apply)

First generation

Nontraditional

Black, Indigenous, and people of color (BIPOC)

Latino

Immigrant

International

Low income

If there are other characteristics, describe them here. (*Open response*)

(6) What subjects do you primarily cover in your teaching? (Select all that apply)

Environmental science
 Agricultural science
 Biology
 Chemistry
 Physics
 Mathematics
 Engineering
 Computer Science
 Health
 Other (*open response*)

(7) What best describes your position?

Part-time
 Full-time
 Other (*open response*)

STEM Education

(8) Indicate the importance of the following goals for STEM programming at your institution:

Academic achievement
 Retention (persistence)
 Articulation / transfer to 4-year institutions
 Educational attainment (e.g., completion of degree or certificate)
 Scientific literacy
 Hands-on skills (laboratory, technical, etc.)
 Career and job preparedness
 Diversity, Equity, and Inclusion (DEI)

Scale: Not at all, slightly, moderately, very and extremely important

(9) Describe any other goals for STEM programming not included above: **Open response**

(10) When you are selecting educational resources for your course(s), what characteristics do you consider most important? Rank the following characteristics.

Cost
 Flexibility / customization / ability to be modified
 Ease of access
 Alignment with existing curriculum
 Other (*open response*)

(11) How do you learn about new resources to integrate into your curriculum? (Select all that apply)

Professional development at my institution
 Department chair / dean
 Library at my institution

Professional organization or network
 Curriculum committee
 Colleagues (word of mouth)
 External professional development
 Newsletter
 Other (*open response*)

**If “professional organization,” “external professional development,” or “newsletter” is selected:*

(12) What is the name of the organization / PD / newsletter?
**(Optional, open response) **

(13) Which of the following statements best describes your ability to incorporate resources in your curriculum (for example, assigning a news article for students to discuss)?
 I am able to incorporate any resources into my curriculum at my discretion
 I am able to incorporate resources into my curriculum if they align closely with the learning objectives / course content
 I am able to incorporate resources that have been vetted internally (as part of a library guide, etc.)
 I am able to incorporate resources into my curriculum only with department or committee approval
 I am not able to incorporate new resources into my curriculum (curriculum is standardized across department / multiple sections)
 Other (*open response*)

(14) Do you encourage students to use your institution’s library guides and databases?
 Yes
 No
 Other (*open response*)

(15) How frequently do you engage your students in:
 “Round tables” or discussions
 Research projects involving literature review and database searches
 Laboratory components
 Data analysis (interpreting data sets, graphs, charts, etc.)
**Scale: Never, sometimes, all of the time*

(16) Do you incorporate any of the following open educational resources (OER) into your curriculum? (Select all that apply)
 TED Talks
 Podcasts
 YouTube videos
 News articles
 PhET science simulations
 Other (*open response*)

(17) How often do you include recent scientific events in your curriculum?

- Never
- Sometimes
- Most of the time

(18) In which area are you looking for additional educational resources? (Select all that apply)

- Scientific methods
- Current findings in STEM
- More explanations on the content
- Instructional ideas
- Extension materials for students
- Case studies
- Laboratory guides
- Materials in other languages
- Other (*open response*)
- I am not looking for additional educational resources

Science News

(19) Had you heard of *Science News* before this survey?

- Yes
- No
- Not sure

If Yes:

(20) Have you ever used *Science News* in your curriculum?

- Yes
- No

If Yes:

(21) How did you use *Science News*? Please indicate if you used any of the educator resources such as discussion guides or student activities.

Open response

(22) How likely would you be to include *Science News* materials in your curriculum in the future?

Scale: extremely unlikely, somewhat unlikely, neither likely or unlikely, somewhat likely, extremely likely

(23) Please indicate how useful you would find the following *Science News* educator resource features:

Readability score

Discussion guide (science literacy)
 Discussion guide (data analysis)
 Student activities
 Printable worksheets
 Highlighting diversity in STEM
 Comprehension guide (paired to article)
 Online educator community
 Webinars
 Weekly email newsletter
 Print editions
 Search by keyword
 Spanish language materials
Scale: not at all, slightly, moderately, very and extremely useful

(24) How might you use *Science News* materials, articles, or lesson plans as teaching tools? Select all that apply.

Background information for me as an educator
 Real-world applications of STEM concepts to supplement the textbook
 Literacy skills (vocabulary, annotating and summarizing articles, etc.)
 Substitute plans or individual student take-home activities
 Inspiration for whole-class or small-group discussions
 Sources of primary research
 Student research project ideas
 Graphs, data tables, or other visualizations for data analysis
 Media literacy (defining trustworthy resources, writing citations, etc.)
 Purposeful leisure reading
 Examples of STEM fields and career opportunities
 Other (*open response*)

(25) Please let us know anything else you think would be helpful
Open response

Thank you for your responses!

(26) Please enter your institutional email to be entered to receive a \$200 Amazon gift card. Drawing will be on DATE. (Your email address will be disassociated from your responses).
Open response

(27) Are you interested in a 45-minute follow-up interview reviewing *Science News* educator materials? Participants receive a **\$25 Amazon gift card**. Interviews will be conducted between 03/28 and 04/08.

Please check below if you are interested:

Yes
 No

APPENDIX D: THINK-ALoud AND STRUCTURED INTERVIEW INSTRUMENT

Part 1: Think-Aloud (20 min)

Search Function (10 min)

- Instruct participants to share their screen
- Instruct participant to use the search function as if they were seeking resources to incorporate into their course curriculum
 - Copy URL into chat: <https://www.sciencenews.org/snhs/search>
 - “Imagine you are thinking of including new resources in your courses and have come across *Science News* educator resources. Please feel free to click through to specific resources that interest you or continue searching if you do not find anything of interest.”
- Instruct participant to continuously narrate their thoughts aloud
 - “Please say whatever comes to mind as you are using the search function and clicking through to resources. These can be questions, thoughts, or just saying out loud what you are noticing or what you are going to click on next. It’s OK to pause while reading, but otherwise please verbalize everything that passes through your head.”
- According to Cotton and Gresty, it is not realistic to expect participants to “read and simultaneously vocalize their thoughts about a piece of text.” (2006) However, when appropriate, we will use the following prompts if the participant stops talking:
 - “How are you deciding where to go?”
 - “What do you think about the information in this section?”
 - “Just a reminder to think aloud – please say whatever comes to mind.”

Domain-Specific Guide (10 minutes)

- Ask participant if they were able to review the material prior to the interview
 - “Did you have time review the educator guide before our meeting?”
 - If yes: “What stood out to you when reviewing the guide?”
 - If no, Copy URL into chat and say “Please take the next 5 minutes to go through the guide. Please continue thinking aloud.”
- Specific prompts:
 - “Did you notice the **readability score** associated with the article? How might you use this?”
 - “Let me draw your attention to the **comprehension guide** associated with the article. What do you think of these questions?”
 - “The materials are available as **printable student worksheets**. What do you think about that option?”
 - If present:
 - “Did you notice the _____? What do you think about it?”
 - Associated *Science News for Students* article
 - Associated *Science News for Students en Español* article
 - **Student activity**
 - Science literacy **discussion guide**

- Data analysis **discussion guide**

Part 2: Feature Descriptions and Questions (10 min)

- Describe the following features and ask for participant thoughts:
 - “SNHS provides 10 **print editions** to participating schools.”
 - Share screen and pull up URL: <https://www.sciencenews.org/sn-magazine>
 - “What do you think about having print editions available for students?”
 - “SNHS currently has a **program schedule** that looks like this.”
 - Share screen and display _____
 - “SNHS sends educators **email newsletters** such as this one when new resources are available”
 - Share screen and display example email
 - “In what ways would receiving emails like this support you as an educator?”
 - “SNHS invites educators to an **online educator community**.”
 - Share screen and show Edmodo Science News community: <https://new.edmodo.com/groups/science-news-for-students-and-educators->
 - “Do you see yourself participating in this?”
 - “SNHS hosts **webinars** for participating educators”
 - Share screen and webinar series: <https://www.societyforscience.org/outreach-and-equity/science-news-in-high-schools/current-year-info/>
 - “In what ways would webinars support your use of Science News materials?”

Part 3: Overall Questions (10 min)

- How easy was it to find what you wanted using the search function?
- Would you incorporate these materials as-is?
 - If yes:
 - How frequently would you use them?
 - How would you assign them to students?
 - If no:
 - What would need to be changed for you to use them?
- How could the materials and services be improved?
- Out of everything we reviewed, what was the most appealing?
- Out of everything we reviewed, what was the least appealing?
- In what ways would your students feel represented or not feel represented in the materials that you saw?