

SUREbyts: Presenting Early-Year Undergraduate Students with Videos on Research Topics

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Abstract

Undergraduate research initiatives such as mentoring programs, conferences, and journals typically focus on the later stages of undergraduate studies. It is not unusual for a student to reach the final year of their program without developing their awareness of research within their discipline or their institution. SUREbyts is a project that provides first- and second-year undergraduate students with access to research through video recordings of professional researchers and research students discussing their own research, with each video structured around a research question with a set of possible solutions. This article presents the successes and challenges faced by the project’s initial implementation in six higher education institutions in Ireland and offers advice to institutions globally that are considering engaging their students with research in this way.

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Embedding research into the undergraduate curriculum has been shown to be a highly impactful pedagogical

approach across all disciplinary areas (Walkington 2015). By engaging with structured research opportunities as part of their undergraduate studies, students are encouraged to creatively explore the topics being taught while also developing important disciplinary and transversal skills (Healey and Jenkins 2009). The opportunity for students to engage fully, or partially, with a research project and then present their findings at an undergraduate research conference or publish their findings in a journal has attracted substantial attention in recent decades, as evidenced by the proliferation of dissemination platforms for undergraduate research (Barker and Gibson 2022). These opportunities, however, tend to focus primarily on students at the latter end of their undergraduate studies. Despite this, there is increased attention in the literature on how undergraduate students at the earlier stages of their studies can become involved in, or exposed to, research projects (Shelby 2019; Wolkow et al. 2014). This article describes one project that shares this objective: the SUREbyts project.

The SUREbyts project allows first- and second-year undergraduate students to engage with research through a collection of video recordings in which experienced and early-stage researchers describe a problem, pose a question and possible solutions related to the problem, and

then describe their research-informed view on the most appropriate solution. These videos, covering many of the prominent scientific disciplines, are freely available to all lecturers to use in class with their students under a Creative Commons BY-NC-ND 4.0 license. Suggested uses include integrating SUREbyts into a discussion regarding the topic of the video or using SUREbyts as part of a formative or summative assessment. Of the 294 students who responded to a survey about their engagement with SUREbyts, the majority reported that it had increased their interest in research in general, and their understanding of the work undertaken by researchers specifically. There are challenges, however, associated with this approach. Researchers often find it difficult to present their research in an accessible fashion, appropriate for early-stage undergraduate students. Creating an interesting and engaging video requires careful guidance and usually several design iterations. Additionally, lecturers require guidance on how to incorporate these videos meaningfully into their teaching, as misaligned use can result in a negative student learning experience.

The next sections describe the SUREbyts project in detail. The article concludes with a set of recommendations to institutions that are considering implementation of such a project using SUREbyts as a model. Institutions that do so will be well equipped to enhance the awareness of research among their first- and second-year students.

SUREbyts

The Science Undergraduate Research Experience (SURE) Network (O’Leary et al. 2021) launched the SUREbyts project in 2021 with the objective of enhancing research awareness at the early stages of undergraduate programs in the sciences in Ireland. Through SUREbyts, experienced researchers and postgraduate research students were invited to record a brief video (a SUREbyt) centered on a question related to their research. The videos were then made available on the website of the SURE Network (SURE Network 2021), from where both students and lecturers could access them. Lecturers were encouraged to use SUREbyts videos in class to help their students learn about the research that was taking place within their discipline.

Video was chosen as the medium for this project for a variety of reasons, including ensuring that the research that was taking place throughout the network could be showcased to all students; and enabling the content to be reviewed and edited in advance of its use to ensure that it meets the requirements of the project. Of most relevance for this article, the SURE Network has ambitions for the SUREbyts collection of resources and the SUREbyts model to be adopted by institutions beyond Ireland. The collection currently comprises 34 SUREbyts videos that are freely available for use under a BY-NC-ND 4.0 Creative Commons license. To better understand the impact

of the SUREbyts model, the project team surveyed lecturers and students who had used the SUREbyts resources. Thirteen lecturers and 294 students replied to the online surveys. The feedback obtained, both positive and negative, shapes the remaining sections and provides guidance to others who wish to either contribute to, use, or replicate the SUREbyts model.

Format

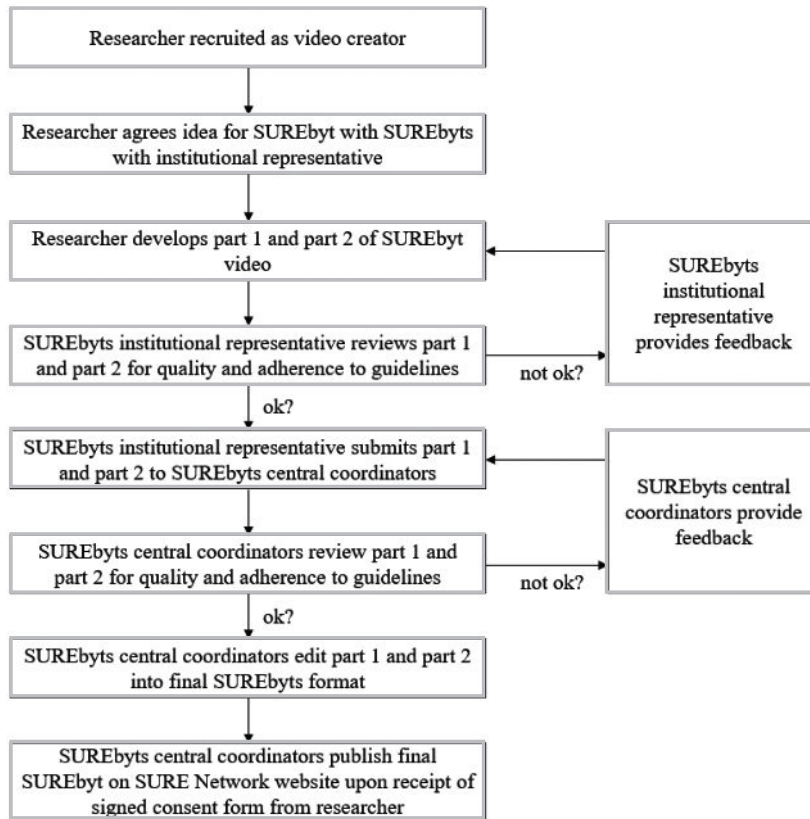
A SUREbyt is a 10- to 12-minute video designed to provoke a discussion among students when played in class. In the video, students are informed about the research career and work of a research student or professional researcher at their own or another institution. The students are then presented with a question related to that work and three possible solutions. This can be thought of as the type of question that might be offered to an audience with a request for a show of hands on the most suitable answer. A break in the video then shows a countdown clock for two minutes, during which time students are encouraged to discuss the possible solutions with their nearest classmates. The second part of the video then presents the researcher’s own view on the best solution. Often, the researcher will explain that they have a preferred solution but that other researchers do not share their view. It is important that students are exposed to this type of discourse so that they appreciate that research does not always result in one, true answer, and that it is acceptable for researchers to hold diverse views based on their own findings.

In part 1 of the SUREbyt video, shown in Figure 1, the researcher introduces themselves and their research and presents a question and possible solutions. In part 2, also shown in Figure 1, the researcher’s preferred solutions are presented and justified. Both parts are fully developed by the researcher, based on strict, but accessible, guidelines available through the SUREbyts website. The researcher then submits their videos to their institutional SUREbyts point of contact, as shown in Figure 2. The institutional point of contact reviews the video and may request edits or may liaise with the central coordinators of the SUREbyts project who review the videos for quality and adherence to the published guidelines. When complete, the researcher will submit both parts with a signed consent form to the project team. The two parts are then edited into the final format shown in Figure 1 by the SUREbyts project team. At this stage, a themed introduction and outro are added to bookend the videos, and a two-minute countdown clock is inserted between the two parts. Once finalized the SUREbyt video is published and categorized by discipline on the SURE Network website, where it is made available at a unique URL. Many videos are multidisciplinary and appear in multiple categories, helping alert students to the importance of research that transcends subject boundaries. The creator of a published SUREbyt video can apply for recognition with a digital badge issued by the SURE Network.

FIGURE 1. Video Format for a SUREbyt Video

Intro	Part 1:	Middle section:	Part 2:	Outro
	Researcher introduces themselves, presents their research, posts a question and offers three possible solutions.	Break for discussion among students viewing video in class.	Researcher discusses the three possible solutions and offers and justifies their opinion on why one or more answers are most appropriate.	
5 seconds	6-7 minutes	2 minutes	4-5 minutes	5 seconds

FIGURE 2. SUREbyt Creation Flow Chart



Collection

A primary metric of success for the SUREbyts project was the recruitment of 34 researchers from around Ireland, in all the SURE Network’s partner institutions, to create the videos. Of these, 19 were lecturers who were actively involved in research, and 15 were postgraduate research students. The mix of creators at different stages of their career meant that the full SUREbyts collection was representative of the diversity of experience that features in the research landscape. It also provided early-stage researchers and postgraduate students with a means of disseminating their research and enhancing both its engagement and impact, a common requirement of grant-awarding bodies.

Equally important was the diversity of disciplinary areas, as shown in Table 1. Thirty-four SUREbyts videos were published, with several in multiple categories.

The project resulted in a collection of cutting-edge research videos addressing accessible, engaging topics and featuring questions that were designed for a novice audience. The most popular of the videos was titled *Feeding Martian Colonies*. In this SUREbyt video, the creator, a postgraduate student, explained her research background and project, which related to hydroponics. Following a four-minute description of her research, the researcher posed the question, “How are we going to feed Martian colonies?” and

TABLE 1. Count of SUREbyts Videos in Each Category

Disciplinary area	SUREbyts
Biology	12
Computer science	10
Environment and sustainability	9
Mathematics	7
Physics	6
Chemistry	6
Food and nutrition	4

offered three solutions: (a) mix Martian soil with “human fertilizer” (urine and feces); (b) send constant resupply missions from Earth; (c) soil-less growth under controlled environment. At this point the video moves to a two-minute break so that viewers can consider the possible solutions, discussing them as appropriate with classmates. In the final part of the video, the researcher explained why the third option was her preferred solution and related this to her own current research. This SUREbyts video attracted approximately one-quarter of all the hits for the whole collection. Other popular videos cover a range of disciplinary areas. Titles include *Pond Water*, *Endocrine-Disrupting Chemicals*, *Walking*, *Microbial Growth Strategies*, and *Tsunami*.

Quality

The SUREbyts coordinators evaluated the quality of each of the SUREbyts videos against a set of technical requirements, a set of formatting requirements including the length of video, and the requirement for the video to be engaging for novice science students. Survey respondents subsequently helped further develop understanding of quality.

Survey feedback has suggested a diversity of quality among the videos and a dissatisfaction among students when the videos do not adhere fully to the guidelines. This is evidenced by one respondent’s comment about one of the videos that was almost 20 minutes in length.

I definitely felt some were of higher quality (the ones I used) than others—so it would be great if they were continually updated to give more choice. Students seemed to enjoy them but the group who watched the microplastics one felt it was too long—I really enjoyed this one in particular and so do not agree but thought this feedback may be useful (one student told me she increased the speed so that it was more watchable!).

Students also commented on the need for “simpler language and avoiding terminology” and that “there should not be much written text on the screen.” Students were

frustrated by poor-quality recordings and the need to “improve the mic quality [because] some background noises could be heard and the audio was difficult to comprehend because of this.” There is a balance to be struck between the requirements set out for video creators, which may serve as barriers to their participation, and the requirement for high-quality videos.

Suggestions from survey respondents on how to improve the videos included the addition of subtitles to the videos and the inclusion of quizzes at the end of each video. The addition of subtitles is easily achieved through software automation and will be implemented for the next iteration of SUREbyts videos. The addition of quizzes was given consideration, but it was felt this would alter the purpose of the SUREbyts video, which is intended to focus on a single focal question in a classroom situation. Lecturers may decide to build quizzes related to the content of the video within the instructional context in which the video is used. It is important, however, that the overall burden on the creator of the video is kept to a minimum, as the success of SUREbyts is dependent upon the willingness of busy researchers and research students taking the time to develop accessible, engaging videos centered upon a carefully designed question.

What is clear is that students and lecturers have a very good sense of what constitutes good quality, and this is reflected in the popularity of certain videos. Popularity is driven, in the first instance, by the lecturer who decides on which video to use in their class, and how to use it.

Instruction

Lecturers in first- and second-year modules in SURE Network partner institutions were encouraged to use the SUREbyts resources as part of the learning design for their classes. As with the video creators, lecturers could apply to the SURE Network for a digital badge once they had incorporated SUREbyts into their classes.

A dedicated online session was arranged for lecturers to explore different ways in which the resources could be used on their courses. Of these approaches, which are described on the SURE Network website, the one that was adopted by the majority of lecturers was “class opener.” With this method, a lecturer commences a class by playing the SUREbyts video from start to finish. When the middle part of the video plays, students are asked to discuss the possible solutions with each other, which they do again after the video completes. The lecturer then relates the subject of the SUREbyts to the topic under discussion in that week’s class. Other approaches such as “class bridge,” in which the playing of the video is divided between sessions, were also adopted by some lecturers. Others innovated and developed their own approach to using the videos, such as this lecturer:

I used the videos in a slightly different way than what was perhaps intended. First, I used the videos at the start of the semester as an ice breaker. This enabled the students to initiate conversations with each other, and it was very effective—the noise from the conversations was very loud!

Based on survey responses, the perception of lecturers on the value of the SUREbyts videos was generally positive, but not universally so. Nine of the 13 lecturers surveyed (69 percent) felt that their students’ awareness of research was enhanced through their engagement with SUREbyts. Ten of the lecturers (77 percent) said that they would use the videos again, with seven of that group (54 percent) “very much” likely to do so. These lecturers identified how the videos they used were good triggers for discussion, with one lecturer commenting that:

The videos were perfectly pitched for first-year students who really engaged and considered the questions posed. The videos were great examples of real-world applications of computing research that were clearly presented at the right level for students.

However, other lecturers felt that the introduction of subject matter relating to postgraduate research was not appropriate for the early stages of first-year undergraduates. One lecturer responded in the survey with the following view:

For the vast majority of first-years in semester 1, which is the only time I teach these groups, they are not ready to start thinking about postgraduate research.

Another lecturer felt that the material presented was more appropriate for more experienced students, commenting that they “felt that second-year students responded better.” The same lecturer struggled to find time in their class for the use of the SUREbyts resources, and decided to “provide them with a list of videos and links to use in their own time.” The videos were designed to be used in class, and ideally for first- and second-year groups, so the feedback helped surface both an inconsistency in target level across different videos and a need to be aware of uses inconsistent with the design.

An overriding objective of SUREbyts is to increase the awareness of research as an activity, with a secondary objective being to raise disciplinary knowledge among students. Greater than 60 percent of the 294 students surveyed agreed that SUREbyts enhanced their understanding of the work of researchers (73 percent), their interest in research in their area (62 percent), and their interest in carrying out research in the future (65 percent). Fewer than this, although still a majority (54 percent), felt that they had an increased understanding of the topics they were

studying in their program. Some student feedback was glowing in praise:

All of this information that I have gathered from her astounding video has allowed me to ponder the world of horticulture. I never expected to be interested in such topics however, through SUREbyts videos I am sure I will discover many new academic discoveries.

Other students, however, shared the view of some lecturers that the videos are more appropriate for later stage students:

As an introduction to new students who have no idea about computer science and are new to it, it is confusing, but for ones who have knowledge about the area it is an interesting and further opening to the subject matter of machine learning.

In general, feedback suggests that both lecturers and students recognized the value of the resources in starting in-class discussion, such as this lecturer:

For the module that I am teaching students need to create a technology solution (high-level prototype design) to address one or more of the SDGs (sustainable development goals), so these examples served as a great point of discussion on how we can design technology to address real-world problems and consider the needs of end users. This is a great resource that I will certainly use in future!

This highlights the importance of the resources being used as part of a facilitated session or class, rather than as a stand-alone web-based resource. The videos are designed to commence, or contribute to, a discussion, for which the role of the lecturer is essential.

Recommendations

The SUREbyts project developed an innovative format for brief videos intended to be used to introduce early-stage undergraduate students to real research projects that are taking place in higher education institutions. The project produced detailed guidelines for video creators and users. The project had a mixed but generally positive response from lecturers and students, as detailed in earlier sections. Based on the experience of running the project, the authors of this article present recommendations in the sections below to other institutions that may wish to adopt some or all aspects of the SUREbyts project.

Video Development

Researchers and research students tend to be time-poor but eager for recognition for their research. Research students should be advised on how the creation of videos for instruction can fulfill the dissemination requirements of

their research grants, and help raise their profile. Lecturers and researchers should be made aware of how teaching of undergraduates can have benefits for active researchers (Feller 2018), and of how research and teaching can support each other (Ashrafa 2010). SUREbyts digital badges were made available to the creators and users of videos, although very few badges were applied for in practice.

Focus

Digital learning provides a means through which otherwise abstract or unknown concepts can be “illustrated and become tangible” (Kerres and Otto 2022, 701). The illustration of the concept, the question, and the possible solutions are central to the quality of the SUREbyts video. It is important to ensure that the creators of the videos are focused from the start on identifying and presenting a clear, easily understood question that will engage their audience in a meaningful discussion. All other aspects of the SUREbyts video will pivot around the question. In the pilot project described here, templates, detailed guidelines, and dedicated, local support were provided to help achieve this objective.

Interpersonal Support

The SUREbyts project benefited hugely from the support of the established SURE Network (O’Leary et al. 2021). As a nationwide network with representatives in institutions throughout Ireland, SURE was able to provide local support, encouragement, and guidance to video creators. This support was invaluable for encouraging participation in the project and subsequent usage of the videos.

Barriers

It is important that as many barriers to participation as possible are lowered or removed. Creators should not have to carry out extensive editing themselves; this should be provided as part of the final production process. Although guidelines are important and should be adhered to as much as possible, some flexibility should be afforded to the makers of the videos to be creative, within reason. Those videos that stray too far from what was expected, such as an excessively long video, will not be as attractive to students and lecturers.

Revise

During the SUREbyts project, it became evident that videos that did not reach a certain threshold of production quality, accessibility of the question, appropriateness of the language used, and content of the presentation would be ignored by lecturers and students. A large disparity in usage between the popular and unpopular videos showed the value of continually revising the videos with feedback until the appropriate quality is reached. Based on this outcome, the SUREbyts group has revised the guidelines to highlight this to future collaborators and content creators.

Lecturers

Lecturers require guidance on how to use the videos effectively. SUREbyts videos should enable students to experience what Pedaste (2022) describes as the orientation phase of research engagement: a “process of stimulating curiosity about a topic and addressing a learning challenge through stating a problem.” (151) For the SUREbyts project, a series of usage scenarios was presented to lecturers to encourage them to use the videos as part of a discussion with their classes. The videos are not intended to be used in the absence of an opportunity for peer discussion. Lecturers can be supported through dedicated training sessions, online resources, and, most valuable of all, case studies of effective use.

Conclusion

Based on feedback received, SUREbyts has proven effective at raising the profile of research among early-year undergraduate students in Ireland. The project team would welcome the adoption by others of the resources, format, or overall approach developed through the project. This article has provided guidance on how to do so. It is hoped that future users will learn from the successes of the SUREbyts project and avoid some of the challenging situations that emerged during the project.

Data Availability Statement

The research instruments used to collect data are available at <https://sure-network.ie/surebyts/use>. The following statements regarding the storage and availability of data were agreed to with the Technological University Dublin Research Ethics and Integrity Committee:

- Data will be stored securely, and analysis will take place within the project team, possibly with the support of a small number of administrators external to the team.
- All data collected will be deleted upon completion of the research, no later than one year following the collection of the data.

Ethical Review Board Statement

The Research Ethics and Integrity Committee of Technological University Dublin approved this project (REC-20-183) on October 11, 2021. This approval was noted and approved by the corresponding committee at each institution at which data were collected.

Conflict of Interest Statement

No conflict of interest to declare.

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