

A school-wide pilot program for incentivising technology-enhanced teaching practices to improve educator and student relationship building

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ABSTRACT

CONTEXT

COVID-19 and the shift to online forms of teaching and learning since 2020 has brought major changes and challenges to tertiary student life experience and students' ability to focus on their studies. Therefore, it is paramount to re-address and elevate student learning approaches and educator-student engagement and relationships in engineering education. The Student Relationship Engagement System (SRES) is an innovative web-based application developed by the University of Sydney. Its unique functionalities have been previously demonstrated to promote positive teacher-student connections, through pedagogically sound application by educators.

PURPOSE

A community of core unit educators implemented and evaluated a 12-month SRES pilot scheme to trial transformative strategies for improving student engagement, feedback delivery, relationship building, process efficiency, and academic integrity within the Biomedical Engineering (BME) degree program at the University of Sydney.

APPROACH

The transformation of multiple units over a 12-month period included the selection of nine core BME undergraduate units, ranging from first-year to third-year levels. A dedicated education design and advisory team partnered with educators in planning and strategic execution of suitable utilisation of SRES to enhance student engagement, inclusion, and sense of belonging. Each educator was supported with financial incentives to use the system and was offered additional part-time teaching support relief so that they could freely explore the use of SRES. The impact of SRES-enhanced changes to teaching practices was evaluated from different perspectives, including through progressive student feedback mechanisms, tracking of student behavioural and engagement changes, teaching team feedback sessions and consultations, educator-submitted reflections, pre-semester surveys to gauge student expectations and notes from the community of practice meetings.

OUTCOMES

The implementation of the pilot scheme in the selected BME units resulted in measured improvement in four dimensions of impact – educator engagement in the exploration of SRES, student satisfaction with the BME learning experience, collaborative information sharing between coordinators and resource creation for wider dissemination.

CONCLUSIONS/RECOMMENDATIONS

The pilot study implementing an incentive and support strategy for teachers to adopt and leverage SRES functionality in core engineering units provided good evidence of its transformative benefit in teacher-student engagement, including increased uptake of the technology by teachers and improved student experience throughout courses. This model may be useful more generally in promoting technology-enhanced transformation of teaching practices.

KEYWORDS

Education, Strategy, Software, Technology, Engagement, Relationship-building,

Introduction

Current and recent global events, including the COVID-19 pandemic and virtual learning experience, have significantly impacted student life experiences and challenged student focus and engagement in engineering education in tertiary institutions (Arif and Shafiullah, 2022). Students have faced increased social disconnection, reduced opportunities for peer-to-peer learning, challenges in providing and receiving assessment feedback, and compromises to academic integrity, thus necessitating a re-evaluation of the approach to student engagement and educator-student relationships.

COVID-19: Impact on the Learning Environment for Biomedical Engineers

The COVID-19 pandemic has substantially disrupted the traditional university learning environment, including reduced social elements that are critical to support learning. The shift to remote learning resulted in far fewer face-to-face interactions among students and between students and educators, leading to a diminished sense of community and belonging in student cohorts (O'Keeffe, 2013). The pandemic limited opportunities for students to build relationships, collaborate, and seek mentorship outside formal academic settings, which in turn has negatively impacted their critical thinking skills, as well as their attitude, curiosity, and motivation towards such activities. Moreover, students have continued to face technological, socioeconomic, and mental health challenges, often amplified by the pandemic context. The gradual return to physical campus life starting in early 2023 for students has not necessarily reversed this impact as students are readjusting to another 'new norm' of tertiary learning after endeavouring to acclimatise to the 'pandemic mode' of learning for the past three years during formative years at the university or in high school (Limniou et al., 2022) (Zhao and Xue, 2023).

Using Technology to Enhance the Virtual and Physical Learning Environment

Interestingly, the pandemic has accelerated the academy's appreciation of the crucial role of education technology to facilitate online learning and maintain academic continuity. Educational institutions have adopted digital tools and platforms to deliver lectures, assessments, and student support services remotely (Limniou et al., 2022). While technology has been instrumental in ensuring learning continued, the loss of natural physical connection either by necessity (e.g. enforced lockdowns) or collaterally (e.g. students customising their learning experience due to personal circumstances and extracurricular commitments) has highlighted the importance of proactively building effective engagement and fostering personalised interactions to establish a strong sense of 'virtual connection'. A good learning environment is built on a solid foundation that encompasses holistic learning avenues at both the social and academic levels (Coll et al., 2014) (O'Keeffe, 2013). As such, a key ingredient in enhancing the learning environment for students is to create a friendly and value-based learning environment by providing effective and timely feedback, as well as structured and interactive learning activities (Nicol, 2006).

Advancements in technology have opened new possibilities in education. The SAMR model (Substitution, Augmentation, Modification, and Redefinition) offers a framework for evaluating the transformative impact technology can have on teaching and learning practices. (Hilton, 2016). Through this model, we can empower educators to improve existing methods and explore innovative approaches to enhance student learning experiences.

Introduction to SRES

SRES (<https://sres.io/>) is a web-based application that functions as an "online programmable spreadsheet", enabling educators to customise student engagement, feedback, and communication between teacher-student and student-student. SRES assists in personalising bulk contact, saving time on data entry, and making targeted and filtered feedback more efficient. This functionality is achieved by creating programmable filters and portals linked to a cohort spreadsheet or "list", in which customisable conditions generate student-specific output, usually in the form of a text-based correspondence. Filters can be used to send personalised emails directly to students via SRES like 'mail merge', whereas portals can be embedded into learning

management systems (LMS) such as Canvas to create a personalised dashboard. SRES enables educators to provide targeted support-based data analysis, facilitate in-class grading with rapid feedback delivery via filters or portals, and manage attendance efficiently. Its functionalities have been demonstrated to promote positive teacher-student connections through pedagogically sound application by educators in other faculties within the University of Sydney (Liu 2019).

The focus of this paper involves the core unit of study coordinators (UoSCs) within the University of Sydney's School of BME leveraging SRES to efficiently scale up personalised pastoral and learning support to large cohorts. This paper reports the results of a 12-month pilot scheme within the School of BME which aimed to (i) Incentivise a community of core UoSCs to upskill and use SRES within the School of BME and (ii) Collectively transform teaching practices using SRES to impact relationship-building between students and educators.

Methodology

The pilot program spanned two consecutive semesters, August – December 2022 and February – June 2023. Seven UoSCs, capturing nine core units of study (UoS), and two educational support staff, including one staff member paid from the Faculty Education Grant, participated in this initiative. The core UoS comprised two in first-year (UoS#1, #2), four in second-year (UoS#3-6), and three in third-year (UoS#7-9), with a mean \pm SD of 140 ± 32 enrolled students.

Contextually, UoS#1, UoS#2, UoS#6 and UoS#9 have had the same UoSC since 2019; UoS#3, UoS#7, and UoS#8 have existed since 2019 but had new UoSCs in place in 2021; UoS#4 was first offered in 2023; UoS#5 was first offered in 2021 and a new UoSC in place in 2023. In Semester 2, 2022, a 'hybrid' delivery mode was offered across the UoS, with roughly 10% of the cohort in core units opting for online delivery (90% for on-campus delivery). In Semester 1, 2023, all students in the School of BME returned to on-campus learning.

SRES Platform

The use of SRES was guided by two key themes: "relationship building" and "improving efficiency". Key functionalities used by our UoSCs included: (1) establishing touch points via student-input surveys; (2) setting up assessment rubrics for scoring and feedback by multiple tutors simultaneously, together with automated aggregation of grades; (3) setting up customised filters and portals for personalised student feedback; (4) attendance monitoring and roll displays; and (5) setting up filters and portals for reminders at key checkpoints in the semester. In each case, the specific functionality was implemented by creating and linking relevant columns in the SRES list for a given cohort to output functions such as filters and portals.

Grant Funding and the Incentive Scheme

The UoSCs were financially incentivised through additional casual teaching support to explore SRES. This was funded through an internal Faculty of Engineering Education Grant administered in Semester 2, 2022 and Semester 1, 2023. The incentive scheme offered core UoSCs teaching/coordination relief up to a maximum of 38 hours (1 week) per unit in exchange for dedicated time to develop basic competencies using SRES and to work with educational support staff to implement UoS-specific SRES-based strategies. Following strong uptake and engagement in the pilot by UoSCs in Semester 2 2022, part of the funding was used to employ an additional education support staff member as an SRES consultant throughout Semester 1 2023. The funds were also utilised to support the educators in creating shared resources.

Whole School Approach

The pilot SRES project embraced a "whole School of BME approach", emphasising the importance of student relationship building and creating an environment for our UoSCs to share and collectively upskill. This approach promoted a cohesive and supportive educational

ecosystem within BME by fostering collaborative efforts and resource sharing. The sharing of UoSC experience and perceptions in using SRES was facilitated through three structured workshops spaced throughout the pilot. The resultant interactions fostered a culture of collaboration and continuous improvement. Educators shared experiences, best practices, and strategies to optimise the use of the SRES and enhance student engagement. The final workshop was run in July 2023 to consolidate key reflections from the pilot and to establish recommendations for a sustainable SRES program in the School. For this reason, the final workshop was an open invitation to all UoSCs regardless of formal involvement in the pilot.

Analysis and Evaluation

The success of the pilot scheme of technology-enhanced transformation of the selected UoS was evaluated through four dimensions of impact: (1) educator engagement in the exploration of SRES; (2) student satisfaction with the BME learning experience; (3) experience and expertise sharing between UoSCs and support staff; and (4) resource creation for broader dissemination.

Outcomes (1), (3) and (4) were assessed through quantitative and qualitative feedback, including commentary on the resources and support provided throughout the initiative, in the form of UoSC reflections and an anonymous survey (Qualtrics). The UoSCs completed this survey at the final workshop, which provided an additional platform for understanding impact in all four dimensions. Qualitative and reflective feedback included: (A) the overall value of the summary workshop; (B) specific value-additions for UoSCs from the workshop; and (C) whether future community of practice sessions would be beneficial. UoSCs were also asked to quantify (out of 10) and comment on their: (A) familiarity with SRES before the pilot; (B) confidence using SRES after the pilot; (C) likelihood of using SRES again in the future; (D) willingness to mentor peers on SRES; and (E) likelihood of recommending SRES to peers. The success of resource creation (4) and educator engagement (1) was also quantified based on the number of shared reflections and the number of portals and filters designed and implemented within SRES. The student learning experience (2) was evaluated using anecdotal data on student response to the various SRES functionalities, using the reflective methods described previously. We evaluated the themes of responses to personalised emails generated by SRES, and carried out a thematic summary of the official anonymous University of Sydney Unit of Study Survey (USS) completed by students. Our results also compared USS scores across three annual periods (Period 1: S2 '20 + S1 '21; Period 2: S2 '21 + S1 '22; and Period 3: S2 '22 + S1 '23) for questions relating to student feedback (*"I have been guided by helpful feedback on my learning"*) and the learning environment (*"I felt part of a learning community"*). Period 3 corresponds to the period of the SRES pilot study. We note that the UoSC for UoS#3 independently implemented SRES in Period 2 prior to this initiative.

Results

Summary of SRES experience from the seven UoSC coordinators:

Table 1 summarises the five distinct functionalities of SRES used by the participating UoSCs and their associated commentary and reflections. Some key insights include:

- Positive feedback from the students who have received personalised and detailed feedback, and positive feedback from the tutors regarding the grading tool (UoS#1, #7)
- *"Increased personalisation resulted in increased "approachability" which in part has attracted research students to the coordinator."* (UoS#2)
- *"Increased use of SRES for personalised emails across the School may diminish the value of SRES towards relationship building"* (UoS#3)
- *"(USS) engagement significantly increased after sending personalised emails, with participation rates rising from 34% to 46% in one business day"* (UoS#4)
- *"The survey-driven approach, attendance tracking, and personalised emails played a role to lower failure rates and increase average marks in units."* (UoS#8)

Table 1. Summary of the SRES functionalities and associated commentary with reference to the SAMR framework and reflections by the UoSC, classified under five key functionalities - 1. Touch points and surveys, 2. Marking interfaces, 3. Personalised feedback, 4. Attendance checking, 5. Personalised emails and nudge reminders

	Functionality					Commentary/Reflections
	1	2	3	4	5	
UoS#1, UoS#6 (same UoSC)	✓	✓	✓	✓	✓	<ul style="list-style-type: none"> Improved convenience and efficiency of marking (A) Allowed for iterative design based on tutor feedback (M) Feedback portals and filters improved formatting of feedback (A) Could provide personalised portals containing a summary of specific student marks for all assessments, along with the cohort averages (M) Reduced unnecessary email reminders to students the messaging didn't apply to. (A) Feedback from students was extremely positive. Future: <i>"We only scratched the surface in terms of personalising the portals and filters, but even what we tried was much better than what we can normally achieve";</i>
UoS#2				✓	✓	<ul style="list-style-type: none"> Provided new insight than Canvas alone on student engagement (M) Ability to tailor personalised emails based on Canvas engagement (R) Allowed for keeping track of student engagement and sending personalised emails when engagement was low (R) Increased personalisation resulted in increased "approachability", which in part has attracted research students to the coordinator.
UoS#3, UoS#5 (same UoSC)					✓	<ul style="list-style-type: none"> User of SRES since before the grant (i.e. 2021) with a focus on relationship building in large cohorts. (A) Only a small amount of cohort responds (10%), but those that do show notable appreciation Many students do not respond to the emails, which may indicate that they know that there is some personalisation function being used Challenge: Increased use of SRES for personalised emails across the School may diminish the value of SRES towards relationship building
UoS#4					✓	<ul style="list-style-type: none"> The inclusion of students' names in the emails helped develop rapport and a sense of belonging, especially in larger classes generating an increased response rate. (M) Survey engagement increased after sending personalised emails (responses rose from 34% to 46% in one business day.) SRES initially seemed complicated, but training and resources made it more manageable. Challenge: Personalised emails should be used selectively to maintain their impact Future: Will expand the use of SRES in the following year as class size increases to 180 students, recognising its advantages for marking and communication.
UoS#7	✓	✓	✓			<ul style="list-style-type: none"> Increased fairness of marking (as tutors marked the same question for the whole cohort) and improved functionality. (A) Feedback from tutors was that once we improved from Quiz 2- 3, it was better than past options and easy to use. (M) Improved the quality and delivery of feedback (reduced requests for re-marks or explanations of marks from previous years) (A) Was easy to learn/implement; Would use it again Future: Plans to expand the use of SRES for larger classes and take advantage of its features for improved communication
UoS#8	✓			✓	✓	<ul style="list-style-type: none"> Allowed for pre-survey to gather insights from students, which helped present course content in the context of their interests. (R) Attendance tracking and personalised emails had a significant impact, leading to student engagement and conflict resolution. (M) The survey-driven approach, attendance tracking, and personalised emails played a role to lower failure rates and increase average marks.

						<ul style="list-style-type: none"> • Future: Plans to continue implementing effective activities with SRES and expand use to marking interfaces and personalised feedback.
UoS#9	✓		✓	✓		<ul style="list-style-type: none"> • Grouping for assessments didn't provide a lot of value, especially because Canvas LMS has a similar function (S) • Experimented with embedding a form after lectures for student reflection but found the standalone approach less effective. (R) • Initially used SRES to trial personalised communication and feedback for students; ~10% of students responded with positivity on the personalised emails that summarised their grades. (M) • Future: Plans to integrate interaction during lectures and use SRES for programmable marking and feedback in the future.

Feedback from UoSC Workshop Survey

There were eight respondents to the final survey: six were UoSCs involved in the pilot; of the remaining two respondents, one had previous experience using SRES. On the “helpfulness of the concluding workshop”, 7 out of 8 attendees found the sharing from other educators “useful”, and 1 out of 8 “somewhat useful”. A common theme in the feedback was how different each use of SRES had been across UoSC participants (6 out of 8 respondents) and how this encouraged coordinators to try new features (5 out of 8 respondents). When asked if more “community of practice” workshop sessions would be useful, 6 out of 8 attendees responded “yes”, and 2 out of 8 responded “maybe”. Participants believed that these sessions would be most useful either bookending the semester (3 out of 8 respondents) or once during the semester (3 out of 8 respondents). One participant believed that time was better spent with one-on-one support in implementing new tools, “...I think for implementation, having one-on-one meetings would be the most important to customise the tool for that particular unit.”

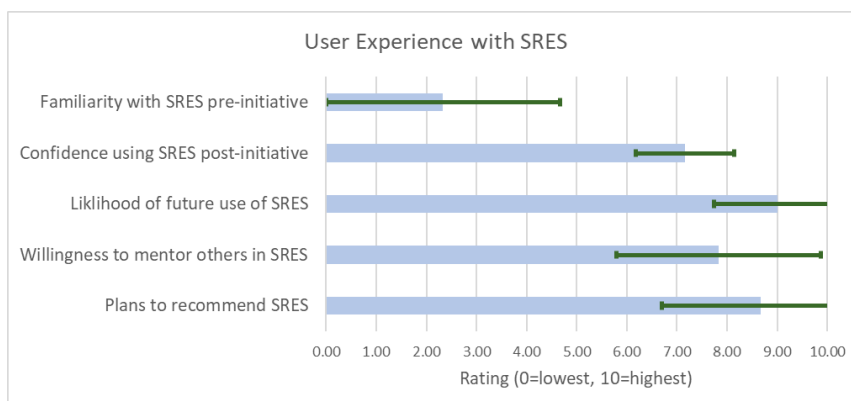


Figure 1. Scores reflected in the concluding workshop regarding the SRES user experience.

Figure 1 shows that the UoSCs (n = 7) were largely unfamiliar with SRES before the initiative was implemented (2.3 ± 2.1 out of 10). After the initiative, we report a statistically significant increase in their confidence using the SRES platform to 7.2 ± 0.9 out of 10 (p<0.05). We also observed positive survey outcome scores for the likelihood of using SRES again in the future (9.0 ± 1.1 out of 10), willingness to mentor peers on SRES (7.8 ± 1.9 out of 10), and the likelihood of recommending SRES to peers (8.7 ± 1.8 out of 10) (data presented in mean ± SD).

Analysis of Student Feedback through USS metrics and commentary

Figures 2A and 2B indicate the USS scores for the questions “I have been guided by helpful feedback on my learning” and “I felt part of a learning community”, respectively, across the three nominated periods. For both questions, there was a notable increase in score for the 1st- and 2nd-year core UoS#1-#6 between Periods 2 and 3. The exception was UoS#3, implemented SRES in Period 2 and which demonstrated a notable increase between Period 1 and Period 2. 3rd-year core units generally decreased in score for the two questions between Period 2 and Period 3. UoS#4 was offered for the first time in Period 3.

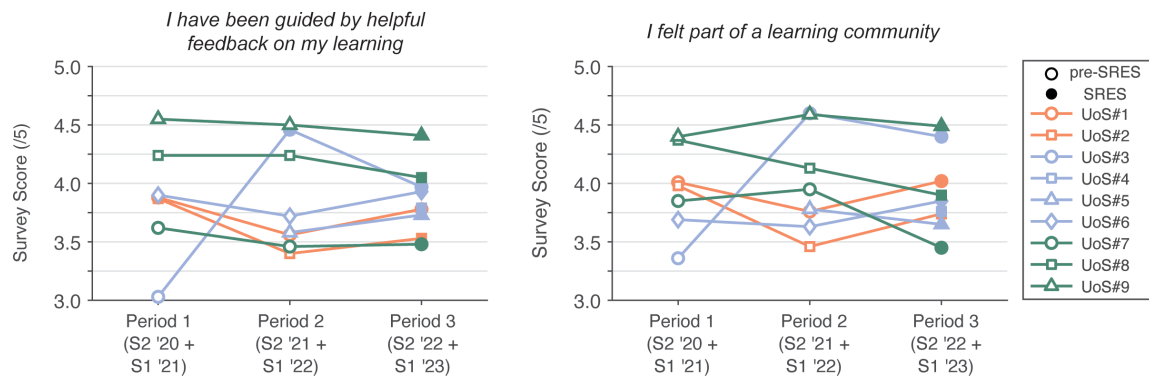


Figure 2. USS scores (out of 5) for the questions (A) “I have been guided by helpful feedback on my learning” and (B) “I felt part of a learning community.”

Furthermore, a thematic analysis of the USS comments that pertain to the potential SRES intervention was carried out. The key themes identified within the written comments of the USS survey were: (1) Appreciation for transparent marking criteria, which helps students understand their evaluation better; (2) Praise for personalised feedback on quizzes and assignments; (3) Positive remarks about unit coordinators who are organised and communicate well with students; and (4) Appreciation for regular feedback and updates from the unit coordinators.

Discussion

This study trialled an incentivised model for UoSCs to upskill in SRES, an in-house education technology to promote a positive learning environment through relationship building, and to trial targeted SRES approaches in their UoS with expert support. The outcomes are primarily reported through the educators’ lens (Brookfield 1998). This approach of reporting through the educators’ lens is important, as no matter how excellent a piece of technology is, the primary users must embrace and be enthusiastic about its implementation for effective utilisation (Lachner et al., 2021). The experience of UoS coordinators involved in the pilot was overwhelmingly positive. Student feedback also reflected clear benefits from the initiative. Some of the key conclusions that reflect the experience of our UoSC and how they have upskilled in the SRES implementation, derived from the collected reflections, workshops, USS student comments and scores, and the end-of-initiative survey, are as follows:

Personalised Communication: SRES was successful in enabling personalised communication between instructors and students. Sending individualised emails, tailored surveys, and specific feedback allowed students to feel seen and heard, fostering a sense of belonging and rapport.

Improved Student Engagement: SRES contributed to enhanced student engagement. Features such as pre-semester surveys, attendance tracking, and progress-checking emails motivated students to participate in course activities and respond positively to communication efforts, including calls to complete the end-of-semester USS survey (UoS#4). Student feedback on SRES implementation was consistently positive, with students appreciating personalised emails, engagement with feedback portals, and timely reminders about deadlines. Educators can leverage SRES to enhance student experience and build a positive learning environment.

Efficient Assessment Management: SRES effectively facilitated assessment management, e.g. for quizzes and assignments. Simultaneous marking by multiple tutors, automated feedback generation, and centralised data tracking streamlined the assessment process and saved time.

Community of Practice: Educators could share their experiences and strategies with SRES, which was valuable in fostering a network for upskilling and learning from one another.

Continuous Learning and Refinement: Many educators found value in fine-tuning their approaches, exploring new strategies, and sharing experiences with SRES. Continuously refining

SRES usage can lead to improved student engagement and learning outcomes; one coordinator had explicitly attributed the reduction in fail rate and higher mark attainment to SRES (UoS#8).

Customised Support and Resources: UoSCs expressed interest in continued support and resources for implementing SRES. Dedicated one-on-one meetings and written resources like simplified "cheat" sheets can help guide educators' use of SRES. UoSCs also identified the value of ongoing support from support staff and colleagues in implementing new SRES strategies.

Exploring New Features: Educators expressed interest in exploring the features of SRES used by other UoSCs, such as personalised communication and feedback dissemination. Workshop participants highlighted the diverse ways SRES were used across different UoS. This diversity encouraged educators to try new features and adapt SRES to suit their specific teaching needs.

The initiative had achieved its primary aim to establish a community of core UoSCs within the program and collectively upskill and transform teaching practices using SRES to impact relationship-building between students and educators, as evidenced by the generally positive reflections and feedback provided by the UoSCs in the School of BME at the University of Sydney. With the increased anticipated use of SRES within the School of BME, we expect this core group of UoSCs to be a platform to disseminate further and encourage the use of technologies such as SRES to enhance not only the engagement of students within these units but also to more effectively manage feedback and educator-to-student communication, which are critical ingredients in delivering effective learning activities and curriculum (Maier and Klotz, 2022). It is also encouraging that coordinators were able to appreciate the value of being upskilled in using educational tools such as SRES and that the intended outcome of the additional financial support in both buying out time in the form of additional support for this initiative has helped with the success of this program (Brody and Hadar 2011) (Lachner et al., 2021). A similar framework to the one implemented in this study can also be readily applied to any other education technology identified in the future for potential improvement in the educational experience of the UoSCs and the students within engineering programs.

For this study, the thematic analysis of the formal USS provides useful information on the student experience potentially influenced by SRES implementation, such as positive comments on active engagement and effective communication by the UoSCs, and personalised and regular feedback. The authors take obvious caution in weighing our discussions and conclusions based on the USS scores. Firstly, students are unaware that SRES is being used for their UoS. USS scores are often a product of multiple concomitant factors that cannot be solely attributed to a single intervention like the use of SRES implemented for our study. However, these scores can serve as rough indicators where a potential impact trend can be noticed. Notably, we find that almost all of our 1st-year and 2nd- year core units see a jump between the periods where SRES is implemented for the two questions about feedback and the learning environment. This jump cannot be solely due to SRES implementation, but rather a mix of factors, including the fact that the students could return to campus and physically experience the learning environment.

Overall, UoSCs in the School of BME experienced SRES as a valuable tool for enhancing student engagement, providing personalised feedback, and improving the learning experience. UoSCs benefited from the financial support in providing the opportunity to upskill in SRES and recognised the positive impact of SRES and intend to use it in the future, making considerations to optimise its effectiveness and maintain meaningful interactions with their students.

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