THE UNIVERSITY OF SYDNEY STEM TEACHER ENRICHMENT ACADEMY

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THEME:

Teacher education and professional learning in STEM

SYMPOSIUM OVERVIEW

Established within The University of Sydney in 2014, the STEM Teacher Enrichment Academy has an alumnus of 800 teachers from 139 high schools and 370 teachers from 90 primary schools. The Academy is driven by the belief *that STEM education is not a 'fad' and has the potential to transform pedagogy, thus motivating and enthusing students to participate more fully in the STEM disciplines, continue into senior secondary STEM subjects and beyond, ultimately addressing a shortage in STEM-related careers*

As the availability of professional learning opportunities in STEM for in-service teachers increase, their efficacy needs to be queried in a scholarly manner. The significance of this symposium is that it shares the design and structure of the Academy's evidence-based programs as well as research on its efficacy.

STRUCTURE OF THE SYMPOSIUM

Presentation 1 distills evidence from four years of research on the impact of Academy programs on teachers and identifies success factors for school STEM projects.

Presentation 2 outlines the design features of the Academy programs, exemplifying using secondary STEM projects.

Presentation 3 outlines an innovative tri-level approach for shifting towards integrated STEM in the primary program and initial research on its efficacy.

Time will be provided for questions and discussion. Participants are invited to view the Academy website and come prepared with questions and/or comments.

STEM Academy website. https://www.sydney.edu.au/engage/schools/stem-teacher-enrichment-academy.html.

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THE EFFICACY OF STEM ACADEMY PROGRAMS, INCLUDING SUCCESS FACTORS

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THEME

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BACKGROUND AND AIMS

While in-service professional learning opportunities for teachers of STEM related subjects have flourished and offerings continue to grow, the jury is still out on the efficacy as well as success factors for such programs. In particular, Margot and Kettler (2019) in their systematic review of teachers' beliefs and perceptions of STEM in schools, recommend quality in-service instruction and collaboration time with peer teachers. Since the core function of the STEM Teacher Enrichment Academy (Anderson, 2019) is provision of year-long in-service programs in which school teaching teams collaborate in designing their school STEM projects, reorganising curriculum, and planning deployment and evaluation, examining the efficacy of Academy programs provides insights on both teacher development as well as success factors for in-service STEM professional learning programs. This presentation will address both;

What evidence is there of the impact of the STEM Academy on teacher development?'

What are the success factors for implementation of STEM projects in schools?

METHODOLOGY OR PROCESS(ES) UNDERTAKEN

Over the lifetime of the STEM Teacher Enrichment Academy, substantive research has been undertaken on the impact of Academy programs on teachers, students, and schools. A content analysis of the research questions, methods and findings on teacher efficacy as well as case studies on implementation of STEM projects has been conducted.

RESULTS AND CONCLUSIONS

The results show that the Academy programs facilitate pronounced shifts in teachers' understanding and implementation of curriculum integration, making processes and outcomes purposeful and intentional. In addition, there are statistically significant shifts in teacher self-efficacy. According to teachers, one of the most pleasing aspects has been improved engagement from students who were generally more disengaged. Success factors, pointing to implications for good practice in in-service STEM professional learning programs are: (1) extended programs (2) equipping teachers with STEM tools and resources, (3) time for peers to develop customised STEM lessons for their learners in view of their school context, (4) sharing with other teachers, (5) mentor support and (6) support from leadership team.

REFERENCES

Anderson, J. (2019). Supporting STEM curriculum implementation with professional learning: The University of Sydney STEM Teacher Enrichment Academy. *Journal of Physics: Conference Series. 1340 012001*

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SUPPORTING SECONDARY TEACHERS TO DESIGN AND IMPLEMENT INTEGRATED STEM PROJECTS

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THEME

Teacher education and professional learning in STEM

BACKGROUND AND AIMS

The STEM Teacher Enrichment Academy provides accredited, high quality professional learning, focussed on themes embedded in the Australian Curriculum (F-12), for teachers of Science, Technology and Mathematics, through a year-long program. These programs aim to enhance teachers' knowledge of content and pedagogy and ultimately improve students' engagement in STEM disciplines in senior high school (Year 11 and 12) and beyond. Each school is invited to send up to six experienced teachers or leaders (ideally two science, two mathematics and two technology) who have a commitment to STEM education and can implement STEM strategies both within their discipline as well as across the STEM disciplines. To demonstrate the University's commitment to the partnership, teacher relief costs, and in some cases, travel and accommodation, are funded by the Academy.

The secondary program includes a three-day residential workshop commencing at the end of school year, a one-day workshop (non-residential) mid-year, and a final one-day Showcase and Graduation (non-residential) in October of the following year. In addition, each school is assigned a mentor who supports them, throughout this period, to develop, implement and evaluate their STEM projects. After completion of the program, the Academy continues to engage teachers in a range of ongoing professional learning opportunities at the University.

In this presentation we will provide details on the structure of the program and share examples of the projects undertaken by school teams that completed our program in 2020/2021 and the position of these on the 'inclined plane of STEM integration' described by Vasquez (2015).

METHODOLOGY OR PROCESS(ES) UNDERTAKEN

Final reports and presentations were analysed to examine the scope and breadth of each school's STEM projects and evaluate their level of integration. Projects were assigned to the following categories: disciplinary, multidisciplinary, interdisciplinary and transdisciplinary.

RESULTS AND CONCLUSIONS

Preliminary analysis shows that the majority of projects fall in the multidisciplinary and interdisciplinary categories. Few projects met the criteria for the highest level of integration, the transdisciplinary category. Our results show that although schools are committed to embedding an integrated STEM strategy, designed to engage and motivate students to continue with their studies in STEM, a truly interdisciplinary approach is achievable only when school structures allow access to appropriate resources (including time and teaching materials).

REFERENCES

Vasquez, J.A. (2015). STEM – Beyond the acronym. Educational leadership, 72(4), 10-15.

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STEM EDUCATION 1, 2, 3

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THEME

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BACKGROUND AND AIMS

A growing body of research advocates the educational value of engaging primary students in authentic integrated STEM inquiry projects, yet also identifies the difficulties that teachers can have in achieving the high-quality student-learning experiences to which they aspire (Anderson et. al., 2019; Rosicka, 2016). Less research is available to guide the design of effective approaches to support teachers through the complexities of moving towards curriculum integration and increased student autonomy in STEM projects. After two years of working with teachers, the STEM Teacher Enrichment Academy developed a tri-level approach to scaffolding the skill development of teachers and their students (1 STEM skills, 2 Design process, 3 Integrated STEM projects).

The purpose of this presentation is to reveal the initial findings of an ongoing study focused by the research question: In what ways does the *Tri-levels* approach to STEM education support the development of STEM integration practices in primary schools?

METHODOLOGY OR PROCESS(ES) UNDERTAKEN

Teachers from the 2021 Academy program were invited to participate in one semi-structured interview at the end of the year. Twelve teachers from five of the schools were available in the limited timeframe. Interviewees were sent a copy of the guide questions and could opt for an individual or school-group interview via Zoom. Interviews were audio-recorded and transcripts analyzed using a thematic approach.

RESULTS AND CONCLUSIONS

All teachers found that working through the first two levels was critical for preparing both the children and teachers for the challenges of larger integrated STEM projects. The importance of taking time to develop students' collaborative group work skills was emphasized, as was the value of students' listening to each other's ideas and learning from failure in the design process. A strong theme was the usefulness of the tri-level approach for building the confidence of teachers involved in the Academy, and as structure for conducting professional learning to involve other teachers across the school.

The initial findings suggest the efficacy of the tri-level approach and form the foundation for gathering further evidence through continuing the study.

REFERENCES

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Rosicka, C. (2016). Translating STEM education research into practice. Camberwell, Vic.: Australian Council for Educational Research.

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