Integrating STEAM into Early Childhood Education Planning and Practice

Investigating the barriers and facilitating factors

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This article discusses the role of STEAM in early childhood education and care (ECEC), and why the terminology used should be *STEAM* as opposed to *STEM*. It reports on the author's ongoing PhD research exploring educators' integration of STEAM in ECEC practice.

Introduction

Science, Technology, Engineering, the Arts and Maths (STEAM) is an approach that draws on knowledge and skill from two or more of the STEAM domains (Hapgood et al., 2020) which are applied to address real-life problems and find practical solutions (Moore et al., 2014). For example, the use of solar panels to promote sustainable energy draws on scientific understanding of solar energy, mathematical knowledge to calculate energy requirements, and technology, engineering, and creativity to design and create the solar panels and associated infrastructure to transform the sun's energy into a useable power source.

The use of solar panels draws on scientific understanding of solar energy, mathematical knowledge, technology, engineering, and creativity.

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Recently there has been increasing focus on STEAM in educational policy and curriculum reform in Ireland. From the recent literature review by French et al. (2022) to the reform of the primary school curriculum (Department of Education [DE], 2023a), the enriching educational benefits of STEAM are reinforced. However, the Department's 'STEM Education: Policy Statement 2017–2026' (DE, 2017) and Department of Education Inspectorate report (2020) recognise that educators in early childhood education and care (ECEC) need training and supports to help them incorporate STEAM into their practice.

STEAM, not *STEM*

The arts undoubtedly has a significant role to play in the STEAM approach. In recent years the value of the arts and creativity has been recognised as supporting the development of future-oriented skills (Kim & Kim, 2017) and engagement of the STEM learner (Allina, 2018). The arts have particular relevance for ECEC as a modality to support children to express their ideas and thoughts about how the world works (Sharapan, 2012), in addition to expressing their interest in, and knowledge of, the other STEM domains (Johnston et al., 2022).

This year the DE published recommendations for enhancing STEM education, aligned with the arts, due to opportunities for enriched STEM engagement which the arts can offer (DE, 2023b). But the terminology it used is 'STEM and the Arts', due to concerns that using 'STEAM' might undermine the value of the arts:

> *The acronym STEAM . . . carries the risk of framing the arts in education entirely within its relationship to the STEM disciplines and ignoring the wider reach of arts education beyond its commonality with those disciplines (p.3).*

Contrastingly, I suggest, just as the arts support engagement and expression in the other STEM areas, it would be difficult to identify an area of arts engagement that does not draw on STEM funds of knowledge. For example, a dancer uses spatial reasoning when moving across the stage, or uses gravity when lifting their partner; a graphic designer uses technology and software; a sculptor uses knowledge of scale, height, and geometry to create a lifelike piece.

Separating the 'A' and using 'STEM', or even 'STEM and the Arts', may actually perpetuate an idea that the arts are subservient to the other STEM domains. Whereas 'STEAM' places significant and equal importance on each domain, highlighting STEAM's reciprocal transdisciplinary nature, where the arts can both support and be supported by the other domains.

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A dancer uses spatial reasoning when moving across the stage, or uses gravity when lifting a partner.

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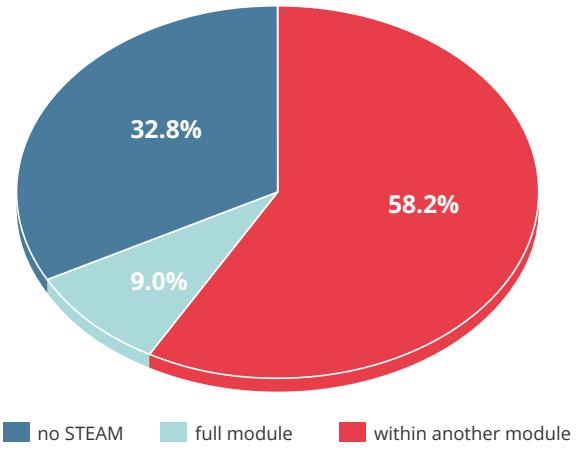
My STEAM in ECEC research

58% of survey respondents reported receiving no STEAM training during their initial ECEC qualification, 32.7% said that STEAM was incorporated within another module, and only 9% said that a full module on STEAM was included in their initial training.

The OECD calls for ECEC to become increasingly 'future-oriented' (2023, p.117) so that children are enabled to be active 21st-century citizens. Incorporating STEAM in ECEC helps children to develop important 21st-century skills to support this (Leavy et al., 2022; OECD, 2023). However, research indicates that educator knowledge and beliefs about STEAM can significantly impact their ability and inclination to include STEAM concepts (Ball & Cohen, 1996; Pajares, 1992; DeJarnette, 2018; Jamil et al., 2018).

My PhD research, funded by the Higher Education Authority's (HEA) Technological Universities Transformation Fund and Dundalk Institute of Technology, explores the barriers and facilitating factors affecting the integration of STEAM in ECEC practice. Its findings will be used to develop an appropriate STEAM training intervention for educators.

In the first phase, data from surveys (n = 245) and focus group participants (n = 6) indicated that the biggest factor affecting educators' integration of STEAM is insufficient training. Most survey respondents (58%, or 142) reported receiving no STEAM training during their initial ECEC qualification, one third (32.7%, or 80) said that STEAM was incorporated within another module, and only 9% (22) said that a full module on STEAM was included in their initial training.



STEAM During Initial Qualification

The survey findings also indicated that educators who received STEAM training perceived their knowledge of STEAM to be higher and were therefore more likely to consider STEAM in their planning and practice. This aligns with existing literature describing how educators' belief in their understanding and ability in a particular area directly impacts their behaviour (Hsiao & Yang, 2010) and their ability to successfully introduce an area into practice (Greenfield et al. 2009; Tschannen-Moran et al., 1998).

The next stage of my research will involve developing and delivering a STEAM training intervention to a cohort of practising ECEC educators. The following six themes, identified through reflexive thematic analysis (Braun & Clarke, 2022) of the focus group data, will be addressed when developing the training:

1. The Importance of STEAM	Does the training support educators to understand the importance of STEAM in ECEC?
2. Definition of STEAM	Does the training support educators to fully understand the definition of STEAM and the role of the educator to facilitate STEAM?
3. (Mis)Perceptions of Technology	Are perceptions and misperceptions addressed to delineate what constitutes technology and the importance of active over passive use?
4. Training and CPD	Does the training meet educators where they are at in terms of differing levels of qualification and prior interest in and knowledge of STEAM?
5. Intrinsic Value of the Arts	Does the training appropriately address the important reciprocal role of the arts within STEAM?
6. Other Barriers	Does the training address other barriers, including time and cost of materials, to support educators to incorporate STEAM seamlessly in their practice using affordable and accessible resources?

Conclusion

STEAM in early childhood education and care helps children develop important 21st-century skills and dispositions such as critical thinking, problem-solving, and collaboration. However, ECEC educators are not currently receiving training to support them to incorporate STEAM in pedagogical practice. My research aims to address this issue.

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