

“WHAT’S NEXT?”: A PROJECT-BASED STEM WORK EXPERIENCE MODEL FOR FUTURE TECHNOLOGISTS

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Abstract

This paper aims to present and evaluate ‘What’s Next?’, a project-based STEM work experience model designed to bridge classroom learning and industry readiness for secondary pupils. Unlike typical STEM placements, the programme combines agile rituals, peer-led teaching, and structured reflection against 17 competencies, creating a distinctive approach that blends technical practice with metacognitive and civic dimensions. We designed “What’s Next?” to feel like a real week in a software team. In collaboration with Cardiff Commitment and Technocamps, pupils in Years 10–12 stepped into roles, ran sprints, built educational tech, and then taught younger learners using what they had made. Over two summers (2023–2024), demand grew from 28 to 32 places from ~80 applicants, and in 2025, 96% of participants said they would recommend the programme. In this paper, we tell the story of how the week works—day by day—why we chose agile rituals and accessible tools (Minecraft Education, LEGO® SPIKE™, BBC micro:bit), and how daily reflection against 17 skills connected classroom learning with workplace expectations. We situate the design within the Curriculum for Wales Digital Competence Framework and the Cardiff Commitment ecosystem and draw on evidence from STEM project-based learning, agile pedagogy, and game/robotics-based education. The narrative offers a replicable pattern for schools, universities, and employers who want to build inclusive, high-engagement STEM work experiences that align with regional skills needs (Department for Education, 2025; Open University in Wales, 2025).

Keywords: *STEM education, project-based learning, work experience, agile learning, digital competence.*

1. Introduction

The starting point was simple: young people need earlier, better, and more authentic encounters with digital work. In Wales—as across the UK—employers continue to report skills shortages, particularly in AI and digital roles, and they call for structured, inclusive routes into those fields (Department for Education, 2025; Open University in Wales, 2025).

Policy already points in the same direction. The Curriculum for Wales makes the Digital Competence Framework (DCF) a mandatory cross-curricular skill, positioning digital capability alongside literacy and numeracy (Hwb, 2018; Hwb, 2025). Locally, the Cardiff Commitment convenes schools, employers, and universities to open “eyes and doors” to work, creating partnerships for experiences that matter to pupils (Cardiff Commitment, 2022; Cardiff Commitment, 2025).

Within this ecosystem, we built “What’s Next?” as a week that feels like real software engineering: problem framing, sprints, stand-ups, demos, and retrospectives—culminating in delivering workshops to primary pupils. We drew on Technocamps’ national network, which offers free STEM outreach and teacher professional learning across all Welsh universities (Technocamps, 2025; Swansea University, n.d.).

What distinguishes this model from other experiential STEM programmes is its integration of agile rituals, peer-led teaching, and structured reflection against 17 competencies—elements rarely combined in short-term work experiences. These features make the programme unique in blending technical practice with metacognitive and civic dimensions.

2. The story so far: Why a week, why agile, why these tools

We chose a single, immersive week to create momentum and purpose. A short, time-boxed project offers the urgency that many pupils find motivating, while still allowing for iteration and reflection (Rehman et al., 2024; Balemén & Keskin, 2018). Day 1 begins with a paper-airplane simulation: pupils experience planning, a sprint, a review, and a retrospective—plus a shared Definition of Done.

The simplicity of paper and the physicality of flight make agile ideas stick (Frydenberg, Yates, & Kukesh, 2018; Agile Alliance, n.d.).

From there, teams select a brief: build an educational resource we can deliver to primary pupils. Some choose Minecraft worlds to teach biodiversity or cybersecurity; others design SPIKE™ robots or micro:bit systems to explore sensing and data. The toolkit matters: Minecraft, SPIKE™, and micro:bit lower barriers to entry and support mixed-ability teamwork, which research links to engagement, creativity, and inclusive participation when tasks are scaffolded (Sarıçam & Yildirim, 2021; Nebel, Schneider, & Rey, 2020; Micro:bit Educational Foundation, 2025; Education Business UK, 2023).

3. Pedagogical frame: Design–build–test–teach

Our week follows a design–build–test–teach cycle. Teams define a problem and audience, prototype solutions, test with peers, and then teach primary pupils using their artefacts. Project-based learning (PBL) meta-analyses consistently report positive effects—often moderate to large—for science and STEM achievement and creativity when experiences are authentic and well scaffolded (Balemen & Keskin, 2018; Kwon & Lee, 2025; Cao et al., 2025). Agile rituals provide the metacognitive spine that keeps PBL moving: planning focuses attention; reviews promote feedback; retrospectives turn experience into improvement (Frydenberg, Yates, & Kukesh, 2018; Agile Alliance, n.d.).

Because game-based and robotics tools can increase cognitive load if used without structure, we build micro-rubrics and checklists for each tool. Evidence on Minecraft shows engagement is high but learning gains depend on careful scaffolding and alignment to outcomes (Tablatin, Casano, & Rodrigo, 2023; Minecraft Education, n.d.). Similarly, SPIKE™ and micro:bit are most effective when tasks are purposeful and inclusive, supporting computational thinking and collaboration (Education Business UK, 2023; Mardian & Azzahra, 2024).

4. What happens during the week: A narrative walkthrough

On Monday morning, the room feels like a studio: sticky notes on the wall, teams huddled around paper airplanes. By the afternoon, pupils have self-selected roles—product owner, developer, tester—and they have set their Definition of Done. Tuesday is build day: one team tinkers with redstone logic in Minecraft to model secure doors in a “cyber lab,” while another gets its SPIKE™ robot to sort coloured bricks using a light sensor. In a corner, a micro:bit group is logging blue-tooth signal strength to demonstrate how data changes with distance. Each team runs a stand-up, shows progress, and captures feedback (Frydenberg, Yates, & Kukesh, 2018; Tablatin, Casano, & Rodrigo, 2023).

Wednesday is iteration. We encourage pupils to test with peers and revise based on what primary pupils will need. Research on informal STEM PBL suggests small group sizes, clear assessment, and appropriate duration amplify effects; we intentionally keep teams compact and the project time-boxed (Santhosh et al., 2023; Rehman et al., 2024).

Thursday pivots to presentation and pitching. Industry volunteers (e.g., Red Hat) run short sessions on speaking clearly, telling a story, and building confidence. Friday is delivery day: pupils teach primary classes with their own materials. The act of teaching consolidates understanding and gives immediate, human feedback—smiles, questions, and moments of “I get it now” (NatCen/SQW, 2017; CEDEFOP, 2018).

5. Evaluation: What we heard, what we saw

Evaluation draws on mixed methods: daily self-assessments across 17 skills, mentor observations, and end-of-week surveys. These instruments capture both perceived and observed growth in technical and employability skills, aligning with best practices for experiential learning assessment.

We capture daily self-evaluations across 17 skills (teamwork, communication, dependability, productivity, initiative, problem-solving, and more) and mentor observations, then a cohort survey on Friday. In 2025, 96% of pupils recommended the programme; perceived gains were strongest in teamwork, communication, and project management. These findings mirror UK evidence that structured work-experience activities build employability skills when well prepared and debriefed (NatCen/SQW, 2017; CEDEFOP, 2018).

Participants loved the hands-on, collaborative feel—especially LEGO-based engineering and team project development—but they asked for more kits, clearer scheduling, and deeper technical content. Those requests align with the literature: resources and scaffolding mediate PBL outcomes, and technical depth should be staged as confidence grows (Santhosh et al., 2023; Balemen & Keskin, 2018).

6. Reflections: What made the difference

Four elements mattered most. First, authenticity: designing for real primary pupils adds purpose and quality stakes. Second, agile as shared language: rituals and definitions kept projects moving and gave teams agency. Third, accessible tooling: Minecraft, SPIKE™, and micro:bit allowed everyone to contribute somewhere—build, code, test, present. Fourth, regional infrastructure: the DCF and Cardiff Commitment lent curricular legitimacy and connected us to employers and schools (Hwb, 2018; Cardiff Commitment, 2025).

We also recognise limits. Our evaluation is short-term and self-report heavy. Next, we will introduce pre/post rubrics keyed to DCF strands, add artefact quality ratings, and track medium-term outcomes (e.g., enrolment in CS qualifications, apprenticeships), responding to calls for structured skills plans and evidence-backed pathways (Open University in Wales, 2025; Department for Education, 2025).

7. Replication guide: Practical steps for schools, hubs, and employers

Start with a one-week frame and a paper-airplane agile simulation on Day 1; keep teams small and goals clear. Build briefs around real audiences (e.g., a local primary class) and a Definition of Done. Use frequent demos and retrospectives to manage scope and surface learning (Frydenberg, Yates, & Kukesh, 2018; Careers & Enterprise Company, 2017).

Choose accessible tools and scaffold them with micro-rubrics; budget for enough SPIKE™ and micro:bit kits to reduce bottlenecks; borrow or share kits across a local network. Map tasks explicitly to the DCF to support buy-in, and draw on city or regional initiatives (e.g., Cardiff Commitment) for employer talks and school links (Hwb, 2018; Cardiff Commitment, 2025).

Evaluate every day. Pair pupil self-ratings with mentor notes and artefact reviews. Build a simple pre/post rubric for computational thinking, collaboration, and communication, and track progression across terms where possible (NatCen/SQW, 2017; CEDEFOP, 2018).

8. Conclusion

“What’s Next?” shows that a short, agile, and authentic work-experience week can make STEM feel accessible, purposeful, and communal. Pupils leave with stories of what they built and taught—and with clearer language for how teams plan, test, and improve. With modest resourcing, strong partnerships, and careful scaffolding, this model can be replicated across schools and hubs to strengthen regional pipelines into digital careers (Technocamps, 2025; Universities Wales, 2018).

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