Simulated internships in schools: engaging learners with the world of work to promote collaborative creativity

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Abstract

School curricula have often struggled to authentically engage young people with the world of work. This chapter examines the potential of 'simulated' school classroom-based internships to support collaborative and creative learning and links to the workplace. It reports on design-based research in areas of low social mobility in England. This investigates how simulated internships give students access to authentic experiences of workplace practices in addition to enhancing skills associated with collaborative creativity. Through a challenge-based learning pedagogy implemented as part of regular classroom instruction, simulated internships involve small groups of students aged 11-13 studying Computing or Design and Technology. Over six-to-seven-weeks, together they design, model, or build a local solution to a global challenge presented virtually by engineers in two leading international telecommunications companies. An empirical 'case study', based on discourse and thematic analysis, is provided to evidence the scope and challenges of embedding a mutual focus on creative collaboration and supporting authentic insights into the world of work. Reported research is significant as it offers a proof of concept that identifies the potential of simulated internships in generating meaningful insights into the world of work. Focused on the development of collaborative creativity, this conceptualisation of simulated internships can inform and guide future pedagogical and research initiatives. Potentially this could expand to cover other curricular areas and, indeed, other educational settings.

Keywords

simulated internships; schools; collaboration; dialogue; creativity; industry; world of work

1. Introduction

By the time somebody aged 11 today is 21 it is conservatively estimated that around 400 million people globally will lose their jobs due to technological advances such as automation (Manyika et al., 2017). In the UK, for example, around 20% of all workers are considered at high risk of being replaced by machines (PricewaterhouseCoopers, 2018). These threats were acknowledged before COVID-19, with the situation even more precarious now. Automation, in tandem with the aftermath of the pandemic, is creating a 'double-disruption' scenario for workers. In addition to likely pandemic-related economic contraction, technological adoption by companies is predicted to transform tasks, jobs and skills as early as 2025 (World Economic Forum, 2020).

However, commentators' perspectives are not all negative. The same advances in technology that threaten jobs may also lead to new employment possibilities and the redefinition of existing roles. Innovative approaches to education are nonetheless needed if young people are to take advantage of such opportunities.

Surveys of employers appear to tell a consistent story about the skills and competencies workers need: technical and practical skills alongside transferable skills, such as creativity and teamwork, that help individuals thrive in any organisation. Indeed, it is widely recognised – if occasionally disputed – that education today should include education for the 'future skills' that will enable young people to navigate a rapidly-changing world of work (Kotsiou et al, 2021; Wagner, 2010). Employers also need access to aspiring talent that could be nurtured through links between education and enterprise. This raises important questions: How may we best enable learners to develop such skills and competencies? And, how can such skills and competencies be developed through linking education meaningfully to real-world work contexts?

Traditional curricula in schools have often struggled to authentically engage young people with the world of work. Most work experience also tends to happen during the latter stages of school. By that time, young people's ideas about careers may have been formed. Research suggests children decide their future interests surprisingly early: around the time of starting secondary school (Croll et al., 2010) if not before (BBC, 2019). Policies such as the Department for Education's Careers Strategy (2017) – which requires all learners in secondary (high) school in England to have a 'meaningful encounter' with an employer at least once a year – are a positive step towards strengthening links between schools and the world of work. But more needs to be done if the gap between education and the workplace is to be bridged. School classroom-based 'simulated internships' offer one possible way of responding to this challenge. This is because they might offer engaging, collaborative, and creative learning environments – grounded in authentic industry practices (such as designing, researching materials and prototyping) – that better prepare students for an increasingly dynamic global environment (Irvan, 2020).

Consider the example of engineering. The impression young people have of engineering can be limited and negative unless they encounter engineers in their workplace. This is often difficult to organise and supervise given the nature of engineering. Further, while teachers recognise their unique position in providing learners with careers guidance, many are concerned that their 'distance' from sectors such as engineering may produce bias and misinformation that is possibly harmful to learners' futures (Watermeyer et al., 2016). Simulated internships could potentially engage learners with the work of real engineers. They might also enable the simulated experience of working together with others through role playing as engineers. For both engineering and other subjects however, little is known about the potential of implementing simulated internships in schools.

The aim of this chapter, therefore, is to critically examine the potential of implementing school classroom-based ***'simulated internships'*** to support collaborative and creative learning and rich links to the work of work. We define simulated internships in the sense of role-playing workplace practices, taking on the 'mantle of the expert' (Heathcote & Herbert, 1985), in responding to authentic workplace challenges developed in close partnership with industry colleagues. This idea of simulated internships has roots in several theoretical perspectives, for instance, drawing on a sociocultural view of learning as a social process mediated by a range of cultural tools (Mercer, et al., 2019). Following this tradition, we recognise all learning experiences are situated – and so not reducible to isolated cognitive functions (Vygotsky, 1962).

We report on design-based research undertaken in areas of low social mobility in England as part of the Virtual Internship Project (VIP) at the University of Cambridge. This project investigated how a model of simulated internships can give students access to authentic experiences of workplace practices in addition to developing skills associated with collaborative creativity. This school-based model involves developing lower-secondary aged (11-14 years) learners' 'future' skills of dialogue

and groupwork, during a Challenge-Based Learning programme (drawing on Apple, 2010) linked authentically to the world of work through embedded digital resources offered by real-world engineers. Working with Design and Technology (D&T) and Computing teachers in 'Education Opportunity Areas' in England (where social mobility is traditionally known to be low), the programme is designed to take around 10 in-class hours over a 6–7-week half-term period (see Appendix 1 for programme outline). With tasks structured to support teaching and student engagement, small groups of students work collaboratively to define and research local responses to global challenges (e.g., climate change or digital divides) and engage in dialogue to design, model or build a solution and communicate their findings (Twiner et al., 2022). Reported research reveals how role-play-based contexts and situated, simulated scenarios can potentially afford valuable insights and skill development aligned to curricular targets and workplace practices. This research is significant as it might inform initiatives to address the inequitable nature of careers provision in schools (Long et al., 2020). In particular, the potential of simulated internships to disrupt the cycle of existing digital, social, and geographical divides is identified to be important given such issues must be overcome if schools are to effectively engage *all* learners with the world of work (Moote & Archer, 2018).

2. Linking education and the world of work through simulated internships: existing theory and practice

Simulated internships in education can be traced back to several theoretical perspectives. For example, the idea that learning is a social process mediated by a range of cultural tools is well established (Mercer et al., 2019). Such work posits that learning is situated in social and cultural practices (and thus involves much more than 'just' individual cognitive functioning; Vygotsky, 1962). The potential educational benefits of gamification and simulation have similarly been recognised across a range of learning domains and levels for some time (Mayer & Mastik, 2007).

During the last three decades, the theory of situated learning has grown in prominence. Emphasising the situatedness of learning (e.g., Lave & Wenger, 1991), this can be defined as the nature of learning in relation to being located in a specific environment (Theelen et al., 2020). Sadler (2009) outlines how such environments or contexts are formed, in part, by learners and other participants along with available ideas, tools and physical resources (i.e., contexts afford and constrain what learners can do and come to know). This, Sadler argues, suggests that learning cannot be abstracted from the environments in which it takes place. As individuals participate in environments and engage with the communities that form these environments, they learn. In situated learning theory affective and behavioural aspects are integrated with the cognitive such that learning is seen as the trajectory of social identity change through different experiences of participation (Wenger, 2010). This closely relates also to research featuring the virtual world 'Second Life' as a situational learning environment (Inman et al., 2010).

These concepts can also be extended to learning about situations, such as through Heathcote and Herbert's (1985) 'mantle of the expert'. This involves the simulation of situatedness: taking on the role of another, such as an expert, to problematise a challenge. The premise is that if learners are facilitated to engage with problems and contexts that, for instance, 'real' engineers face, employing practices that real engineers do, they can be supported to think like an engineer. This notion of simulating workplace contexts, challenges and processes, in preparing students for the world of work, has strongly informed the development of the simulated internship programme (reported in Section 4).

Building on theoretical perspectives such as those above, the work of David Williamson Shaffer and colleagues at the University of Wisconsin-Madison perhaps best exemplifies the implementation of simulated internships in education. For several years, a team at the Wisconsin Center for Educational Research has investigated how virtual internships can provide meaningful work-based learning opportunities. An example of their internship programme features undergraduates conducting

research, developing and testing prototypes, working with peers, and proposing a design solution. Positive outcomes include female undergraduates becoming more motivated to pursue an engineering degree than those on a traditional engineering course (Chesler et al., 2013), and students more successfully developing the identity and habits of mind of professional engineers (Arastoopour et al., 2016).

However, much existing work on simulated internships is targeted at older (often undergraduate) students with more limited support for those at a younger age and with a less-developed sense of career readiness. Potentially simulated internships in schools could contribute to overcoming common issues including school curricula struggling to authentically engage young people with the world of work (Alfeld et al., 2013). They might also help to address issues such as careers education typically being restricted to active contacts with key staff or parents in a way that is difficult to maintain beyond the focal event or intervention (Davies et al., 2013).

In the wake of physical restrictions for educational and workplace practice brought about by the global pandemic, facilitating virtual experiences, communication and engagement has timely and future potential. Indeed, simulated internships appear well poised to respond to some of the ongoing challenges presented by COVID-19 such as enabling productive educational encounters with the world of work remotely. Thus, in addition to delivering educational benefits like those observed in other fields (e.g., simulations in the hospitality industry - Ampountolas et al., 2019; Edelheim & Ueda, 2007), they may also offer an avenue for ensuring school-led careers guidance is afforded ballast and continuity, both in the local school context, and with the external contribution of the wider educational and occupational community (Watermeyer et al., 2016).

3. Defining 'collaborative creativity'

Motivated by the increasing attention to the role of such skills and competencies in education, interest in learning environments that can support creativity has accelerated in recent years (Richardson & Mishra, 2018). Despite different definitions being put forward, 'creativity' remains a nebulous concept (Aguilar & Pifarré, 2019). Nonetheless, research indicates that creativity can and should be taught. It is also widely held that creativity can be developed, rather than being a set trait possessed by a select few, and that environments which nurture creativity can enhance learning outcomes (e.g., Sun et al., 2020).

Despite being an area of academic research since the mid-20th Century, it is only relatively recently that the social aspects of creativity have been studied and not treated as external influences (Elisondo, 2016). This acceptance of the social nature of creativity has led to an interest in identifying characteristics of dialogue conducive to the promotion of creativity that is 'collaborative' (Sawyer & Dezutter, 2009). Co-creative dialogues have been summarised by Pifarré (2019) as being open-ended and situated, open-minded, and holding different perspectives and multiple voices. This conceptualisation is compatible with the view that research should consider relationships between people, communities and cultural artefacts which are generated in, and which promote, creative processes (Elisondo, 2016).

A dialogic theory of *collaborative creativity* therefore focuses on the emergence of new perspectives from the interplay of 'voices' (Cook et al., 2020). Through the generation of new perspectives, creative thinking can facilitate creative co-construction as participants explore and build on their own, and others', ideas (Wegerif, 2005). Given the complexity of creativity as a concept, it is perhaps unsurprising that there are a variety of views on how the capacity for creativity should be taught in schools. There is however strong evidence for the value of constructing a 'dialogic space' (Wegerif, 2007) that maintains balance between structure and freedom in enhancing students' creativity (Brem et al., 2016).

This focus on collaborative creativity emphasises that the group process can be far richer than the total of what each individual can do independently: thus, there is considered to be the potential for something significantly enhancing about the nature of the group interaction that facilitates creativity (Twiner et al., 2021). Much research advocating for teaching creativity however runs counter to the restricted and prescribed nature of the curriculum and assessment regime most schools and teachers are monitored against (e.g., Henriksen & Mishra, 2015). Research is also clear that some competencies required of employees – including effective collaboration and creative thinking – have often not been appropriately developed through 'traditional' schooling (Gube & Lajoie, 2020). Aligned to this, one argument around teaching for creativity emphasises the value of involving outside organisations, and in taking students 'out' of school, in building creative learning environments. Davies and colleagues (2013) identified the value of partnering with non-school bodies, but with the added warning that often, 'the lessons from such "critical events" do not readily become incorporated into everyday practice once the special project has finished' (p. 84). Thus interventions may need to capitalise on valuable relationships with external organisations, in order that the positive impacts of such engagements are reinforced outside and beyond the intervention or event.

Within the present project, it is contended that this 'taking out' of school could be facilitated virtually – online or through classroom-based simulation and role-play – such as through video resources from industry colleagues representing authentic industry practices and challenges, and in enabling classroom-located but 'industry-situated' activities to develop collaborative creativity. Utilising schools' existing digital platforms, such mechanisms may also support a longer trajectory of education-industry engagement.

4. Investigating the implementation of simulated internships in schools: a design-based research approach

4.1 Overview

The broad aims of the Virtual Internship Project (VIP) are to determine how simulated internships impact the ways that young people *(i)* authentically engage with and relate to the world of work; and *(ii)* develop key 'future' skills and competencies related to dialogue, collaborative problem solving and creativity (conceptualised as 'collaborative creativity'). Specifically, the project aims to simulate meaningful encounters with the world of work for lower secondary students aged 11-14 in England. In partnership with two global telecommunications leaders (BT and Huawei), an ambitious simulated internship programme was developed through undertaking design-based research in collaboration with teachers. This involves working with schools in two education 'opportunity areas' (OAs) identified by the Department for Education as areas of low social mobility. OAs intend to promote activities to develop young people's knowledge and skills and ensure they can access high-quality advice and enriching life opportunities (Easton et al., 2018).

As stated in the introduction, we define 'simulated internships' in the sense of role-playing workplace practices, taking on the 'mantle of the expert' in responding to authentic workplace challenges. Partnership with industry colleagues has informed the development of resources throughout the programme (including video induction and challenge setting; structuring authentic evaluation criteria; and worksheets to support various processes and organisation). During the present version such experts are not 'on hand' as groups engage with their challenges. Instead, co-present teachers are subject experts, and broker simulated internship experiences for their students. Students are therefore encouraged to use their initiative, group members and teacher as resources in overcoming challenges.

Specifically, the programme of simulated internships developed features small teams of learners role-playing as interns in BT and Huawei, developing and designing new solutions or products. Digital technologies are used to present global challenges framed by videos of senior management in these organisations asking learners to help them solve problems and design new products, with support

from videos of real engineers describing their design and development processes. Participation takes about 12 in-class hours with some independent study across six-to-seven weeks. Learners are issued a global problem or scenario (such as climate change) and tasked in small groups to design, model or build a local solution (such as how to improve energy efficiency at home or school). Incorporating video resources, work-based tasks, scenarios, and assessment criteria used in industry, these are intended to be as 'real' as they can be in a teacher-facilitated classroom setting. The design of the programme is such that opportunities are offered to students and schools with varying levels of local access to equipment and enterprises.

4.2 Pedagogical approach: Collaborating2Create

Project-based learning (PBL) is a student-centred form of instruction that promotes students' autonomy, constructive investigations, goal setting, collaboration, communication and reflection within real-world practices. It has been explored in various contexts (from primary to higher education; Kokotsaki et al., 2016) and evidence suggests it can have a positive impact on learning (including in schools in areas of low social mobility; Duke et al., 2021). A key influence on the simulated internship programme was challenge-based learning (CBL). While a 2010 report by Apple (2010) is widely cited as establishing CBL, it is a pedagogical approach that builds on the rich history and tradition of PBL.

Within this wider frame – and with explicit incorporation of the theoretical framing around collaborative creativity offered in Section 3 – various tasks and links were outlined across the programme. Influenced by research on educational intentionality (Warwick et al., 2020), one critical focus across these structures was operationalised through what is termed 'Collaborating2Create' (C2C).

C2C is a conceptual and pedagogical tool that brings together the research, world of work and educational aspects of the developed simulated internship programme (Figure 1). The term *'create'* here refers both to the process of *creating* a product or solution, and also to *being creative*. The aim is not only that products are created, though this often represents the assessed element of a project. The bigger goal is to support individuals and groups to be more creative: *to build their capacity for creativity*. The *'collaborating*' element involves the productive use of classroom talk, or dialogue, particularly in groupwork.

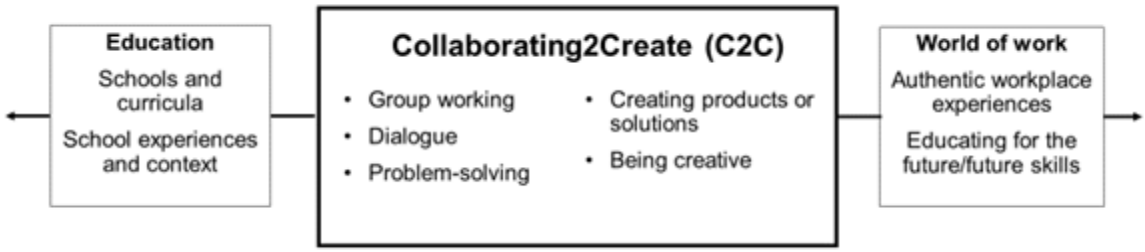

Figure 1: Collaborating2Create (C2C) as a means of linking education and the world of work.

VIP's industry partners reinforced the value of these skills and competencies in terms of preparing for the world of work. For instance, it was noted during collaborative planning sessions that employers often give interviewees team exercises, asking them to solve problems on the fly, or to present on something. Supporting these experiences, and reinforcing C2C in school, thereby offers the potential to enhance students' preparation for the world of work. Appendix 1 provides a high-level overview of the five main stages and core tasks within the developed simulated internship programme.

4.3 Research context and methods

The project overall is informed by a design-based research (DBR) framework involving collaboration between teachers, researchers and industry experts. DBR informs the development of educational 'products' by employing theory and research findings in combination with iterative use in real-world settings, data collection, analysis, evaluation, re-design and adaptation (Bakker, 2019). The design-based element of the research was particularly important in grounding simulated internships in authentic practices of industry as well as schools' curricular requirements and practical constraints. Through iterative development combined with research, DBR aims to rigorously understand not only what works, but also why and how it works. To achieve this, we initiated a two-phase approach, with iterative revision of programme resources according to observation, feedback and learning (Figure 2).

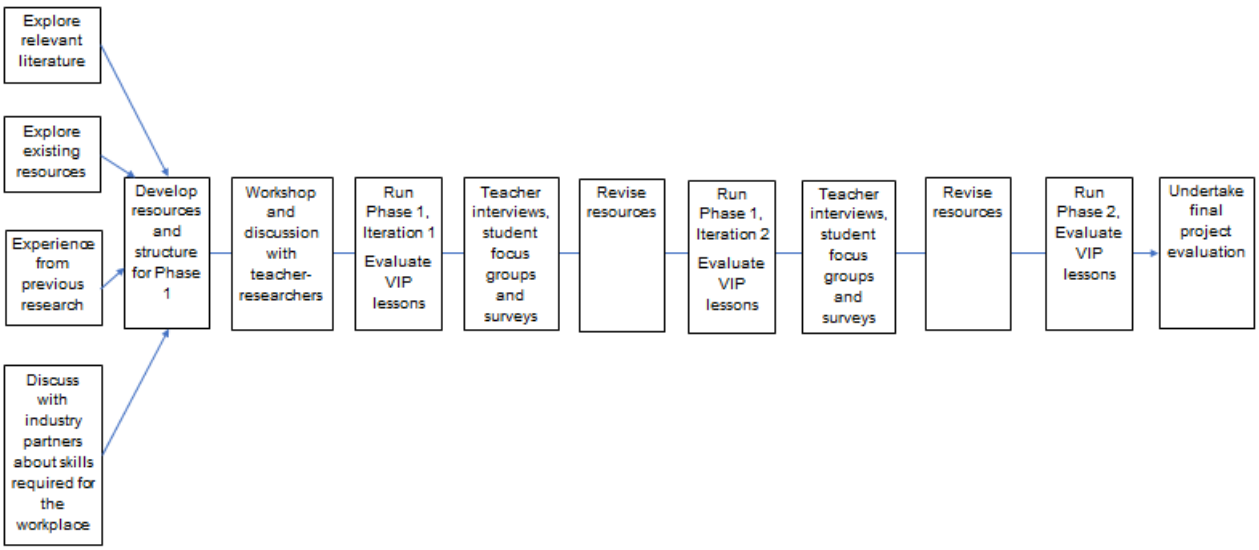

Figure 2: An overview of the design-based research (DBR) process employed.

VIP involved working closely with teachers to design simulated internship experiences and to evaluate their impact with a view to developing further versions. Students from four secondary schools, located in two English OAs were involved during the 2019/20 and 2020/21 academic years. Class sizes ranged from 14-30. In total, 330 students and eight teachers were involved. Data collected in these 'lead research schools' includes video from 16 lesson observations, six audio-recorded post-programme interviews with teachers, five student focus groups, and retrospective pre-post-test student surveys. Schools were located in different urban and rural contexts, covering mainstream state schools and schools supporting students with additional learning needs. The intention of involving different school contexts was not to offer 'generalisable' findings, but rather to generate case studies of successful implementation and identify points for improvement. All schools were involved in Phase 1 Iteration 1, with teachers and students physically in school. Three schools started Iteration 2, though this was disrupted due to enforced COVID-19 lockdown. One school participated in Phase 2 in 2020/21 with two cohorts. Whilst the instantiation of the programme therefore had to adapt to local circumstances, this demonstrates the flexibility of the core programme to be delivered in a range of physical and digital contexts.

Approaches to consent, privacy and data storage were underpinned by university ethical approval and safeguarding procedures and BERA (2018) ethical guidelines. Rigorous analytic processes and findings across data sources are outlined in other publications (e.g., Twiner et al., 2021), with others in preparation.

5. Empirical case study and analysis

An empirical 'case study' from Phase 1 Iteration 1 is now presented. This was selected in line with our analytic intention: to evidence the scope and challenges of embedding a mutual focus on creative

collaboration with supporting authentic insights into the world of work. This selection does not suggest such interactions were observed across all simulated internship lessons or groups. The purpose here is to exemplify what C2C can look like and how it can be facilitated, as well as what can hinder it, rather than making wider generalisations. Data presented occurred in a pre-COVID context, where students and teachers were physically co-present.

Lesson data were explored systematically through discourse analysis, coding short sections in relation to certain features of interest. These included group, whole class or individual work; use of technology; student and teacher talk; expression or discussion of creativity; using or referencing ground rules for talk. The extract below is presented with integrated analytic commentary, followed by a critical commentary, to make salient features of dialogic interaction alongside use of other resources that promote or hinder dialogic and creative challenge-based learning, and authentic insights into the world of work.

Reported interview and focus group data were explored through deductively framed thematic analysis (drawing on Braun & Clarke, 2006) in preparation for this chapter. Specifically, analysis was used to explore data around the themes:

- value of collaboration in school projects;
- challenges of encouraging dialogic and creative collaboration;
- the role of simulated internships in generating authentic insights into the world of work.

Extracts are presented to corroborate points identified from the lesson analysis and offer participant reflections to ground and contextualise analytic insights. Analysis reporting on wider project findings are available in other publications.

5.1 Empirical context

At this larger-than-average rural secondary school in the East of England, a Year 7 D&T class (students aged 11-12) used simulated internships to address the global challenge of climate change. They were thus tasked, as a group, to design, model or build a local solution that in some way reduced the impact of climate change. Groups variously came up with ideas about electric buses, or switching off mobile phones when a threshold of energy usage had been reached, to name two examples. Whilst being very willing to try the simulated internship programme (reporting a need to somehow approach things differently), the participating teacher was open about their general reluctance to use group work – mostly due to the rising 'volume' that tended to ensue. Equally, whilst D&T can be considered an arena for creativity, it was acknowledged that students tended to be instructed in designing and producing the same objects, working to set intervals and teacher instruction. Thus, students were relatively unaccustomed to working together and generating product designs in the way encouraged through participation in the project.

5.2 Participants

There were 14 students aged 11-12 in the class. The focal group for this analysis were two boys and one girl, seated on one side of a table, around printed resources. Each lesson the teacher provided cut-out worksheets to focus discussion and record specific tasks. Students then stuck their worksheets onto a large sheet of paper, to collate and evidence process and progress across the lessons.

5.3 Teaching and learning focus

Aligned to Stage 1 tasks (see Appendix 1), in their second simulated internship lesson groups were discussing ideas they could develop in response to the challenge. Framing this lesson, the 'dialogic intention' (Warwick et al., 2020) focused on discussing, setting and using group 'ground rules for talk'. They had been given printed worksheets (one per group) with questions to consider in breaking

down the challenge, and were expected to write their answers. After some discussion, the teacher asked groups to decide which idea they wished to pursue and develop into a potential solution. This extract (Table 1) is interesting to consider as it exemplifies group members' and the teacher's intentions to use the ground rules that had just been explored within their work-focused task. In terms of industry links, there is also some clear consideration of identifying a product's requirements, preparatory user-needs analysis, and troubleshooting.

Table 1: Lesson Extract (Lesson II, 41.42-43.37).
The transcribed extract uses the following key:

- T = teacher;
- B1, B2 = different male students;
- G1 = female student;
- Analytic comments are given in square brackets, grey highlight and italicised.

1	B1	What should our 'big idea' be? *[open question to group]*
2	B2	I don't know. I was thinking while [teacher] was speaking there, what if - you know lights? - what if, because you know sometimes you leave your lights on and you fall asleep? What if it detects when - like if you've fallen asleep, it just turns them off? *[potential solution 1, grounded in real-world experience; lots of hedging suggesting idea is still forming or open to critique]*
3	B1	Yeah, and then it detects, like if you wake up in the middle of the night, like it just detects that you're not sleeping and it would turn on. *[B1 building on B2's idea; further link to real-life potential]*
4	B2	Yeah, that's the one that I think, I mean you might not want your light on. I think we should have like a little remote control. (pause) Yeah, but you know um, you also need to put something in it so like it can detect whether it's just a cat or something. *[identifies potential stumbling block, need for additional programming; link to real-world technology and situations]*
5	B1	So it detects your eye movement? *[developing detail of how potential solution might work]*
6	G1	But what if you're doing this ((moves eyelids but with eyes closed)) *[identifies further potential stumbling block, with physical demonstration]*
7	B2	No, when you close your eyes, it detects you're asleep. *[G1's critique acknowledged but disregarded]*
8	B1	I think it should be able to know whether there's a human in the room or not, because if it's just an animal *[picking up on B2's comment on the need for species-specific detection]*
9	G1	Shall I write 'energy saving technology'? (pause) Shall I write that ((points to whiteboard)) in there ((worksheet))? *[reference to physical worksheet – proposing candidate summary of ideas just shared; volunteering to be group scribe]*
10	B1	What?
11	G1	Energy saving technology, as our idea?

12	B2	No. *[dismissive response? Or cut short by T joining group in next turn?]*
13	T	[joins group] What's the challenge guys ((points on worksheet))? What are you going to focus on? What are you going to go with, because you had a few different ideas? *[recapping, focussing]*
14	B2	Um, I don't know ((laughs))
15	T	Not sure? Ok. Well you've got to come to a group decision here. So which direction are you going to go with, because you've talked about ((checks on worksheet)) lighting in the classrooms and some sort of sensor technology you said didn't you for that? *[reminder of need for shared decision; reads ideas logged on worksheet to prompt thoughts]*

5.4 Analysis and critical commentary

This analysis exemplifies the scope and challenges of encouraging collaborative creativity in activities designed to offer authentic insights into the world of work. It is important to note that the extract is from relatively early in the simulated internship programme. While there are limitations to analysis at this point, advantages of such selection include exploring how the teacher and students engage with these new tools, and with each other in the process. It also offers insight into how the students cope with the scoping aspect of design processes - coming up with ideas, expanding on suggestions and funnelling down to a concept - and how the assessed and timetabled curricular context may help or restrict this process.

Across the brief minutes presented, various features are noteworthy regarding how the students and teacher engage dialogically – at points – in their challenges, and create authentic insights into the world of work. For instance, B1 opens the discussion by inviting contributions. This represents a key component of group ground rules for talk – asking what others think – suggesting at least some engagement with the lesson's dialogic intentions.

B2 accepts the invitation with a relatively lengthy suggestion, which in itself is interesting. Research is consistent and clear that in whole class talk, student contributions are overwhelmingly short (Hardman et al., 2003). Thus the peer group arena, especially early in the programme (given its focus on ground rules to encourage collaborative dialogic engagement), offers a rich space for students to share ideas. Within B2's contribution, his numerous hedges '*I was thinking…*', '*what if…*' (the word '*if*' used four times in this contribution) potentially indicates he is forming his thoughts whilst speaking ('thinking socially', to paraphrase Mercer, 2004). These hedges also leave the suggestion open for group members to disagree. This could of course reflect efforts to 'save face' (Goffman, 1982), if others criticise what is at this point his idea, or genuine dialogic interest in what others think. In making meaningful connections with the world of work, B2 does not propose an abstract technological solution, but one grounded in everyday life (falling asleep with the lights on).

Cumulative talk (e.g. Mercer, 1995) is witnessed as B1 takes up B2's suggestion, developing the initial idea (line 3). B2 re-enters the discussion, ideas cascading. In his again relatively lengthy contribution, B2 identifies a potential complication to the sensor technology, whereby some manual control might be needed, as well as some inbuilt artificial intelligence to differentiate species. This contextualisation further illustrates how the group are relating their challenge-based learning to the need for real-life technological solutions. B1 and G1 offer potential challenges to B2's idea (lines 5 and 6) – how the technology might work. These challenges are however glossed by B2, with the argument of the need to distinguish between humans and cats resumed by B1. At this point, therefore, the students' dialogic engagement is perhaps still superficial.

In the post-programme interview the teacher identified the value of students creating and owning the ground rules, but embedding these within interaction remained a challenge:

> I think taking the angle of getting them to set the rules rather than the teacher just saying 'you will do this, that and the other' was probably more likely to lead to them accepting them. I think they understood and respected the rules, but, because our lessons are so few and far between [due to timetabling], I think it's important to remind them quite often about those.

Such comments reinforce the importance of making dialogic engagement with ideas an explicit and reiterated dialogic intention. This is particularly the case when teachers do not see students regularly, and when students usually work independently. Some weeks after the students finished their projects, during a post-programme focus group, they were able to recall some of the underlying principles behind the ground rules they established:

> when someone is speaking, do not speak over them. You can wait until after. And if you have an idea, to not be shy to say it.
>
> And let everybody have a say.

This was encouraging to hear, but of course recall after the event is not necessarily the same as embedding these notions within spontaneous interaction. Indeed, the interaction within the lesson extract above around writing '*our idea*' is also of note (line 11). With this framing, G1 indexes this should be a shared decision – no longer owned by individuals – reaffirming the ground rules to share and discuss ideas. Her comments and the annotated transcription also highlight the perceived value of spoken and written work in the school context of performance and assessment, as she suggests making the discussed idea permanent and visible to others by writing. Such action is also reinforced by the teacher's comment after this extract that '*You can put that in there*' (i.e., write the idea on the worksheet). G1's suggestion – to log '*our idea*', or that '*energy saving technology*' represents a shared idea – is however dismissed as the teacher joins the group.

This discussion of different ideas before committing to a group decision was emphasised in programme resources to encourage students' creativity through enabling a 'safe' (Davies et al., 2013) and 'dialogic' space (Wegerif, 2007). The teacher reflected positively on the process and effect of this – observed in class and relevant to the world of work – during the post-programme interview:

> Working together is essential in the workplace, isn't it, and any company that is involved in engineering or design, it's very rare that one person is just responsible for everything. You know, you share ideas, you bounce off each other, and from what I saw from the idea generation with the students, what they came out with was very different to what I'm used to seeing when they only ever work as individuals. It was far more creative, far more varied.

Despite these aims however, the drive to have tangible, assessable outcomes still pervaded interactions represented in the extract. This was mediated through the worksheets, the teacher's verbal reference to ideas he could see logged on the group worksheet, and reminders to write further ideas as a record of achieved, shared decisions. This perhaps explains some challenges raised earlier – of the implicit valuing of creativity, but limited evidence of its encouragement in educational practice.

Reflecting after the conclusion of Iteration 1, the teacher commented that the project had '*certainly changed my opinion of group work… for the better*'. He reiterated the challenges faced, but identified that these challenges are part of a process and representative of – as well as authentic preparation for – the world of work:

> ...everybody has their idea which they treasure, don't they, because it's their idea and therefore they think it's the best. Getting them to take on board other people's ideas is probably quite a big jump for them in terms of maturity. So again, whilst they may not be there yet, something like this project works towards that and helps them have those difficult discussions and come to those difficult compromises without arguing or falling out - hopefully.

These points were reinforced by students in a post-programme focus group, as in the comment below:

> Well that would be hard because everyone in our group has an idea, and everyone wants to have their idea in the project, so it was a little bit hard to point out your idea and to choose another idea from a friend.

This difficulty resurfaced later in the student focus group discussion, in terms of the personal and social dynamics of sharing, critiquing and developing ideas as a group through the project:

> …when you have an idea and your friend has another, I realised that if I would choose mine because like it's better than someone else, he would be upset, 'why didn't you choose mine?' That was one of the difficulties which I found in the project
>
> Interviewer: So did you learn any ways - how to deal with that or cope with that?
>
> Yes, I just tried to put his idea into another one, or give him another idea which maybe can help him modify, that hopefully can improve the idea or something else.

With these reflections in mind therefore, whilst identifying challenges to collaborative creativity and the need to structure and revisit how to encourage it in practice, when asked if they had learnt any skills from the project comments included:

> I think I've learnt better how to work as a team.
>
> I've learnt how to work better in a team as well, and I've learnt how to realistically think about projects and stuff and research.

Such reflections are promising, given this was a stated aim of the programme and critical to any development of C2C, and was borne out in other interview and observation extracts. From reviewing the data as a whole however, it was clear more structure and explicit reminders of how to work effectively as a team, and why this is important, were needed throughout the programme stages. We also appreciate that what we present here is a snapshot of the data, selected to exemplify key analytic points.

This in itself was an important learning point from Phase 1 Iteration 1 – influencing revision before Iteration 2 – whereby more explicit reminders were embedded in resources to encourage students' dialogic engagement with ideas and group members. The value of maintaining a dialogic and creative thinking space, balanced against the need for recording shared decisions, was also acknowledged in Iteration 2, and remains a focus of ongoing work. The current chapter reports on data from the first Phase and Iteration, but formed the groundwork for collaborative programme development across Phases and Iterations.

Despite the lengthy discussion by this group of students presented in Table 1, light sensor technology was not the solution group members reported to the teacher shortly after this extract, and the group pursued a different idea over the subsequent weeks. The idea they took forward over the seven-week project was an electric bus powered by wireless charging (drawing on examples of wireless charging for existing mobile phones). They researched various costs and complications around what the product would need, how it would work, and what it would look like. For more detailed and extended exploration of this group's ongoing interactions see Twiner and colleagues (2021).

6. Reflections on role of simulated internships in the future of education

Some argue that the current education system is not good at preparing students for the real world. Simulated internships potentially offer a chance to address this problem. Many curricular areas could be taught using real-world challenges in partnership with real-world enterprises including not-for-profit and government agencies. In this way, students would understand the purpose of their learning. They could also learn how to develop positive workplace behaviours such as collaboratively solving problems and creating solutions.

The aim of the research reported in this chapter was to investigate if – and how – the simulation of an internship, supported by resources from industry partners, could be used to give secondary students authentic experiences of industry practices and challenges whilst also developing future skills

associated with collaborative creativity. In part, this research was a response to concerns around the inequitable nature of careers education in schools (Long et al., 2020) and as students in many classrooms still spend limited time on activities that foster collaboration and creativity (Gallup, 2019). The exploratory research undertaken through the Virtual Internship Project (VIP) reveals the potential for using simulated internships to successfully link schools and the world of work. While prior to COVID-19 the prospect of such an initiative working at scale might have been considered as quite remote, following the pandemic, simulated internships may offer one option to the global education community as it seeks new ways to bridge the gap between education and workplace.

Of particular note are the high levels of teacher and student motivation and engagement observed, and how facilitating simulated workplace experiences can offer a vehicle for developing collaborative creativity in regular classroom instruction. Snapshots of data and analysis presented in Section 5 illustrate the potential for this, with the teacher perhaps taking a step back so that students could step forward to forge their own learning paths aligned to both the curriculum as well as industry challenges, in collaboration with their peers. Maintaining this space for students to explore opportunities, openness and ownership yielded rewards as they created collaborative and innovative solutions that reflected their own personalities, contexts and priorities (reporting here on wider observations than those presented in the current chapter). Continuing this thread of contextualisation and personalisation, the feasibility of simulated internships in helping to address priorities of careers education was established, particularly in areas of low social mobility and in widening educational access for marginalised learners (such as those with disabilities; Kraft et al., 2019). The programme overall, and embedded focus on collaborative creativity through the C2C tool, offer a core template and structure for future initiatives. These can be adapted to a range of curricular, physical and digital contexts, as well as industry challenges and criteria – allowing developers, teachers, and learners to play with the 'situatedness' of the learning encounters and experiences they wish to simulate.

For educational practice the reported model of classroom-based simulated internships provides a rigorous, evidence-based programme structured with tasks that potentially raise students' aspirations and awareness of career options beyond school. As the reported preliminary analysis indicates, simulated internships may therefore offer opportunities for students to take ownership of their learning through working on relevant real-world challenges. Simulated internships may also potentially enable work experience opportunities and insights to students at scale, and earlier in education trajectories than more traditional models (see Twiner et al., 2022).

In addition to providing these practical insights to inform educational practice, a theoretical contribution to knowledge is also made. Drawing on a sociocultural view of learning as a social process mediated by a range of cultural tools (Mercer, et al., 2019), it has been demonstrated how teaching and learning approaches that emphasise dialogue – through which students learn to reason, discuss, argue, and explain to develop their higher order thinking and oracy skills (Jay et al., 2017) – can be effectively integrated within simulated internship scenarios aligned to curricular targets and workplace practices. A further contribution is to inform work on the social nature of creativity in education. While creativity itself has been a focus of research for a number of years, it is only recently that its social aspects have been studied and not treated as external influences (Elisondo, 2016; Hennessey & Amabile, 2010). The reported instantiation of simulated internships – including the focus on C2C – demonstrates how creative thinking can be learnt in the context of a 'dialogic space' characterised by 'the emergence of new perspectives from the interplay of voices' (Wegerif et al., 2010, p.613). Underlain by Bakhtinian dialogic theory, in this conceptualisation creativity is viewed as the expansion of understanding that emanates from seeing an issue from a new perspective. As indicated in Section 5, through the generation of new perspectives, creative thinking might potentially widened this dialogic space and facilitate creative co-construction as participants explore and build on their own, and others', ideas (Wegerif, 2005).

There is still much to learn about the potential of simulated internships. How to overcome concerns about quality, supervision, peer-interaction, and authentic exposure to business culture being among

them (Pittenger, 2021). As Pittenger outlines, just as the capacity for online education had to be built by traditional schools, a capacity for simulated internships is required. There is also an issue of capacity on the part of employers who wish to engage with schools through such initiatives. Even simulated internships, based in classrooms and facilitated by a teacher, demand additional employer resources (e.g., induction videos and challenge setting, structuring evaluation criteria, developing materials to authentically 'situate' the internship). For more sophisticated simulated internships involving students actively becoming part of an organisation (a virtual placement on a university course for instance), then resources for onboarding, engagement, socialisation, supervision, and mentoring, in addition to the distribution of (and training in) technology required for remote work must be provided (Thompson, 2020).

Motivated by current problems facing education, and given many schools have become more capable of working digitally, the research team will now explore how to develop online simulated internships that can personalise and adapt to learners' needs and preferences. Taking the programme fully online offers the potential for hybrid delivery that enables both in- and out-of-school study. The adaptable nature of simulated internships may flexibly support teachers and students via a mix of online and offline – synchronous and asynchronous – activities and resources: for instance, when teachers and students are in class or accessing learning from home.

Steps beyond that might include exploring whether a simulated internship approach could be generalised and then scaled to impact on global education. One possibility is building a platform that can marry teachers with enterprises of every kind, in addition to supporting partners in developing simulated internship scenarios that cover a wider range of skills, academic disciplines and real-world issues. This might allow any student, regardless of background and geographic location, and particularly those from marginalised groups, to join up with world-leading organisations to experience learning that enables them to make a positive difference to their own lives and the world.

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Appendix 1: Challenge-Based Learning stages as instantiated in the Virtual Internships Project

Stag	Stage Aim	Intended Outcomes	Core Stage Tasks	Links
1	To use challenges from the world of work to frame a challenge-based learning project – the aim of Stage 1 is for groups to take ownership of the ground rules for talk, have narrowed down from the big idea, and agreed on a challenge to pursue.	**All groups** establish whole class ground rules; agree and record group challenges. **Most groups** understand relation of local challenge to global issue. **Some groups** consider research strategy.	**S1.T1.** Watch BT-Huawei 'welcome' video. **S1.T2.** Discuss and establish ground rules for talk. **S1.T3.** Watch and discuss 'challenge' video presented by BT-Huawei; Choose the 'big idea'; Agree the group challenge. **S1.T4.** Introduce student logbook.	**Link to the world of work and curriculum:** Explore a genuine workplace challenge. **Link to C2C:** Establish what ground rules for talk are useful and productive, for group interaction and for meeting task requirements.
2	To ground a response to the challenge in research evidence and user perspectives, with consideration of appropriate methods, timescale, available tools and access.	**All groups** brainstorm ideas, plan and gather evidence in response to the challenge. **Most groups** conduct research outside the classroom. **Some groups** conduct interviews or surveys.	**S2.T1.** Brainstorm ideas and encourage a creative approach to the challenge. **S2.T2.** Research the challenge.	**Link to the world of work and curriculum:** Consider user perspectives and needs; Research the challenge. **Link to C2C:** Brainstorm ideas; Stay mindful of ground rules; Divide research tasks amongst group members**.**
3	To understand user and/or expert perspectives on the challenge; Decide on a potential solution on the basis of this understanding.	**All groups** discuss different possibilities, and agree on ideas for a group solution. **Most groups** ground their ideas in research evidence. **Some groups** explore multiple ideas before agreeing on one.	**S3.T1.** Watch and discuss BT-Huawei 'creativity' or 'collaboration' video. **S3.T2.** Discuss themes in the data – what does this mean for building a solution? **S3.T3.** Brainstorm and consider alternative solutions; Select one solution to pursue, using authentic industry criteria.	**Link to the world of work and curriculum:** Use evidence to think of innovative solutions to a challenge, based on real-world evaluative criteria. **Link to C2C:** Discuss themes from data, share suggestions and explore alternatives.

4	To use the understanding from previous Stages to design, model or build a solution that is innovative, sustainable and user-focused, and to evaluate this against authentic workplace criteria.	**All groups** implement, discuss reasons and evaluate a solution (design, model or build). **Most groups** indicate how they could improve their solution. **Some groups** amend their solution based on evaluation.	**S4.T1.** Implement a solution. **S4.T2.** Evaluate the solution.	**Link to the world of work and curriculum:** Use authentic workplace criteria to implement and evaluate the group solution. **Link to C2C:** Share and discuss reasons and actions for how to implement their solution, and for scoring it on the evaluation criteria.
5	To present the group's process and implemented solution, and give a rationale for its evaluation against workplace criteria.	**All groups** prepare how to present the group solution, and present it. **Most groups** have a design, model or product to present. **Some groups** present how they would amend their solution based on evaluation.	**S5.T1.** Prepare the presentation. **S5.T2.** Present the group solution and evaluation. **S5.T3**. Reflect on their development through the project work.	**Link to the world of work and curriculum:** Use different media to present solution and evaluation; Align group work with real-world workplace criteria. **Link to C2C:** Work as a group to prepare and present their solution.