Best practice in experiential learning

Evidence review

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Summary

Experiential learning is the process by which students have hands-on experience of the subject they are learning, in order to both appreciate the realistic demands and skills involved, and to learn how to practically navigate them. Within the construction industry, the UK has been at the forefront of using experiential learning programmes to introduce students to the realities of a construction site, often, to give practical context to what they are already learning in classrooms and almost universally, for the first time.

These programmes have shown great initial success, both in terms of students' enjoyment and enthusiasm for construction, but also for their practical skills and employability. It is important, then, to understand the key elements that make experiential learning successful, and what is 'best practice' that can be used going forward.

Many of the key points of best practice are intuitive, in that they emphasise the integral traits of experiential learning around student independence, and how best to support students' freedom to learn deeply from their successes and mistakes, as a team. Some, however, are specific in terms of novel technologies that can host experiential learning; or, addressing the bigger picture of how best to tie experiential learning into career options and industry connections.

These tips for best practice are given in more detail in the body of the review, along with the summary of evidence that supports each theme. A high-level summary can be seen overleaf:

Best practice in experiential learning in construction: high level summary

Give students freedom…

- to make mistakes; reflect; adapt
- as a means of boosting confidence
- where everyone's role is equally valued

Think of construction workers as role models

- Talk to students openly about the industry pros and cons
- Have mutually respectful dialogue
- Show diversity among construction workers where possible

Build strategic relationships

- Do outreach with schools and colleges
  - Emphasise the benefit to skills and employability
  - Be flexible on tying activities into their curricula
  - Reach out widely, to a diverse range of schools
- Do outreach with construction companies …
  - for sponsorship of programmes, and/or disadvantaged schools
  - to volunteer their time at activities
  - as an investment in their future workforce, and opportunities to scout talent

Embrace the potential of virtual reality or video games, but:

- Do not assume that flashy technology will be successful without other considerations
- Make sure that it is genuinely fun by doing market research and consulting young people
- Make sure that it is accessible for teachers to pick up and use

1. Introduction

This literature review outlines best practice in experiential learning programmes within construction and engineering sectors, as part of a broader evaluation of the Construction Industry Training Board (CITB)'s commissioned funding to organisations delivering experiential learning for construction projects across the UK. Research for this review included a range of published academic papers and case studies, as well as a selection of online material promoting experiential learning programmes.

'Experiential learning' is a concept used across many forms of education, and broadly refers to:

"… learning from experience or learning by doing. Experiential education first immerses learners in an experience and then encourages reflection about the experience to develop new skills, new attitudes, and new ways of thinking."[1]

As such, experiential learning differs from other kinds of 'interactive' learning in that it is 'hands-on' - participants are actively engaging in skill experiences themselves, rather than for example, visiting and passively viewing topics in practice, or hearing from those who work in the sector themselves. It has been a popular technique for primary school, secondary school, and further and higher education as a means of increasing students' enjoyment of education, and helping them learn in a more long-term and transferable way. Mostly, then, experiential learning has occurred around academic school and university subjects (e.g., Geography field trips), and research on the effects of experiential learning has similarly focussed on classroom subjects.

However, it is also argued that experiential learning is an important component of industry skill learning, to complement otherwise theoretical study at college and university level. In addition, any interplay between education and job skills is sometimes but not always referred to as 'cooperative education,' as a subset of educational learning.[2] Within the UK, innovative programmes have developed where students are able to not only *visit* construction sites and hear from professionals, but are given responsibility over running skill activities themselves – examples include the Constructionarium, Construction Live, and others using virtual reality and mobile units to provide experiential experiences. The UK are pioneers in this regard, with no similar organised initiatives existing elsewhere in the world in the construction industry.

Feedback on these programmes has been overwhelmingly positive, both from the participants and from the schools and universities that engage them in it. However, to date there has been no systematic research identifying best practice across these programmes, although notably some reviews have been written which discuss:

- Optimal strategies for making the most of experiential learning *in general*
- Best outcomes that can emerge from experiential learning *in construction*

For this review we have extracted some overall suggestions for best practice strategies for experiential learning; for each, we discuss the evidence and **rationale** that the academic and grey literature provide, and summarise top **practical tips** for how to implement them. Some of these practical tips have been directly suggested in the articles we reviewed; in other cases, the recommendations were quite broad and we have presented suggestions for practical implementation tips ourselves. Generally, these practical tips are aimed at those who are organising or running experiential learning construction sites themselves, but the messages and strategies may be relevant to other parties such as teachers or employers.

Best practice strategies are identified as follows:

- Giving students independence and autonomy over their decisions
- Embedding reflection and learning
- Providing exposure to construction workers
- Coordinating with teachers and colleges
- Fostering links with (other) construction companies
- Making virtual reality learning effective

2. Methodology

This literature review was based on an online review of materials on 'experiential learning,' framed by the definitions and parameters described previously in the introduction. Our understanding of experiential learning in construction was very much shaped by an initial search and read of websites for experiential learning companies and programmes; however, these sources do not focus on *best practice* itself, meaning that only a few tips for best practice could be inferred and included here.

For a more rigorous comparison of different approaches to experiential learning, we searched for published research articles on Google Scholar.[i] We used search terms relating to 'experiential learning' but also 'cooperative learning,' 'cooperative education,' 'action learning,' 'site visits' and 'field trips' because although each of these are different from the specific nature of experiential learning, they have relevant similarities for best practice in terms of student engagement and non-traditional teaching for deep learning. In combination with each of these terms, we framed searches with a variety of other terms and phrases.[ii]

Overall, we found and reviewed 22 published academic articles or book chapters and 8 online reports, presentations, or websites. This bibliography and the findings discussed here are not intended to be taken as exhaustive of the rich field of construction education, but are those that provided the most relevant extractable tips for best practice in experiential learning itself.

[i] www.scholar.google.com
[ii] E.g. 'construction,' 'engineering,' 'science,' 'virtual reality,' 'video games,' 'Minecraft,' 'best practice,' 'employability,' 'role models,' 'deep learning,' 'confidence,' 'strategies,' 'recruitment,' etc. (Not including terms which yielded no relevant results)

3. Best practice

3.1. *Giving students independence and autonomy over their decisions*

There is consensus in the literature that one of the main key benefits of experiential learning is the degree of independence it offers to students, and the unique opportunity it gives students to have autonomy over their own learning.

Rationale: By having the freedom to direct their own experiences and learning, students are able to **learn skills more deeply**. Research from engineering education exercises argues that students are able to pick up transferrable problem-solving skills better if the answers to problems are not given to them, and **students have the space to learn from recognising their own initial mistakes**.[3] An early review of experiential learning (as a general approach) highlighted the key importance of a **power shift** during experiential learning – not giving the students absolute control over all aspects of their learning, but empowering them to influence their own planning and learning.[2]

In practice, some challenges to this empowerment and independence approach have been highlighted. Those running experiential learning sessions often hold onto some degree of control over determining the scope of the learning exercise, and this can cause confusion over who ultimately decides on actions.[2] **Less confident students** can also struggle with the level of responsibility and decision-making that is given to them in experiential learning environments, and it is especially important for their sake to make sure that everyone has a solid understanding of the exercise they are being asked to explore, and are comfortable with any theoretical or knowledge-based understanding that they will need to draw on.[2]

Overall, it is important to make sure that students really do have some degree of free exploration of hands-on problem solving. By definition, experiential learning is meant to provide opportunities for "exploration, adaptation, inquiry and testing out"[4] (p.3), but in practice this can involve paper exercises for problem-solving after having passively witnessed real-world construction. The premise of hands-on experiential learning, such as the Constructionarium, is that **students themselves are responsible for designing solutions, and organising themselves**.[5]

Practical tips:

- Give all students equal (if different) roles and responsibilities
- Allow students to make their own mistakes, rather than giving them answers
- Be clear on what responsibilities belong to the students, and what responsibilities are still with the organisers/ teachers
- Provide a solid framework of understanding to students beforehand,

and check that *each* feel confident with the task required

- Do not structure the programme too tightly – allow for flexibility according to students' own goals

3.2. *Embedding reflection and learning*

Rationale: Having given students greater control over their own learning experience, there is also a particular point around using that opportunity to enable students to reflect on their own learning. For experiential learning in general, researchers and practitioners have suggested that the most important outcome for students is to "**learn how to learn**" as a result of these hands-on approaches, above and beyond any specific skills. In fact, some argue that experiential learning such as internships is the *only* time that students have the proper opportunity to reflect on their own learning and adapt their learning styles,[6] something referred to in education psychology as **metacognition** (literally: thinking about thinking).[7]

Specific research in engineering education has focussed on this importance of **developing learning strategies** in students – early research from the 1970s was arguing that the skills most prized in engineering and employment are the kind of decision-making and problem-solving skills that are developed in hands-on experiential learning.[8]

To achieve this, then, students have to have the **embedded opportunities to take stock of their progress**, and reflect on how their strategies and learning may need to be adapted. A variety of past research has suggested that opportunities to not just experience but also then *reflect* are key to effective learning.[9]

Students who aren't very confident with learning may find this difficult, if they perceive self-reflection and adaptation as a failure of their first ideas and strategies. On the other hand, some teachers have found that experiential learning and the adaptive thinking it encourages can actually play to the strengths of learners who are otherwise not very good classroom (rote) learners.[3]

Practical tips:

- Structure a reflection period at the end of the day to allow students to collectively discuss their learning and strategies
- Encourage students to take risks, and take an experimental approach to new ideas in order to test out their strategies
- Build confidence in students' willingness to reflect and change strategies by giving positive feedback, and modelling yourself your confidence to self-monitor and adapt

3.3. Providing exposure to construction workers

Rationale: As well as getting their own hands-on experience with the skills and problem-solving strategies of the industry, experiential learning allows students to come into contact with construction workers themselves. By doing so, students have the opportunity to hear from those in the industry about the **day-to-day realities of their different jobs, both the positive and the downsides**.[10,11] Students may be able to get these perspectives from more traditional site visits or guest lectures, but the less formal structure and longer duration of most experiential learning visits may mean that students are able to get **richer informal perspectives**; it can also mean that students see these professionals as **role models** for their future careers and values.[12] Increasingly, these opportunities are not likely to be present in the classroom,[10] where research has pointed out a longstanding trend towards teaching by career academics, rather than those with industry experience.[13]

The potential for **inspiring and encouraging a new young workforce** is crucial, at a time when the construction industry in the UK is facing a potential workforce crisis. Although the Office for National Statistics estimates that construction contributed around £103bn to the UK economy in 2014,[14] and the value of construction new work in 2017 was around £109,387 million,[15] some estimates have suggested that the sector faces an '**inexorable decline**'.[16] With an ageing workforce[17] and the Royal Institute of Surveyors estimating that 8% of the UK's construction workers are EU nationals at risk post-Brexit,[18] there have been prominent calls for investing in a new generation of construction industry workers. Any initiatives which help students **better understand the industry and see it as an appealing option** are helping, and the face-to-face interactions with industry professionals in experiential learning is an important part of this.

Practical tips:

- Give students opportunities to talk to industry professionals, from a range of job types
- Be open to discussing the practical realities of the industry, both good and bad
- Where possible, try to have some of the professionals be from under-represented groups in the industry e.g. women or ethnic minorities, to provide a range of role models

3.4. Coordinating with teachers and colleges

Rationale: The relationship between experiential learning programmes and the colleges and universities sending students is crucial, in both directions, and at 3 main stages:

1. Outreach. A limitation highlighted for site visits in general is that it can be hard for less wealthy or more remote institutions to hear

about and organise travel for site visits and experiential learning.[19] **Building relationships and spreading awareness** of experiential learning programmes and their benefits may **increase participation**,[20] and students have been shown to best learn to integrate skills if and when there is visible involvement and 'buy-in' from their educational institutions[6]

2. College input: before the experience. One of the key benefits of experiential learning has been identified as the opportunity to **synchronise hands-on experiences with the theoretical understanding covered in an academic syllabus**.[21] As such, coordinating with teachers beforehand is key to ensuring that the experiential learning experience is **relevant to the materials being studied** (with the experience tailored where possible), or that the teachers have the option to cover the most relevant academic material immediately before or after the experience.

3. College feedback: after the experience. Similarly, experiential learning programmes also benefit from relationships and coordination with schools or colleges, in that they have the opportunity to **receive feedback** and **continuously improve** to stay relevant and innovative.[21]

Practical tips:

- Conduct outreach to educational establishments in a wide range of backgrounds, including regions not well represented in the construction industry. Make the case for experiential learning visits by highlighting its impact and benefits
- Invest in relationships and coordination with teachers beforehand
- Try to make sure that you have more than one point of contact at a college or school, to avoid sudden disruption or diminished interest if the teacher moves job
- Encourage a flexible and collaborative approach to the experiential learning programme and academic curriculum in order to maximise transferable learning
- Seek and encourage feedback from schools and colleges after their visits

3.5. Fostering links with (other) construction companies

Rationale: As already discussed, students benefit from the opportunity to be around and hear from professionals from the construction industry. Construction companies can also benefit from this involvement, from the perspective that these students are potentially (and hopefully) the **next generation of construction employees**, and high profile reports have called for greater collaborative relations between academia and industry in order

to maximise employability.[22]

In having these positive face-to-face interactions with students as they learn, construction companies can see two main benefits: the ability to **scout talented students** that they would later like to recruit, and **save money on recruitment drives**;[23] and the **goodwill and positive associations** made with these students, so that they are similarly likely to want to work at that company. Additionally, contributing to experiential learning programmes through funding or volunteer workers can become part of **companies' CSR policy**.[11]

Practical tips:

- As experiential learning programmes, reach out to construction companies for their involvement by highlighting the benefits they can see in employability and talent scouting
- As construction companies, consider moving some funding from recruitment to experiential learning contributions to invest in the emerging workforce
- Make involvement in experiential learning programmes a part of CSR policy, and promote your involvement and its benefits

3.6. Making virtual reality learning effective

Rationale and background: Virtual reality (VR) is an emerging possible method of hosting experiential learning programmes. By simulating construction activities, students can interact with the environment to try hands-on learning, providing most of the important benefits of real-world construction experiential learning programmes. VR environments, importantly, can come in many and varied formats – they can **simulate basic construction sites realistically**; create construction environments for **famous or remarkable buildings or monuments**; or use existing game platforms such as Minecraft to teach three-dimensional planning and awareness in a fun but non-realistic world.

At its best, virtual reality offers experiential learning of construction sites to students and colleges who are **unable to access actual experiential learning sites**.[10] It can also build on the advantage of experiential learning as an **engaging teaching method**, and create additional fun and enjoyment of learning through the novel experience of VR. With this exciting set-up, VR can also be used to **create games out of otherwise 'dry' topics** such as safety education.[24] Here, 'fun' learning environments aren't just argued to be beneficial simply by *being fun*, but more importantly by **encouraging greater participation**, and **deeper learning** by students.

Best practice has therefore been highlighted by researchers and educators as **maximising the fun, 'game-like' experience** of the VR world and set-up, as part of a broader trend towards "**Edutainment**" (education within the

framework of entertainment).[25] This has been used effectively to create a game out of construction site safety ('Safety Inspector'), **increasing students' interest and motivation**.[24] Additionally, existing video games such as Minecraft and its educational adaptation **MinecraftEDU** can be used to host students – individually, or in a collaborative group – to build simple or elaborate buildings, electrical circuits, and logic models. With its immense popularity as a game, and the blend of creativity, engineering, and entertainment, Minecraft is argued to hold a major advantage in learning.[26]

There are also associated downsides with VR, if and when there are difficulties creating a fun environment, or the structure of the task is still too formulaic. After an initial wave of interest in educational games, some criticism has been raised that **not enough research and grounded preparation** is done in development, to tie the game into higher level thinking – these games which are hastily created have been described as "**chocolate-covered broccoli**"[27] – initially appealing, and with good educational content, but fundamentally not engaging enough for students.

Additionally, VR or video games can **be expensive, or difficult for non-technologically savvy** teachers to set up and run.[26] Studies have shown that teachers struggle with the time and effort to **keep up with technological training**,[28] are often not aware of computer games' popularity or educational potential for students,[29] or can be otherwise resistant to change.[30]

Practical tips:

- For those creating the VR environment
  - Ground development in research around what works for engaging young people's sustained educational interest. Consider a participatory development model in partnership or collaboration with young people
  - Consider creating environments with famous landmarks, or other exciting things (space ship, dinosaur) to build
  - Be creative about points or reward systems – take inspiration from existing popular games
  - Allow players the ability to personalise their avatar/ virtual character's appearance
  - Make it a priority for the programme to be accessible not just for the younger student generation, but for teachers to understand and implement as well
  - Spread awareness where possible of the options and benefits of VR or game-based experiential learning among schools
- For educators
  - Where possible, familiarise yourself with game or VR options for teaching as an investment in ongoing lesson plans – ask for demonstrations and efficient training from the creators, if available

- Encourage collaboration and experimental problem-solving among students
- If you have had a good experience with game-based experiential learning, share tips and best practice with colleagues who are less familiar with the technology

4. Conclusion

Experiential learning programmes are an exciting and innovative benefit in construction education. Distinct from more passive site visits where construction is simply witnessed, the interactive and exploratory nature of these programmes holds key benefits in stimulating and maintaining interest; fostering deep and transferable learning for academics and employability; and increasing students' awareness of the sector, and likelihood to pursue a future career in it.

Far from simply being a fun respite or 'reward' field trip, experiential learning site visits or games intrinsically benefit students' knowledge and employability, and have an important role to play in nurturing and driving forward the next generation of construction professionals, in a sector which is trying to prioritise exactly that.

However, although participants in experiential learning programmes have had extremely positive experiences and shown measurable benefits, the main limitation is a lack of awareness and uptake in construction education.

Best practice emerging from research has therefore promoted a range of practical tips (previously discussed), all of which collectively cover 3 main principles:

1. **Keep activities engaging**
2. **Foster deep learning and reflection**
3. **Spread the word**

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