Curiosity, co-creation and constructing knowledge with hydroponics for sustainable wellbeing

Anne Temple Clothier outlines how trainee teachers develop futuristic primary science classes

Figure 1 The hydroponics set up (Sustainable Education CIC)

Building on a project that began in 2016 (Oakman, 2016), Leeds Beckett University students have continued to work with a local Community Investment Company (CIC) that uses surplus food to facilitate learning around wellbeing and sustainable development. Previous undergraduate education studies students produced an education pack (Carole, 2017) to support learning within the key stage 2 (ages 7–11) National Curriculum in England (DfE, 2016) on health and nutrition. This year the students focused on designing a science education pack that would enhance learning and facilitate activities centring on the use of hydroponic installations in key stage 2 classrooms.

Influenced by the work of Stephen Ritz and the Green Bronx Machine (2018) in the USA, hydroponics was chosen as a tool to engage children's imagination and capture their attention. Using these systems, carefully selected seeds can be nurtured to maturation in classrooms over a three-week period, producing food the children can eat (Figure 1).

To prepare the education resources, the undergraduate students researched three key areas:

- **hydroponics;**
- **the science element of the key stage 2 National Curriculum (DfE, 2016);**
- **the United Nations *Sustainable Development Goals* (UN, 2015).**

Their outcomes were to produce a body of work that not only offered a variety of activities to develop key stage 2 skills, including planning, recording and evaluating, but also to provide creative opportunities to facilitate conversations around ecology, sustainable development and wellbeing. The pack, structured around the various stages of hydroponic farming (planting, germination, maintenance, growth and harvesting) was to allow pupils the opportunity to experience each stage from the perspective of a scientist, a farmer and a chef. Lesson plans, activity resources and certificates of achievement were created, and structured into a comprehensive resource to be disseminated to schools.

Sharing ideas and approaches

The work was conducted as part of a two-week placement within the university, where the undergraduate students co-created the pack in conjunction with university staff and representatives from the CIC. A co-creation pedagogical method was used, as outlined by Temple Clothier and Matheson (2017), whereby '*the* [traditional] *power relationship between teacher/learner*' (2017: 3) or '*teacher centred power*' (Bovill, Cook-Sather, and Felten, 2011: 113) is relinquished in favour of a more democratic intellectual community. The participants in this community, the undergraduate students and practitioners, had equal status in terms of agency and strategic direction. Participation in the community was voluntary, and the outcomes of the project were not tied to any element of the student assessment framework. As such, no student could pass or fail any element of their award based on their participation in the project.

The research

The British Educational Research Association *Ethical guidelines for educational research* (BERA, 2018) were adhered to throughout this research. It was made clear that participation in the research was

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neither part of the students' academic engagement with the university, nor was it a required element of the project itself. As such, all participation was voluntary and included the right to withdraw at any point without explanation.

The data analysed here draws on the experiences of nine, out of sixteen, undergraduate students who were involved with the project, with data collected by the university staff in a series of semi-structured interviews and field notes made throughout the duration of the project. The respondents could determine their own level of disclosure and no personal information was collected. It is hoped that the length of the project, its relaxed atmosphere and the collegiate way of working enhances the truthfulness of the responses, and there is no evidence to suggest that this is not the case.

Students' perceptions of the value of the project

When questioned about their experiences in the project four key themes emerged, and these are addressed in turn:

- **using co-creation as a pedagogical approach;**
- **the values embedded in the project;**
- **using hydroponics in the classroom;**
- **engaging with schemes of work and lesson plans.**

Using co-creation as a pedagogical approach

Co-creation was clearly something that the undergraduate students enjoyed. An indicative comment given by one student respondent, '*Co-creation is a fabulous way to learn*' (R1), reveals some of the enthusiasm for this approach that is quite distinct from their usual classroom delivery. Another affirmed that '*Creating something together was really satisfying*' (R2), and this notion of shared focus and responsibility was picked up by a third respondent:

We really enjoyed managing our own workload and working without too much direction. I'm sure the key stage 2 pupils would enjoy it as much. That's why we want the children to be able to take ownership of looking after the hydroponic units themselves; we think they will like the responsibility. (R3)

While another student said, '*Working as part of a team is energising*' (R4), she also noted that '*not everybody works as hard*' and that on occasion it was necessary to '*fill in the gaps to get it all done*' before concluding '*but that's just life isn't it?*'

The values embodied in the project

An indicative comment given by R1 was '*I loved the values underpinning this project, being healthy, living better and creating sustainable plans for the future*' and this appeared to be a sentiment shared by the whole group.

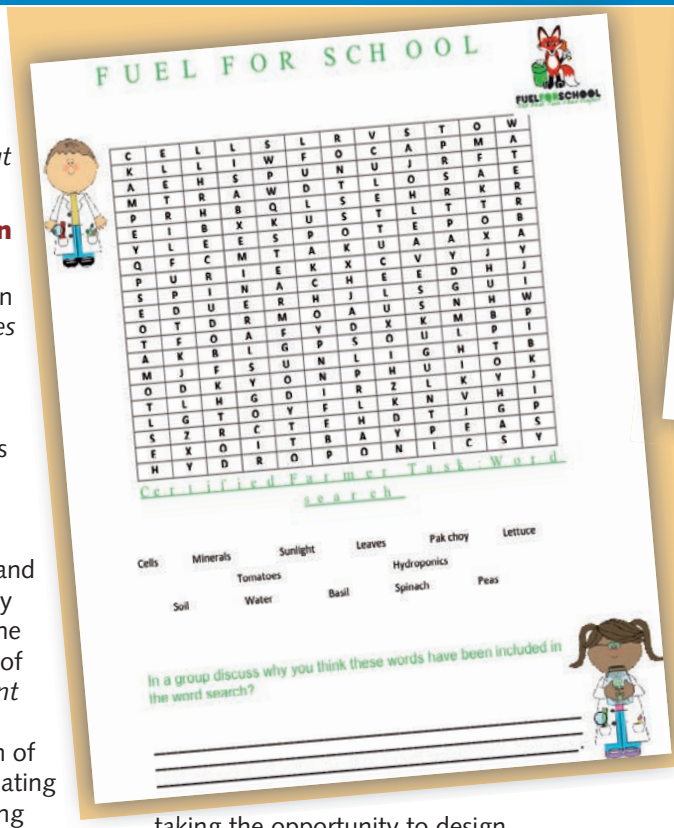
While the key stage 2 National Curriculum in England (DfE, 2016) provided the key framework for developing the scheme of work, the values of the *Sustainable Development Goals* (UN, 2015) were embedded in the application of the science. These values relating to sustainability and wellbeing clearly resonated with the students and were frequently referenced as being a key driver in the initiative. R4 said:

We wanted to make children think about where their food comes from and get them passionate about ecology and sustainable ways of living. It was also key that we make science as exciting as possible, we wanted to do something that was 'real life' and 'hands on' so that the children can see how science is relevant to nearly everything they see and do.

The practical application of these values was noted by R7:
When children plant their own food, and watch it grow, they develop a deeper relationship and understanding of what they eat. They begin to understand the implications not only of the resources needed to grow the crop, but also the air miles and packaging that are used by supermarkets, and then the effect this has on the planet.

Using hydroponics in the classroom

Not all the students were familiar with hydroponic growing at the beginning of the project. As R5 said, '*I'd heard of hydroponics, but never seen one*'. Some associated it with the illicit growing of marijuana: '*We laughed when our tutor suggested that we give out hydroponics sets to primary school children*' (R6). However, after the initial mirth had died down, the students relished



taking the opportunity to design classroom activities around this system of growing. R7 said '*We looked at the work of Stephen Ritz in America and realised that we could do something similar, but on a smaller scale*' and even R6 relented: '*Once we'd had chance to think about it, it kind of made sense*'.

The innovative alternative to soil-based growing, and the speed at which it creates yields, created a sense of wonder amongst these undergraduates:
I knew that they were supposed to grow things quickly, but I did not realise quite how quick it could be. (R7)
One of the advantages of using hydroponics is that they are not affected by the seasons; therefore you can grow what you want, when you want, and it can be a year-round process. (R2).

Other students saw different potential for offering this unique experience to key stage 2 learners, R8 saying '*Even if they have their own garden, I bet they don't grow like this*', and they made comparisons to alternative more traditional primary school installations: '*I remember incubating chicks at my school, and I often wondered what happened to them when they were taken away*' (R9).

Once the suitability of the hydroponic units for classroom teaching was agreed, the students set about brainstorming activities that could be

Figure 2 ***(left)*** **Example of the materials created by the students**

Figure 3 ***(above)*** **A certificate received by the children at the end of the experience**

based around them and conducted some research into the science requirements of the key stage 2 National Curriculum in England (DfE, 2016). The challenges encountered and some of the achievements are considered in the following section.

Schemes of work and lesson plans

The group chose to structure their work around the phases of using the hydroponic unit, setting up the equipment, germinating seeds, maintaining the nutrient flow, measuring yield, harvesting the crop and eating the produce. It was felt that this would be wholly appropriate for teaching science as '*Science is amazing, and it should really engage the children if they are growing something to eat*' (R2).

For each of the phases identified above, the students produced lesson plans, activity sheets and teaching resources (Figure 2). In the completed programme of activities, key stage 2 pupils have their learning scaffolded so that they can progress from 'Beginner' to 'Advanced' in three categories, that of scientist, farmer and chef. On completion of each stage they receive a certificate of achievement (Figure 3).

While the students enjoyed the creative elements of the process: '*I love this side of being at uni, you get to do all sorts of crazy stuff, and experiment*' (R3), for most it was the first time they had designed learning activities and they found '*It's not as easy as you think to write a lesson plan when you don't know how long each activity will last or how the kids will respond*' (R7). Although each of the students contributed at least one idea for a learning activity, as the work developed they became more adept at playing to their strengths. One student took responsibility for ensuring the lesson plans were uniform in their format, saying '*I quite like detailed work, I'm a bit of a perfectionist*' (R4), while another designed the certificates of achievement because '*She is really artistic*' (R8), and another created word-search learning activities as '*I think the kids will really like them*' (R9). Being able to focus on areas they felt good about kept the motivation of the group high and allowed the students the opportunity to reflect on a variety of learning styles and differentiated teaching methods:

We're all just big kids really, so if we design activities we would enjoy there should be something in there for everyone. Not everyone will achieve at the same rate, but if they can do some of it, then it will boost their confidence to try the next bit. (R9)

Conclusion

The responses of the undergraduate students clearly evidence that working with hydroponic units is indeed fun and informative. The creative co-creation of teaching activities had facilitated thought and conversation about the relationship between the science of growing and the values associated with its implications. Having to solve problems and take responsibility for the choices made bound the group together and developed a more critical understanding of the micro and macro issues associated with food production. While the students were mindful of their own development, it was also something they wished to share and nurture with key stage 2 learners.

The undergraduates came to an understanding that:

Science is not only a taught subject, it pervades all we do. By being aware of the consequences of our actions, we may contribute, scientifically, to a better future. That's what I hope comes through in the teaching pack, that we need to look after ourselves, and the planet. (R1)

The use of hydroponics to facilitate this learning was summed up by R3 who said:

It's like magic, I love it, it's so hands-on, I wish we'd done it at primary school. (R6)

As well as supporting the students in their learning and engagement with resources and activities for key stage 2 pupils, we feel that there are many lessons for the teacher from this. Taking an example of something where there is little knowledge and embarking upon a learning journey alongside the pupils is a powerful one. It provides opportunities for deep exploration and offers the chance to engage with co-creation of a knowledge base. Although a step that takes courage we feel that this is something that ultimately benefits the relationship between pupils and their teachers.

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