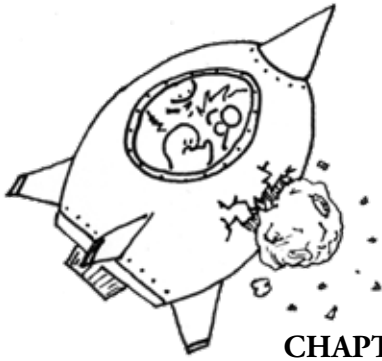


**CHAPTER 17:**

# HOW DID THE APOLLO 13 CREW USE CONSTRUCTIONISM TO RETURN SAFELY TO EARTH?

***Mark Childs, Mike Collins and Becky Cohen***

*Beckzilla decides to stay a little longer in the land of Social Constructivism, so the others agree on an excursion to a nearby area, the Vale of Constructionism.*

*'Constructivism and Constructionism – easily confused,' notes Mikezilla. 'Nonsense,' says Beckyzilla of the clan Cohen, as she joins them on their trip. 'After all, you wouldn't confuse me with Beckzilla just because our names are similar.'*

*While exploring, the Zillas make some discoveries, the first being that this is possibly the place where they have had the most fun. There are robots, LEGO, and coding, oh my.*

*There's also a fair bit of inner mental building of the mind to go along with the outer building with the hands, so it's not much of a surprise to see people from neighbouring lands hanging out here as well. This place keeps the constructivists happy, as well as the social constructivists, and they're all building things together.*

*Isn't it great when people get along?*

In our tour around the various forms of constructivism, we've saved constructionism until last because it brings together a lot of the other theories. With constructionist approaches there's a bit of building, a bit of talking, and a bit of constructing schema in your mind. It's also best to make sure constructivism is thoroughly bedded in as a term before looking at constructionism, as it's quite easy to get the two words mixed up.

This chapter also talks a lot about Apollo 13 (the mission) and *Apollo 13* (the movie) though, obviously, there's a lot of overlap. This is one of our rare forays into reality, so we make the most of it by talking about the real-world space mission, which is useful in setting the scene for the events of the movie. If nothing else, you'll come away with a good idea of how the Moon missions were supposed to go. Moonnobbers[1] and welwalas[2] can skip this first part, but read on if you want to find out the answer to the question: **How did the Apollo 13 crew use constructionism to return safely to Earth?**

## Apollo 13

For many born in the sixties and earlier, the Moon missions were a vision of the future. There were 12 guys (all guys, all white, all American but … ahem, moving on) who showed us that space was something that could also be colonised by white people. That by 2001 there really would be moonbases, and people living on space stations, and missions to Jupiter. A formative memory for Markzilla was being ushered into the hall at Princes End Infant School in Tipton and the whole school sitting together watching footage of Neil Armstrong stepping onto the lunar surface. It's

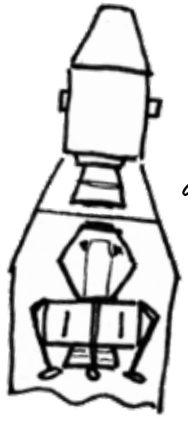
1. A pejorative term introduced by Professor Brian Cox to describe people who do not believe in the Moon landings.
2. See https://expanse.fandom.com/wiki/Welwala





difficult to capture that excitement now. Even by Apollo 13 (the third mission to the Moon) in 1970 there was waning interest in the Apollo programme – then everyone was gripped once again when the mission went wrong.

If you're not familiar with the Apollo rocket configuration, it's basically a huge cylinder topped by a truncated cone, topped by a smaller cylinder, topped by a smaller truncated cone, topped by a smaller cylinder, topped by a tiny cone. The tiny cone at the top is where the three guys sit. That's the command module. The cylinder underneath that is the service module, and the truncated cone below that is where the lunar module (the bit that lands on the Moon) sits. Everything else is just there to get those three modules into space.

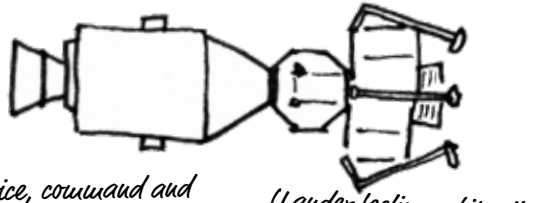


*Apollo spacecraft configuration at launch. Lauder all warm and cosy*

The key to understanding what went wrong with Apollo 13 is that, just after the top section (the top cone, the top cylinder, and the truncated cone below that) leaves Earth orbit, the truncated cone where the lunar module is stored falls away. There's then a manoeuvre during which the lunar module

joins onto the front end of the command/service module (see illustration). That's when Apollo 13 ran into problems.

In Apollo 11, the lunar module and command/service module were joined together as they travelled to the Moon. Then Mikezilla's namesake, Michael Collins, stayed in the command module, Buzz and Neil climbed into the lunar module and went down to the Moon. Only the top section of the lunar module came back, it reconnected with the command module, Buzz and Neil climbed back into the command module, the lunar module was jettisoned, then the remaining command/service module came back to Earth. The whole trip ended when the tiny cone that had formed the tip of the original craft splashed down in an ocean somewhere. Simple. Apollo 12 ditto. Apollo 13 – not so much.




The movie *Apollo 13* is based on the events of the Apollo 13 lunar mission. For astronauts Jim Lovell, Fred Haise and Jack Swigert, everything is going according to plan after they leave Earth's orbit. But then disaster strikes and an oxygen tank explodes. The movie explores the subsequent tensions within the crew and the numerous technical problems that threaten the astronauts' survival and their eventual safe return to Earth.





Some comments on the film: it's a Tom Hanks movie, he plays Jim Lovell, who is not only the commander of the mission, he wrote the book the movie is based on. With Kevin Bacon playing Jack Swigert, it's a double whammy of movie legends. Gary Sinese (another legend) plays Mattingly, an astronaut who's been bumped from the mission. It's Jack Swigert who stirs the oxygen tanks of the service module, presumably to prevent the oxygen from getting a skin on the top like custard. This should be a routine task, but the stirring causes an explosion, due to some wire in the tanks that has damaged insulation. This explosion leads to the oxygen venting into space. There's still enough oxygen to breathe, but as it's also used for fuel by the fuel cells, with no oxygen the astronauts seem doomed to end up running out of power before they get back to Earth.

Initially, crew members weren't sure whether or not it was just a pressure indicator inside the tank that was faulty and misleading them by showing there was no oxygen pressure or whether they were really losing oxygen. They worked out which of these interpretations was true by looking out of a window and seeing that – yes, they were venting oxygen. One of our top tips in relation to constructionism is that it's sometimes useful to look out of the window.

To preserve power in the command and service modules, the astronauts climbed into the lunar module. The plan was altered. They would skip the Moon landing. Instead, they would all hang out in the lunar module, which had been designed for two people for three days. If they didn't use the lunar module to land on the Moon, it would have enough power to fly everything back to Earth. So that's what they did, saving the command module and service module until they absolutely had to use them for the final stage of the journey. Another problem was that they weren't sure whether the command module's heat shield had been damaged in the explosion, so they had no idea whether

they would get back down to the surface without burning up in the atmosphere.

An additional problem, once they'd decided on this course of action, was that the command module guidance system that was to be used for steering the craft back was never supposed to be turned off, but in this case it had been turned off completely. The astronauts therefore had to use the guidance system on the lunar module to do the job. This meant entering all the calculations onto the lunar module computer, which had less computing power than the average phone has today.

As an aside, we note a *Pedagodzilla*-style fact connected with these events. Judith Love Cohen was one of the software engineers who wrote the code for that guidance program. She was pregnant at the time and completed her part of the coding as she went into labour, actually taking a printout of the program to the hospital to finish it off there. Your trivia question is: who was the baby she gave birth to? Our clue is: this is not the greatest trivia question in the world, no, this is just a tribute. See the end of the chapter for the answer.

Yet another problem they had to deal with, which led to one of the most dramatic (and for our purposes here, useful) scenes of the film is that, as there were 50% more people in the lunar module and they were spending considerably more time there than intended, far more carbon dioxide had to be scrubbed from the air than the equipment could handle. Avoiding $CO_2$ poisoning became a key issue. The astronauts could get the carbon scrubbers out of the command module, but they didn't fit in the lunar module. This meant the astronauts had to jury rig a solution using what was available to them in their spaceship, this being in the days before Amazon deliveries. In the movie scene, the staff at Mission Control gather together a set of equipment identical to that available in space and try to





replicate the solution on the ground in order to be able to advise the astronauts.

A final problem arose because all these systems were so finely interconnected. Turning off the fuel cells meant there wasn't enough water to drink, because the cells produced water as a by-product. So the astronauts were dealing with the situation while becoming increasingly dehydrated.

But they all made it back safely to Earth, and there was a brief rekindling of the interest in the Apollo programme, enough to last for four more missions, the final trip being Apollo 17 in 1972. In the half-century since then, no human has returned to the Moon (though, as we write, NASA has announced Artemis II, a crewed mission around the Moon that is planned as preparation for a Moon landing).

## Constructionism

Before moving to construct**ion**ism, let's recap on construct**iv**ism. Constructivism is the whole collection of approaches based on the view that learners build ideas in their heads. So, what you're doing when you're teaching people is helping them build their own ideas by providing experiences, problems to solve, activities, and support along the way that will enable them to do that building. Social constructivism is the idea that learners build those ideas in their heads by interacting with others. Situative learning is concerned with the ways in which learners interact with their environment and how that influences the ways they construct their ideas.

Constructionism blends these concepts by focusing on how learners build an understanding by building artefacts. The approach is basically constructivist because it views learning as a process of individuals building ideas in their heads. It's also

situative, because it involves learner interactions with their environment. The proponents of constructionism argue that it's also social constructivist, because the building process is fundamentally a social activity. Looping back to our discussion of reality in the chapter on *The Matrix*, the artefacts that are built can be constructed in physical or virtual environments, or a combination of both.

For a popular culture introduction to constructionism, take a look at *The Toys That Made Us: LEGO* (Stern and Frost, 2018). This covers how LEGO took on the ideas of Seymour Papert's *Mindstorms* (1980, 2020) to develop the toy in the educational arena.

Papert is a key figure in the development of constructionism. He worked with the psychologist Jean Piaget, who was a founding figure in constructivism, and went on to add some nuances to Piaget's work. Essentially, Piaget argued that constructivism is about building up models in the heads of learners. They are 'builders of their own cognitive tools, as well as of their external realities. For them, knowledge and the world are both constructed and constantly reconstructed through personal experience' (Ackermann, 2001).

Constructionism proposes doing this by *actually* building things so that ideas are 'formed and transformed when expressed through different media, when actualized in particular contexts, when worked out by individual minds' (Ackermann, 2001, 88). And it's even more effective if you allow learners to 'invent for themselves the tools and mediations that best support the exploration of what they most care about' (Ackermann, 2001). These quotations are taken from an excellent text that explores the differences in these approaches, *Piaget's Constructivism, Papert's Constructionism: What's the Difference?* (Ackermann, 2001), which is one of those 'does what it says on the tin' papers.





Edith Ackermann's paper is an example of how academic writing should be – straightforward accessible language, with the various elements neatly laid out. She neatly sums up the distinction between Piaget's constructivism and Papert's constructionism:

> *Piaget's … theory emphasizes all those things needed to maintain the internal structure and organization of the cognitive system (symbols standing for objects, abstraction of rules etc). And what Piaget describes particularly well is precisely this internal structure and organization of knowledge at different levels of development. Papert's emphasis lies almost at the opposite pole. His contribution is to remind us that intelligence should be defined and studied in-situ; that being intelligent means being situated, connected, and sensitive to variations in the environment*
>
> (Ackermann, 2001: 91)

This is why we've placed constructionism as a continuation of the situative learning models, as the approach is so fully embedded in the environment. It overlaps a lot with Krathwohl's (2002) reconceptualisation of Bloom's taxonomy (Krathwohl had been one of the original authors of that taxonomy, but Bloom's name came alphabetically first in the list and so he tends to get all the credit). The revised taxonomy includes a hierarchy of overlapping activities under the headings: Remember, Understand, Apply, Analyze and Evaluate. The final element of the taxonomy, Create, involves 'putting elements together to form a novel, coherent whole or make an original product' (Krathwohl, 2002). Mention of the taxonomy gives Mikezilla another chance to ring his metacognitive bell, because the revised taxonomy has a knowledge dimension, which includes

factual knowledge; conceptual knowledge (the relationships between those facts); procedural knowledge (how to do things in a subject area); and concludes with metacognitive knowledge, 'Knowledge of cognition in general as well as awareness and knowledge of one's own cognition' (Krathwohl, 2002, p214),

We should also fold into our mix (we did a lot of bread-making during Covid) Kafai and Resnick's ideas on learning by design (2011). They point out that, although design theorists have traditionally concentrated on the final products and learning theorists have emphasised the process of constructing ideas, there are strong connections between design and learning. The two fields are converging to some extent, as the focus in design is now much more on the process, including ways of understanding objective constraints and subjective meanings. At the same time, learning theorists, particularly constructionists, have begun to concentrate on the roles played by products and artefacts that learners produce.

So, for example, the LEGO robotics and coding *Mindstorms* sets do what they do so well, which is getting people to learn to code, by showing them immediately the results of their coding with little robots crawling around on the floor and doing things. And, of course, making robots in the first place helps learners to understand and acquire the principles of engineering. Other products, like the Logo Turtle developed by Papert, work on the same principles (Barnett, 2017). The Turtle robot responds to the commands programmed into it – providing immediate feedback on what has worked and what has gone wrong. It's worth noting that, although constructionism seems to be a long way from behaviourism, the immediate reward of success and the disappointment connected with failure align well with the principles of operant conditioning described in Chapter 7.

Building things that are tangible and shareable is typically a social activity, so constructionism draws in a lot of the ideas





around social constructivism. People don't just make a LEGO robot and instruct it to move, they do this individually or as a group, they draw on what they know of the robots that others have created, and they show off their results to other coders or to friends and family. Sharing ideas and negotiating meaning are as important as the process of constructing the artefact.

The map in Chapter 6 is a good example of constructionism at work. Markzilla came up with a sketch that laid out the domains of pedagogy as he saw them, Mike and Beckzilla proposed changes, added the elves and dwarves metaphor, and pointed out inconsistencies in the domains. Between the three of them, a common ground was created. Creating a map, rather than simply discussing ideas, helped focus discussion and led to decisions about which ideas should go into the design, and where domains should be located.

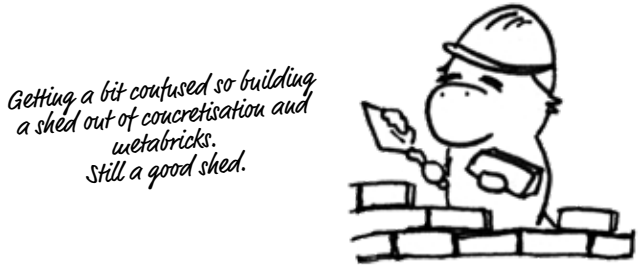
In Lave-and-Wenger speak (see Chapter 16), the object enables reification[3] – or making concrete – things so they can be worked on and designed further (Farnsworth et al, 2016, 9), which is a core part of how communities of practice function. Wenger's idea of reification goes back to Papert's idea that 'building knowledge occurs best through building things that are tangible and shareable' (Barnett, 2017). So, for example, *Mindstorms* (the LEGO product) synthesises *Mindstorms* (the Papert book) and, in a meta way, is a concrete representation of the concepts in the book, while Wenger makes the point that writing a book is an act of reification in itself.

As an aside, talking about *Mindstorms* in the podcast on constructionism was also an act of constructionism, because the podcast was a reification of our various concepts around

3. Reification has lots of fancy definitions, but the one we like best is 'thing-ification' – turning something abstract into an object. You see this a lot on the TV around Christmas when advertisers try to persuade you that concepts such as freedom, love and teen spirit can be distilled and stored in scent / deodorant bottles.

constructionism, informed partly by having watched people using *Mindstorms* on TV. Our podcast was therefore constructing something from our abstract ideas about the TV show; the show reified the uses made of *Mindstorms* the kit (since people worked together and negotiated what that meant when creating the programme); and the kit was a concretisation of the principles expressed in the book; which was itself a product in which Papert coalesced what was in his mind.

And writing this book chapter about the podcast is a concretisation of the ideas formed by reflecting on the podcast …. ahhh, this could be an infinite regression of building concepts by building things. Let's stop before we go down that rabbit hole and instead answer our question.




## The answer

In the description of the issues associated with three men moving into the lunar module for the flight home, a space that was designed for two men for a shorter period, we highlighted carbon dioxide build-up as one of the key issues. There were carbon dioxide scrubbers in the command module, but these couldn't easily be used in the lunar module, because the housing wasn't compatible.

Cue one of the most dramatic scenes in the movie (and the reason for choosing it as our example of constructionism). The





specialists in Mission Control back on Earth cleared a room and collected together their own set of the equipment available to the astronauts in the spacecraft. Between them they had to build something, using only the available materials, that would enable the command module scrubbers to fit into the lunar module housing. They did this while in continuous dialogue with the astronauts.

What makes this a great example of constructionism is that the thinking about the design is done entirely through interaction with the objects; there's no purely abstract conceptualisation, the thinking is enacted through building and through the engineers expressing their ideas to each other by interacting with the objects in the room with them. They're collaboratively building knowledge, literally and metaphorically. Once they have a process developed, they then have to recreate that process in a step-by-step guide for the astronauts.

What helped in this process was that one of the people on the ground, Mattingly, had trained with Lovell and Haise. He had been intended to be on Apollo 13, but had to be scratched from the mission. All these space missions had a prime crew and a back-up crew, but one of the back-up crew (Duke) caught rubella. He could have infected all five other astronauts, but the others were immune – except Mattingly. Normally, if one astronaut was scratched from a team, the whole trio would be replaced, but with one scratched from the prime crew and one from the back-up, this was a rare example of NASA having to mix and match.

Looking at this process through a social-constructivist lens, this mixing and matching may well have helped with the working together. Mattingly would, presumably, have formed a shared group identity with Lovell and Haise, and a group identity helps enormously with collaborative learning (this is sometimes called the congruity hypothesis – Rogers and Lea, 2005, 156), but is particularly difficult to enact with remote collaboration. Here,

though, the group identity would have been formed by them working closely together and developing a shared understanding of each other – which we previously mentioned in the 'Tips for practice' section of the Council of Elrond as helpful in social constructivism. Of course, Mattingly (and the others) would also have been motivated by trying to save the Apollo 13 crew, but we wouldn't recommend 'solve this or your friends die' as a valid teaching approach. It's not exactly a low-risk assessment.

For our final example of constructionist principles, there's the act of looking out of the window to see whether or not they are dealing with an instrument failure or if there really is an oxygen leak. It's Papert's idea that 'being intelligent means being situated, connected, and sensitive to variations in the environment' encapsulated. The environment in question here is a command module, but the idea applies anywhere.

So, to answer our question: **how did the Apollo 13 crew use constructionism to return safely to Earth?** Well, it was actually the Mission Control engineers who did this, but the constructionist principles they used for learning were:

- using design and construction of actual artefacts to develop an understanding of how to make the command module $CO_2$ scrubbers fit in the lunar module by replicating the materials available to the crew;
- pooling, testing and checking knowledge with each other, using these materials as a collaborative space;
- collaboratively creating a physical artefact they could share, which encapsulated the conceptual output of their learning process;
- drawing on social identity formation within the Lovell-Haise-Mattingly team to convey information and work collaboratively at a distance.





- Through these, they found a solution that enabled the three astronauts to breathe more easily and survive the trip back to Earth.
- In short, they initially didn't know what to do, they made something and, by making something, they understood the answer. Which is, basically, what constructionism is.

*(also duct tape)*

## Tips for practice

For an example of using constructionism in learning activities, take a look at Walton, Childs and Jugo (2019). This paper describes a research project that encouraged schoolchildren in five European schools to develop an interest in their national literature by creating videos, comic books and playing cards based on the books they were studying in school. Students had to remain engaged longer with the books in order to create the artefacts, and they stayed interested for longer, which meant they dug deeper into understanding the books. They also had to engage more deeply in order to re-present the content to other students. By drawing on skills not normally demanded of schoolchildren, some students found they had acquired higher status amongst their peers (by being able to edit, perform, speak English etc) and through that gained self-confidence they'd not been able to acquire through standard academic work.

All these findings backed up the claims of constructionism: get students to create something together and they will be more engaged with the content of the course, talk to each other more and find the end results more fulfilling.

The key thing is not to do this in an unstructured BeanDad (Chapter 13) kind of way. What the teachers did in the project wasn't just to set the students off to create something, they all (independently across the five schools) found that the process which worked best was:

1. talk about the book;
2. talk about the artefact they wanted to make;
3. teach students the skills (where needed) to make the artefacts;
4. talk about what the students found out about the book in the process.

So they brought in the Papert principle of making sure students 'invent for themselves the tools and mediations that best support the exploration of what they most care about'.

They pupils didn't just build things – their teachers integrated these activities within a cycle of instruction, collaboration, reflection and the next stage in the creation process. Ultimately, it's the reflection that consolidates the learning. The collaboration itself has to be structured, learners need to be taught the skills to work together effectively and how to create an artefact together. They also need to be able to create meaning not just from the content they are studying, but also from discussing the multiple interpretations that arise from considering that content. Constructionism requires a single output as an artefact, which requires synthesis of these multiple perspectives[4], which is why, in the revised version of Bloom's taxonomy, 'synthesise' is renamed 'create'.

4. Or at least a mechanism for displaying multiple points of view, for example how we've occasionally fractured the narrative into multiple points of view and peppered the text with call-out boxes and footnotes like this one.





So our major learning tip is that MAKING STUFF IS EXCELLENT. It requires learners to think about things from different perspectives and codify their thinking into a tangible output. Essays count here, but consider mixing it up a bit for variety.

So do it, do it all the time, do it loads. Every course, every module that you teach should have some elements of making stuff in it.

There is a danger (again we refer you to the Walton/Childs/Jugo paper, we're not biased) that the students who are considered more academically able, and who can think academically, may be alienated by this approach. Often it's the learners who aren't very good at making stuff or who aren't very good at sharing or working with others who excel in conventional lessons. When they're asked to work with other people to create things, suddenly they're not the ones at the top of the class. You need to find ways to reassure them that they still have an important role to play, even in a situation where the less academically oriented are able to shine.

Constructionism has to be managed to some extent. There's a danger that some students will get too deep into the creation and lose their way. They may not focus on the things to be learnt and, instead, become sidetracked by the process. If you've asked your students to make a film about the book they're studying in order to learn more about the book, steer them away from experimenting with expressionist cinematography and lead them towards talking about the text.

The process also has to be scaffolded. Provide instruction in the skills learners will need, not just the technical techniques but also the collaborative techniques. Maybe one of the students just wants to crochet; support the others to find ways either to incorporate that idea into their final product or to convince the student that another approach would work better. Maybe

someone isn't great at pushing their ideas; the group as a whole needs to be taught how to find a mechanism for communication that includes all voices. Ideally, you'll include some activities to build a group identity first, but also give people opportunities that don't involve group work, because it doesn't suit everyone. For those who have had bad experiences of group work in the past, perhaps because of free-loaders in the group, discuss what went wrong and which strategies they could use in the future.

Crucially, develop a balance and comfort levels between the more traditionally academic skill set and the skill set associated with creating artefacts. Provide opportunities for the academics to be successful, but don't let them rely entirely on their normal ways of doing things. There are benefits to rethinking something conceptually as a physical, tangible thing that a group can all work on; doing this generates possibilities that otherwise wouldn't have been apparent. Anxieties around stepping into unfamiliar territory can be lessened by 1) explaining the pedagogic rationale for the activity and 2) assuring learners that they won't be judged on the quality of the artefact, but on the quality of the learning that emerges from constructing the artefact. And, from an assessment perspective, make sure you really are judging learners on the learning they display and not on the use of chiaroscuro in the mise en scène, or whatever.

Finally, making things together can be fun, not only for learners, but for educators as well. In the research project mentioned above, teachers reported there was more conversation going on in the classroom, there was more engagement, and the activity broke down barriers, because for once the teachers weren't the experts on everything taking place in the school. The students could do things the teachers couldn't, which led to a flattening of the different statuses, which produced a type of environment in which people learn well.





And, even if sometimes they don't learn well, isn't it better to spend your time doing something that's fun rather than miserable? There's always going to be some dreary thing to bring you back down to Earth, which (unless you're stuck out in space) is rarely a good thing.

## Houston, we have a citation

Ackermann, E. (2001). Piaget's constructivism, Papert's constructionism: What's the difference? In *Constructivism: Uses and Perspectives in Education*, Volumes 1 & 2, Conference Proceedings (85-94). Geneva, Switzerland: Research Center in Education. Available at: http://www.sylviastipich.com/wp-content/uploads/2015/04/Coursera-Piaget-_-Papert.pdf

Barnett, M. (2017) Exploring Turtle Art on the pi-top, *Blog:MakerMark*, Medium, 24 April. Available at: https://medium.com/@maker_mark/exploring-turtle-art-on-the-pi-top-f89919d81ff7

Farnsworth, V., Kleanthous, I. and Wenger-Trayner, E. (2016) Communities of practice as a social theory of learning: a conversation with Etienne Wenger. *British Journal of Educational Studies*, 64:2, 139-160.

Kafai, Y. & Resnick, M. (2011). Introduction to constructionism. In Y. B. Kafai & M. Resnick (Eds.), *Constructionism in Practice: Designing, Thinking and Learning in a Digital World* (1-8). New York, NY: Routledge

Krathwohl, D. (2002) A revision of Bloom's Taxonomy: an overview. *Theory into Practice*, 41:4, 212-218, DOI: 10.1207/s15430421tip4104_2

Papert, S. (1980, revised 2020) *Mindstorms: Children, Computers and Powerful Ideas*. Basic Books. USA: New York

Rogers, P. and Lea, M. (2005) Social presence in distributed group environments: the role of social identity, *Behaviour & Information Technology*, 24:2, March-April, 151-158.

Stern, T. and Frost, B.J. (2018) *The Toys That Made Us*, LEGO 2:3. Netflix, USA: Los Gatos, California

Walton, G., Childs, M. and Jugo, G. (2019) The creation of digital artefacts as a mechanism to engage students in studying literature. *British Journal of Educational Technology*. 50:3, 1060-1086.

*Answer to the trivia question is: Jack Black. You gotta believe me.*

Scan the QR code to listen to the podcast episode

This chapter is an extract from the book **Pedagodzilla: Exploring the Realm of Pedagogy** by Dr Mark Childs, Prof Rebecca Ferguson, Mike Collins and Elizabeth Ellis. First Edition 2024.

If you find this useful in your practice or study we would love to know. Drop us a note at mark.childs@durham.ac.uk,at Michael.collins@open.ac.uk or at @pedagodzilla on Twitter (we refuse to call it 'X'). All feedback helps us with our next book!

To download all chapters of the book for free, listen to the Pedagodzilla podcast or purchase a paperback copy (royalties go to funding our next project) visit the book landing page or scan the following QR code: