Is Problem Based Learning Superior to Direct Instruction?

By BRENT SILBY

Alfie Kohn (2008) argues that techniques found in Progressive Education, such as *problem-based learning*, are superior to *direct instruction*. His argument is based upon research carried out primarily with children ranging from preschool to year 3 of primary (elementary) schooling.

Kohn refers to research outlined in Bonawitz et al (2010) "The Double Edged Sword of Pedagogy". Experimenters set up two scenarios with preschool children. In the first scenario, children were given a toy and provided with explicit instructions outlining two functions of the toy. The children quickly learned those two functions and happily continued playing with the toy in the manner in which they were instructed. In the second scenario, children were not provided with any explicit instructions. Instead, they were left to *discover* the toy's functions independently. In this scenario the children, through a process of trial and error, discovered, not only the two functions the previous group had been taught, but also a third function that remained unknown to the first group. Interestingly, children in the first group tended not to discover the third function. They stuck with what they had been taught. Because the second group learned more about the toy than the first group, Kohn concludes that problem-based learning is superior to direct instruction.

Bonawitz's experiment is interesting but I am not convinced that this example adequately demonstrates the superiority of problem-based learning over direct instruction. For a start, there is a vast difference between children aged under 7 years and students aged 15-18 years, so it would be a mistake to make an inference from studies carried out on preschool children to a conclusion on how education should be carried out across all levels. Furthermore, the fact that children in the second group discovered three functions does not, on it's own, entail that problem-based learning is more effective than direct instruction. In Bonawitz's first scenario, children who were given direct instruction learned how to use the toy's two functions quickly and efficiently—certainly faster than the second group who may never have discovered the toy's functions. In fact, it would not have been possible to know exactly what the children in the second scenario were going to learn prior to being given the toy. They could have learned nothing or perhaps learned to use the toy incorrectly.

Proponents of problem-based (or discovery) learning would suggest that it doesn't matter if children learn to use the toy incorrectly. They might claim that *what* children learn is not as important as the fact that they are learning *independently*. Sugata Mitra holds this view. In 1999 he set up the *Hole in the Wall* experiment in which he installed a computer kiosk in a Delhi slum. Children were given free access to the computer. His central hypothesis was that children would be able to, through a process of experimentation and trial and error, learn how to use the computer and Internet without any direct instruction. For Mitra it is vital that teachers have virtually no input in the learning. The only level of intervention permitted is the encouragement of students with positive comments and reinforcement. They are not to influence the learning or make any judgements about what the students are discovering. This is an important point which should not be overlooked. Problem-based learning, as outlined by Mitra, involves students progressing through learning episodes with no guidance from teachers. They learn by working through set problems independently or in small groups.

Mitra claims that his experiment successfully confirmed his hypothesis. However, critics argue that he has been too hasty in concluding the success of the *Hole in the Wall* experiment. As Warschauer (2003) points out, it might be true that the children learned how to use drop-down menus, however most of the time they were simply playing games and drawing pictures. But even if Mitra's hypothesis *was* confirmed, the *Hole in the Wall* experiment would not demonstrate the superiority of problem-based learning over direct instruction. It is likely that children would learn how to use the computer a great deal faster if provided with explicit direction. Furthermore, we need to question whether independently learning how to use a modern computer is such a great achievement. Modern computers are designed to be user friendly. They are designed in such a way as to direct people towards correct usage through a range of self explanatory icons and intuitive screen layouts. It would be more interesting to see students independently learning how to use a command-line based computer from the late 1970s and 1980s. I suspect their level of success would be significantly lower than the students in Mitra's *Hole in the Wall* setup.

Students successfully learn how to use modern computers independently because modern computers were designed to be easy to use. But the universe was not designed to be easy to use. The universe was not *designed* at all. We cannot simplify the universe to make it easier for discovery learners to understand. It is unreasonable to conclude from the fact that students can independently

learn how to use a modern computer that they can therefore independently learn *anything* without direct instruction from a teacher.

Similarly, while it might be true that a child can figure out how to use a toy without direct instruction, moving from this type of example to the conclusion that all learning should be discovery based is a leap too far. There is a difference between learning how to play with a toy and acquiring *propositional* knowledge about the world. It is a mistake to conflate the two types of knowledge—knowing *how* and knowing *that*. When a child learns how to play with a toy they are acquiring *procedural* knowledge. But education involves more than acquiring skills and *procedural* knowledge. Education also involves learning facts about the world, i.e. *propositional* knowledge.

Direct instruction is a means by which teachers provide students with propositional knowledge. This has been the primary method of knowledge transmission for centuries, and it works. Alternative forms of education have to, at the very least, be able to demonstrate equivalent success as direct instruction. But Clark et al (2006) argue that minimally guided approaches found in problem-based learning are not as effective as direct instruction. They cite research by Richard Mayer comparing pure discovery learning (defined as problem-based, unguided instruction) with direct instruction. Mayer examined evidence from the 1950s through to the late 1980s and concluded that in each of those decades, unguided approaches did not work. Further to Mayer's research, experimental studies show that students studying science in pure-discovery classrooms often become frustrated and confused, and this leads to them forming misconceptions (Brown and Campione 1986).

Proponents of the problem-based approach may respond by suggesting that evidence used in support of direct instruction is weighted towards the sorts of skills that one would acquire through that style of learning and fails to acknowledge the skills that problem based learning provides for students. These include *readiness to learn*, *transferable skills*, *self-efficacy*, and *preparation for future learning*. The problem here is that there are few tests available to assess these skills. There is therefore limited opportunity to determine that problem-based learning itself achieves results in each of these areas. Of the tests available, results show unambiguously that direct instruction results in more learning than unguided approaches. For example, tests developed to determine the extent to which students are able to transfer their learning to new contexts show that direct instruction is superior to discovery approaches (Clark et al 2006).

We measure the effectiveness of problem-based learning with the tools we have at our disposal. To be taken seriously as an alternative, it needs to be at least as successful as direct instruction at providing students with propositional knowledge. So the question is: *is it possible to successfully gain reliable propositional knowledge about the world through discovery or problem-based learning?* On the face of it, the notion that problem-based learning is an effective route to learning propositional knowledge is not outlandish. One can easily imagine situations in which problem-based learning enables students to acquire reliable knowledge about the world. However, with no direct influence from a teacher such cases may be accidental. Furthermore, with no direction it is entirely possible that students will come to the end of a problem-based learning episode having gained incorrect knowledge.

Michelle Sowey (2013) argues that problem-based learning can result in students acquiring false facts and ineffective reasoning techniques. She outlines a scenario in which students undertook a problem-based approach to a question which resulted in them clearly ending up with unreliable knowledge. The scenario in question was highlighted by Sugata Mitra himself and involved a group of students working with no guidance investigating the question "Can you kill a goat by staring at it?" Students made factual errors and failures in reasoning and arrived at bizarre conclusions indicating the acquisition of false knowledge.

"... in their post-activity reflections, the children all drew highly credulous conclusions that supported paranormal claims – conclusions such as 'mind over matter', 'if you believe something, you can make it happen' and 'the mind can fix problems without aid'. Another concluded that the facts are relative to one's beliefs: 'I have learnt that there was no answer to the question, it was what people believed in.'" Sowey (2013).

The final student comment is concerning. It points to a sort of truth relativism that may negatively impact future education. Imagine a student encountering astronomy for the first time and claiming that "there is no answer as to whether Jupiter exists, it just depends on what you believe in". Or worse, imagine such a student exploring questions about apartheid and suggesting that whether whites are superior to blacks is simply a matter of belief with no definitive answer. Should teachers, as Mitra suggests, avoid interference and simply admire the answers students are generating, regardless of accuracy? I think teachers have a responsibility to intervene. Relativism holds us back.

The strength of direct instruction is that it minimizes these problems. It allows for the transmission of propositional knowledge from professionals who represent the academic disciplines within which the knowledge has been developed. The knowledge presented to students constitutes the current academic understanding of the world and is the result of centuries of slow accumulation of research and careful thought. The delivery of knowledge is deliberate and measured rather than haphazard. There is a process of gradual introduction to theory and fact. As a student moves through school, their knowledge builds through the meaningful addition of new knowledge that builds on, and is dependent upon, knowledge already held.

Conclusion

Problem-based learning, discovery learning, and other techniques favored by theorists in progressive education involve students working independently with minimal teacher intervention. Support of these approaches is based largely on evidence of trial-and-error learning found in early childhood education. This trial-and-error approach tends to involve the acquisition of skills or procedural knowledge. But education involves more than procedural knowledge. It also involves propositional knowledge. The problem with approaches that involve minimal direct instruction is that students risk acquiring false knowledge and bad reasoning ability. Direct instruction overcomes this limitation by ensuring that knowledge presented to students is reliable. This is because it is delivered by a representative of the discipline which has developed the knowledge over centuries of slow refinement.

Given the fact that direct instruction results in students gaining more reliable knowledge and reasoning ability, and given the fact that skills and dispositions attained through direct instruction are superior to those acquired through problem-based learning, it is reasonable to favor direct instruction—at least until sufficient evidence is presented to support the alternatives.

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