

What the research says about learning

Baume, D. and Scanlon, E. (2018). What the research says about how and why learning happens. In: R. Luckin, ed., *Enhancing Learning and Teaching with Technology - What the Research Says*, 1st ed. London: UCL IoE Press, pp.2-13.

David Baume and Eileen Scanlon

Introduction and summary

Learning has been researched extensively. Fortunately, we do not have to plough through tens or hundreds of thousands of individual articles to extract headline principles about learning and, our particular focus here, what makes learning happen. We don't even have to read hundreds or thousands of review articles, in which researchers have summarised the main findings from all these individual articles. These meta-analyses, too, have been synthesised, and the most robust of results and findings from the research and the review articles extracted. Here we have gone one step further, and synthesised the findings of four syntheses of meta-analyses.

So, here are seven things we know about learning; seven principles for learning. We know these with reasonable confidence, because each of them can be seen in at least two of the four very large syntheses of meta-analyses of, in total, many hundreds of thousands of individual studies. Most of the results here come from the two meta-studies, which mainly focus on learning (Chickering, & Gamson, 1987; James, & Pollard, 2011). However, there is some confirmation, and no contradiction, from the other two meta-studies, which are more concerned with teaching (Hattie, 2015; Pascarella, & Terenzini, 2005).

Learning is most effective when the following conditions are met:

1. A clear structure, framework, scaffolding surrounds, supports and informs learning;
2. High standards are expected of learners, and are made explicit;
3. Learners acknowledge and use their prior learning and their particular approaches to learning;
4. Learning is an active process;
5. Learners spend lots of time on task, that is, doing relevant things and practising;
6. Learning is undertaken at least in part as a collaborative activity, both among students and between students and staff; and

7. Learners receive and use feedback on their work.

Discussion

We are not saying that these are the only seven things that are true about learning. However, we can be confident about these seven principles. Neither are we saying 'just do these seven things and all will be well'. Principles have to be applied in particular situations. This is where the skill, the craft, of the teacher and of the learner, come into play. Simple principles can lead to complex practices.

Before we explore each of these seven in a little more detail: You may feel that most, or possibly all, of these discoveries are fairly obvious, fairly intuitive, perhaps common sense. This shouldn't be a surprise. Look at this in another way. It would surely be surprising if any of these seven key results about learning, which have risen to the top through several layers of research and analysis, were counterintuitive. Why would this be surprising? It would be surprising because we all have a huge amount of experience of learning. Many of us also have considerable experience of teaching, or in other ways supporting learning. Even without formal analysis of this experience, we all know something about what works in learning and supporting learning. (On the other hand, we probably also 'know' some things about learning that are actually wrong, or certainly highly particular and local!)

We all have models or theories about our own learning, whether or not we make these explicit. For example, when we choose to learn about a new topic by reading a book about the topic, or by searching on the web, we are showing that we believe - implicitly - that these are good ways for us to learn. We show our theories about learning, quite possibly implicit theories, by what we do.

Teachers also have models of learning. For example, by lecturing on a topic for 50 minutes, the lecturer shows that they believe that being lectured to for 50 minutes is a good way to learn. (The architecture and the timetabling of the college or university, and the fact that the lecturers are called lecturers, as well as several hundred years of tradition, may also push them in this direction.) Unfortunately, in this case there is considerable evidence that in many situations this strategy is rather poor (Bligh, 1971). A lecture may inspire, motivate and inform, but rarely fulfils the seven principles for effective learning; it is certainly inadequate for developing high-level skills.

What we do, whether as learners or as teachers, shows our implicit theories of learning. A great way to learn about learning is to surface, to make explicit, our implicit theories, by analysing what we do and how we do it. And then to see what the literature, the research, says about these theories. This process isn't always comfortable, but it is usually very productive.

We are absolutely not saying that the research on learning need not have been done, and that common sense can be our complete and reliable guide. But there is evidence (Bain, 2004) that one of the qualities of a truly outstanding teacher is that their own internal models of learning and teaching are broadly similar to what is known from the research about learning and teaching. This is true whether or not these outstanding teachers have undertaken formal study in learning and teaching, and whether or not they make their models and theories explicit.

We now go into more detail about the key principles outlined above.

Learning is most effective when:

1) A clear structure, framework, scaffolding surrounds, supports and informs learning

and

2) High standards are expected of learners, and are made explicit

As we learners blunder about on lower slopes, we need to see the mountaintop – our ultimate destination. The sight of the mountaintop, the thought of arriving there, should inspire us. If it doesn't, then perhaps we have chosen the wrong quest. Or perhaps nobody has successfully shown us a perspective on the destination that could inspire us. Here we see perhaps a vital role for the teacher – motivation.

But the mountaintop may look remote, scary, or even perhaps unattainable. So we also need to see waypoints, intermediate goals, cabins where we can consolidate achievements and recuperate as we plan the next stage of the climb. Better still if we also have a route map, showing the path, or ideally a range of paths, to allow us to choose the one best suited to our current capabilities and enthusiasms. We also need to learn about ourselves: to judge how secure is our progress and how confident we are in tackling different kinds of challenges. Briefly shifting the analogy from mountain to lake, we need to know when we are getting out of our depth, and to have available a framework of routes by which we can achieve a secure footing again. We need tools and resources, information and feedback about our progress, and companionship - and competition – to ensure that our achievements are real and worthwhile.

We have compared learning to the process of climbing a mountain. Perhaps the most vivid aspect of this analogy arises when we reach the mountaintop. Then we can see the full horizon, typically with higher peaks presenting new inspiring challenges that now seem, with

effort, achievable. Education has no Everest: there is always something more challenging to achieve.

Moving away from mountain climbing metaphors, structures for learning can take the form of clear intended learning outcomes, course schedules and an appropriate set of learning activities. High standards can include, again, clear learning outcomes, together with examples of work that achieves these outcomes. Achieving high standards also needs the opportunity to explore why good work in the subject is good and poor work is poor; in other words, the opportunity to articulate and then use criteria to identify good work.

3) Learners acknowledge and use their prior learning and their approaches to learning

If we concentrate on teaching rather than learning, it is easy to end up enacting an implicit theory of learning which treats learners as empty vessels into which knowledge should be poured. What's wrong with this implicit theory of learning? Pretty much everything.

Learning is an active, a purposeful, process. Learning results from continuing conversations, between learners (principle 6 below), and also within us, between our current beliefs and the new ideas, which we are encountering (principle 4 below).

Learning can usefully be seen as a process whereby learners get from where they are to where they want to be. So it makes sense for learners to acknowledge whatever it is they currently know and can currently do. Learners need to build on – which of course will sometimes include tearing down – their current knowledge, and maybe some of their current ways of working. Learning is aided through collaboration, but learning is also in part an individual process. The need for large-scale, mass, education can tug against this individuality. The manufacturing industry has addressed this, with some success - options allow many different versions of the same car model, each assembled to order. Education isn't there yet, although there is progress.

It is hard to learn if we do not know ourselves. It is hard to teach if our learners do not know themselves. It is hard to teach if we do not know our learners. Good learners are often those who have learned to manage their own learning, based on knowledge of themselves as learners. One important job of a teacher is to facilitate learners' self-knowledge.

4) Learning is an active process

The sponge model of learning turns out to be wrong. More precisely - trying to learn by soaking up knowledge doesn't work very well. Continuing with fluid metaphors, our brains are not buckets waiting to be filled.

As just one illustration of a way in which learning is an active process: We are doing (at least) two distinct things when we are learning.

We are trying to fit what we are reading or hearing into our current model or picture of the world. For example, when we read or hear about a new country, we can fit or assimilate what we are hearing into our current concepts of 'country'. We have a, perhaps implicit, concept of 'country-ness', if you like. This concept may include ideas including borders, culture, government, policy, language, currency. Seeking to assimilate new information, new ideas, into our existing world-view is often a valid and productive approach to learning.

But sometimes this doesn't work. Any example involving countries is likely to be contentious, but, if we consider the Guernsey, we may struggle to accommodate Guernsey into our current account of a country. We may discover that we need to re-conceptualize, to accommodate, what we mean by 'country' to cope with Guernsey. The ideas of assimilation and accommodation, originated by Jean Piaget, are well introduced in Wikipedia.

(En.wikipedia.org, 2017)

We use these rather cerebral examples of learning to emphasise that active learning need not mean doing something physical, for example. But learning is an active process. If you are not active, you are most unlikely to be learning.

Of course, activity is no guarantee of learning, at least of constructive learning. But a skilled pro-active learner will learn to ask internally the kind of questions that make for productive thinking, and hence learning. It is in this context that peer interaction, explored below under principle 7, can be incredibly valuable. Any conversation about a shared experience - a visit, a piece of music, a show - will immediately demonstrate how new ideas, even untidy nonsensical ones, can stimulate understanding and making sense of experiences.

The relationship between activity and learning is not a perfect, tidy, 1:1. (The relation between teaching and learning can be even less tidy.) A considerable variety of activities can lead to the same learning. A single activity can lead to multiple learnings. Learning is a complex, indeed often messy, business.

5) Learners spend lots of time on the task, that is, doing relevant things and practising

Again: Learning is an active process, involving doing relevant things, often in collaboration, often if not constantly receiving and using feedback.

But what might be 'relevant things'?

For practical skills, this may be fairly obvious. If we are teaching someone how to ride a bicycle, we don't think of lectures on the physics, law, health and safety implications, sociology and fashion of cycling as necessary precursors – well, perhaps a few minutes on 'how to stay alive'. We would instead prefer training equipment, encouragement, physical support of an instructor and a safe place to practice. A cycling role model and enthusiastic friends who inspire a strong wish to cycle are valuable, along with lots of time for practice; and maybe an occasional bandage or sticking plaster.

All these things have their parallels in academic learning. A successful introduction to a new practice like cycling may even inspire the will to attend the aforesaid lectures, or to read the books.

This suggests starting with practice or problem, with theory afterwards. If we teach this way round, then theory can be presented and experienced as offering both explanations and tools for generating further critical thought and suggesting further action. Education is often conducted the other way around; theory first, application later. This may be one reason why the word 'academic', can sometimes taken to be synonymous with 'irrelevant', however unfair that may be.

Time on task is essential for any kind of learning. Even when tasks are relevant, they need to be sequenced appropriately, undertaken with constructive collaboration and feedback, and with reference to clear, high expectations and standards. Structures are needed in which to think about the issues, and to make relationships between what we are learning and what we know already – you will recognise all this from the list of seven principles.

Think again about the daunting set of lecture topics on the basic knowledge that relates to cycling. We talked above about the appropriate relations between theory and practice. Here we broaden this point. An implicit theory of learning in much formal education is that we need, first, to learn the core concepts and ideas. Only then can we learn to apply them. Consideration of time on task suggests a different approach. Often it may be more productive to start with the intended outcomes of learning: with what we want to achieve and why it is worthwhile. Then, as we initially tackle simple, then progressively more sophisticated versions of the tasks described in the outcomes we become motivated and more able to use and test principles that underlie what we are doing.

John Holt (1977) asked whether he was engaged in learning the cello or playing the cello. Of course, he was doing both. He was playing, for his current pleasure, and with the intention of playing even better, for even greater future pleasure.

Is this how you would describe your formal education? Did you do and enjoy doing maths, languages, geography, whatever, with the intention of doing them even better?

Is this how your current learners describe their learning?

6) Learning is undertaken at least in part as a collaborative activity, both among students and between students and staff

Much of formal education used to focus on individual learning. Indeed, another word for collaborative learning used to be 'cheating'. Most assessment now is still an individual business. And therefore, as the tail of assessment inevitably wags the two dogs of learning and teaching, there is constant strong pressure towards treating learning as an individual process. This is despite the great value that the real world places on collaboration.

Much of our experience probably shows us the value of learning through collaboration, typically through conversation and working together. In good, open, honest, critical and constructive conversations, sharing and testing and developing ideas and practices, we learn, we progress our knowledge and understanding. Every "Oh yes!", and every nod that isn't simple politeness, denotes a moment of learning.

The teacher may have two distinct roles in educational conversations. Of course the teacher is an expert in the subject being taught and learned, and students value the subject expertise that the teacher brings. But the teacher must also facilitate learning, judging when to ask and answer a question, when to steer students towards possible answers or sources for answers, and when to help students develop their own approaches to answering questions. Conversation is an essential skill, for teaching and for learning.

That we learn through collaboration should not be a surprise, given the other principles. Principle 1, the need for a clear structure or framework, describes a prerequisite for effective collaboration rather than an automatic consequence of collaboration – we have probably all worked in poorly structured collaborations, which were less than effective. A constructive, well-motivated group is constantly striving to do better (principle 2). In an effective collaboration, participants value and build on what everyone brings, as well as challenging and questioning as appropriate (principle 3). Effective collaboration involves actually doing things together (principles 4 and 5). Collaboration and conversation include receiving and using feedback on our thoughts (principle 7). This paragraph also suggests the value of considering the various principles together, rather than in isolation.

7) Learners receive and use feedback on their work

Action and reaction, thesis and antithesis and synthesis, call and response, question and answer - the idea of interaction, of conversation, of a statement and critical and/or constructive response, is fundamental to much human interaction. It also turns out to be fundamental to how we learn.

Feedback can mean any kind of usable response. The response can come from the teacher; from a fellow learner; even, perhaps counter-intuitively, from the person who has produced the work being responded to.

'Usable' is crucial here. At a basic level, usable feedback can talk about:

- What was good in the work, and why, and therefore what the person producing the work should continue to do and build on in future pieces of work.
- What was less good, and again why, and what the person producing the work might do differently in future pieces of work.

Usable feedback goes well beyond saying 'good' or 'poor', 'like' or 'don't like'. Usable feedback is specific and constructive. Crucial to usable feedback is the word 'because', as in this example:

"This answer was good because it clearly and directly answered the question; sourced and then marshalled evidence for both sides of the argument; reached a reasoned conclusion, whilst acknowledging the weight of countervailing arguments; and identified future lines of enquiry.

"In future work, you might additionally look at sources including these ... and adopt a more critical stance, perhaps using approaches including ..."

The person who produced the original work could use feedback like this to guide their future work, as well as feeling appropriate pride in what they have produced this time.

It may seem counterintuitive to suggest that learners, as well as tutors, can give useful and usable feedback to each other. But they can (Falchikov, 2004).

It may seem even less likely that learners can usefully critically review their own work. In fact, anyone can take a piece of work they have produced, and ask and answer basic questions including "What is good about this work, and why?" and "In what ways could it be better, and again why?" That, after all, is what we do when we consider the first draft of something we have produced, and set about improving it. Students have been found to be able to become good at this (Boud, 1995).

Feedback goes well beyond a single act of production and a single response. The kinds of collaborative learning explored in principle 6 above involve a rapid cycle of production and response; a conversation leading to learning. This is, after all, how much of the real world conducts itself. Self- and peer-feedback could usefully play a much larger and more constructive role in education than they currently do.

Talking about learning

Beyond these seven things we know, with considerable confidence about learning, synthesised above from a very large literature, we would make a further point about learning.

In formal education, whether in school, College or Higher Education, we rarely talk much with our learners about learning. It would be good to talk about it more – about what we mean by learning, about the conditions for learning, about our individual preferences for learning, about what we know about how we learn and like to learn. These should be conversations, not lectures. The more we all know about learning in general, and about our own and our peers' learning, our learning preferences; in short, the more seriously we take this strange complex vital business of learning; then the better will be our chances of becoming and remaining effective and enthusiastic lifelong learners. This we must do.

Conclusion

No-one promised that learning would be easy. But it will always be essential. It will take us to new places, to important and rewarding new achievements. The principles described and explored here can guide our own learning and the ways in which we help others to learn, although we shall always have to apply these principles to particular settings and learning needs. They are not the last words about learning, but they provide useful starting points.

In a later chapter we apply the seven principles and some other ideas from the literature to using technologies.

Acknowledgements

Thanks to Professor Bob Farmer for conversations about the work of James Hattie, and to Professor Alan Tait and the late Dr Roger Mills for collaboration on an earlier synthesis of the research on learning.

References

- Bain, K. (2004). What the best college teachers do. Cambridge, MA: Harvard University Press., pp 25-6
- Bligh, D. A. (1971). What's the use of lectures? (1st ed.). Exeter: Intellect Books.
- Boud, D. (1995). Enhancing learning through self assessment. Philadelphia: Routledge Falmer.
- Chickering, A. W., & Gamson, Z. F. (1987). 'Seven principles for good practice in undergraduate education', AAHE Bulletin, 39(7): 3–7

En.wikipedia.org. (2017). *Jean Piaget*. [online] Available at:
https://en.wikipedia.org/wiki/Jean_Piaget [Accessed 7 Jul. 2017].

Falchikov, N. (2004). Improving assessment through student involvement practical solutions for aiding learning in higher and further education. London: Taylor & Francis e-Library.

James, M., & Pollard, A. (2011). TLRP's ten principles for effective pedagogy: Rationale, development, evidence, argument and impact. *Research Papers in Education*, 26(3), 275–328. doi:10.1080/02671522.2011.590007

Hattie, J. (2015). The applicability of visible learning to higher education. *Scholarship of Teaching and Learning in Psychology*, 1(1), 79–91. doi:10.1037/stl0000021

Holt, J. (1977). *Instead of education: Ways to help people do things better*. United Kingdom: Penguin books.

Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students Vol. 2: A Third decade of research* (2nd ed.). San Francisco, CA: Jossey-Bass Inc., U.S.