

What the research says about learning and digital capabilities

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Introduction

A chapter about digital capabilities runs the strong risk of being obsolete before the ink is dry on the page, or whatever the equivalent is for pixels and screens.

In this chapter, we manage this risk in two ways.

First, we say very little about particular digital technologies. Rather we consider the kinds of things that digital technologies can do, in the world and in the classroom. This list will also go out of date, but hopefully much more slowly than would a list of particular technologies, whether technology means hardware or software or both.

Second, we start with what we know about learning, and the circumstances and actions that help learning to happen.

These two approaches come together nicely. Technology continues to change, and to change faster and faster. We want to survive and thrive, rather than drown. So we can be sure that we shall still need to learn.

And this continued need to learn applies well beyond the digital domain. The technology will continue to become more capable. It will continue to steal our work / liberate us from the drudgery of mechanisable tasks (choose the version you prefer). We shall continue to need to learn, both how to work effectively with the evolving technology and how to do the things that technology cannot (currently) do. We shall also need to continue to help others to learn, whether we are parents or guardians or co-workers or managers or volunteers ... Learning and supporting learning will increasingly be fundamental and integrated parts of all our lives.

And that's why we start, not with digital, but with learning.

What do we know about learning?

Fortunately, we know quite a lot about learning. Equally fortunately, we do not have to plough through tens or hundreds of thousands of individual articles to extract headline principles about what makes learning happen. We don't even have to read hundreds or thousands of review articles, sometimes called meta-analyses, 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. This approach is so new it doesn't yet have a name.

So, here are seven things we know about learning. We know these with reasonable confidence, because each of them can be seen in at least two of four very large syntheses of meta-analyses of, in

total many hundreds thousands of individual studies.^{1,2,3,4} (Most of the results here come from the first two studies, which focus mainly on learning. But there is some confirmation, and no contradiction, from the latter two studies, which are much more concerned with teaching.)

Learning is most effective when:

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

We are not saying that these are the only seven things that are true about learning. But we can be pretty confident about them.

Neither are we saying, 'just do these seven things and all will be well'. Principles have to be applied to particular situations.

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. To invert this: It would surely be astonishing if any of these seven results about learning, which have risen to the top through several layers of research and analysis, were counterintuitive, surprising to us. Why would this be astonishing? 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. We are in our way experts about learning. We may not have formally analysed our experience, as learners or as supporters of learning. But, at some level, and to some limited extent at least, we all know something about learning. (We probably also think we know some things about learning that are actually wrong, or certainly highly particular and local.)

Let's take this a step further. We all have models or theories about 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, quite possibly implicit theories, by what we do.

¹ Chickering, A. W., and Gamson, Z. F. (1987). 'Seven principles for good practice in undergraduate education', *AAHE Bulletin*, 39(7): 3–7

² 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.

³ Hattie, J. (2015). The applicability of visible learning to higher education. *Scholarship of Teaching and Learning in Psychology*, 1(1), 79–91.

⁴ 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.

Teachers do the same. By lecturing on a topic for 50 minutes, the lecturer shows that they believe that being lectured at 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.) Despite all the evidence to the contrary⁵.

Again: What we do 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 evidence⁶ 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.

So - learning is most effective when:

1. 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'. And much, most, assessment now is still an individual business. And therefore, as the tail of assessment inevitably wags the dogs of learning and teaching, there is constant pressure towards learning as an individual process. This is despite the value that what people who work in education tend to call the real world, the world outside education, 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, can denote a moment of learning.

That we learn through collaboration should not be a surprise, given the six remaining principles. Collaboration is almost by definition an active process (item 2). Collaboration and conversation include receiving and using feedback on our thoughts (item 3). Effective collaboration involves actually doing things together, not just mooning around (item 4). A constructive, well motivated group is constantly striving to do better (item 5). Item 6, the need for a clear structure or framework, describes a prerequisite for effective collaboration rather than an automatic

⁵ Bligh, D. A. (1971). *What's the use of lectures?* (1st ed.). Exeter: Intellect Books. There have been several later editions, but the 1971 version is used here to show for how long we have known, or at any rate had access to, the results of research into the uses and limitations of lectures. Summary: lectures are about as good as other methods for transmitting information, but less good for developing high-level capabilities.

⁶ Bain, K. (2004). *What the best college teachers do*. Cambridge, MA: Harvard University Press., pp 25-6

consequence of collaboration – we have probably all worked in poorly structured collaborations which were less than effective. And in an effective collaboration, participants value and build on what everyone brings, as well as challenging and questioning as appropriate (item 7). This paragraph also suggests the value of considering the various principles together, rather than in isolation.

2. 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 washing metaphors, our brains are not buckets waiting to be filled.

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, which may include ideas like borders and culture and government and policy and perhaps language and currency.

But sometimes this doesn't work. Any example involving countries is like to be contentious, but, if we consider the Isle of Man, or Taiwan; we may struggle to fit the Isle of Man or Taiwan into our conventional account of a country. We may discover that we need to re-conceptualize what we mean by 'country' to accommodate the Isle of Man, or Taiwan.⁷

We use these rather cerebral examples of learning to emphasize that 'active learning' need not mean leaping around or emulating the presenters of Blue Peter by building physical objects. A student listening to a lecture may be intensely active, or completely passive, or indeed asleep. But learning is an active process. If you are not active, you are most unlikely to be learning.

Of course, being active is in itself no guarantee of learning, certainly no guarantee of purposeful and goal-directed learning. The activity must be appropriate to the intended learning. But the relationship between activity and learning is not perfect, tidy, 1:1. A considerable variety of activities can lead to the same learning goal. And a single learning activity can generate a great variety of learning, as any conversation about a recent shared experience - a visit, a piece of music, a show - will immediately demonstrate. Learning is an untidy business.

One of the things most likely to generate learning from an activity is critical reflection on that activity and, as we now go on to consider, feedback.

3. 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 statement and critical and/or constructive response, is fundamental to much human interaction. And it turns out to be fundamental to how we learn.

⁷ As so often, Wikipedia gives a good starting point, here on these ideas of assimilation and accommodation, which were originated by Jean Piaget - https://en.wikipedia.org/wiki/Jean_Piaget

Feedback can mean any kind of usable response. The response can come from the teacher; from a fellow learner; even, perhaps counterintuitively, 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 therefore what the person producing the work should continue to do and build on in future pieces of work.

What was less good, and 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’. Crucial to usable feedback is the word ‘because’:

“This answer was good because it clearly and directly answered the question, marshalled and sourced evidence from both sides of the argument, reached a reasoned conclusion, acknowledged 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. Students can rapidly learn to give good and useful feedback.⁸

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 essentially 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.⁹

Feedback goes well beyond a single act of production and a single response. The kinds of collaborative learning explored in item 1 above can legitimately be seen as involving a rapid cycle of production and response; a conversation leading to learning. This is, after all, how much of the real world conducts itself.

4. Learners spend lots of time on the task, that is, doing relevant things

By now this probably feels glaringly obvious. Learning is an active process, involving doing relevant things, often in collaboration, often if not constantly receiving and using feedback.

What might we mean by ‘relevant things’?

⁸ See Falchikov, N. (2004). Improving assessment through student involvement practical solutions for aiding learning in higher and further education. London: Taylor & Francis e-Library.

⁹ See for example Boud, D. (1995). Enhancing learning through self assessment. Philadelphia: Routledge Falmer.

For practical skills, it is generally fairly obvious what 'relevant things', relevant learning activities, would be. Lectures on the physics, law, health and safety, sociology and fashion of cycling are rarely seen as essential precursors of learning to ride a bicycle. Training wheels; the support and encouragement and steadying physical presence of a parent, guardian or instructor; a safe space; and lots of time - these are some of the conditions under which most of us learned to cycle. Along of course with a strong wish to cycle. And maybe the occasional bandage.

But surely that only applies to practical, sometimes called psychomotor, learning?

No. The meta-reviews are clear: Time on task is essential for any kind of learning.

Of course, time on task alone isn't enough. Even when the task is relevant, appropriate.

Collaboration, feedback, clear and high standards and expectations, clear structure or framework in which to think about what we are learning, and using and valuing what we know already - you will recognise these as other items from this list of principles - are also important.

The perhaps rather silly sounding series of lecture topics in the example above about learning to cycle makes a serious point. An implicit theory of learning in much formal education is that, first, we need to learn the core concepts and ideas. Only then can we learn to apply them. Consideration of time on task suggest a different approach. Perhaps we would find it more productive to start with the intended outcomes of learning, with what it is that we want to be able to do, what kind of questions and problems we want to be able to answer and solve, as we discuss further below under principles 5 and 6. Then, as we practice the kind of task suggested by the outcome, at first simple and then more and more sophisticated versions of the task, we can learn the physics, law, health and safety, sociology, fashion, whatever else, as and when we need to learn it to help us achieve our learning goals. John Holt¹⁰ asks whether he is learning the cello or playing the cello. Of course, both. Perhaps 'playing for current delight and with the intention to play even better'. Was your formal education like this? Did you do and enjoy maths, languages, geography, whatever, with the intention of doing them even better?

5. High standards are expected of learners, and are made explicit

And

6. A clear structure, framework, scaffolding surrounds and informs learning

As we learners blunder about on the lower slopes, we need to see the mountain top, our ultimate destination (for this climb at least - there is always another, higher, mountain.) The sight of the mountain top, the thought of arriving there, should inspire us. (If it doesn't, then perhaps we have chosen the wrong quest.)

But the mountaintop may also look remote, scary, even perhaps unattainable. So we also need to see waypoints, intermediate goals, cabins where we can rest and recuperate as we plan the next stage of the climb, the learning. Better still if we also have a route map, showing the path, perhaps even better a range of paths to allow us to choose the one best suited to our current capabilities and enthusiasms. And yet better if we have ready access to resources, information, feedback on our progress, and companionship.

¹⁰ Holt, J. (1977). *Instead of education: Ways to help people do things better*. United Kingdom: Penguin books.

7. Learners acknowledge and use their prior learning and their approaches to learning

If we concentrate on teaching rather than learning, it is easy, as previously mentioned, 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 1 above), and also within us, between our current beliefs and the new ideas which way are encountering (principle 2 above). Indeed the account under principle 2 of accommodation and assimilation as two ways of learning says much of what we would otherwise have said here, about learners acknowledging and using their prior learning.

Learning can usefully be seen as the process of getting from where we are to where we want to be. So it makes sense for we learners to acknowledge whatever it is we currently know and can currently do, and to build on - which of course will sometimes include, tear down - our current knowledge, maybe also some of our 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. Manufacturing industry has addressed this, with some success - options allow millions of different versions of the same car model, each assembled to order. Education isn't there yet, although there is progress.

Of course, everyone has their own particular preferred ways of learning. For example, some of us learn faster, better, more enjoyably from **visual** representations, for example from pictures or diagrams, whether moving or still. Others prefer **auditory** learning - the very architecture of universities, with lecture theatres, certainly suggests that that universities think that many students learn best this way, although lectures make increasing use of visual materials as well. Reading is still a very popular way of learning, whether in formal or informal education, although among younger people there may be a shift to visual and auditory learning preferences. Formal higher education used to speak of "reading for a degree". Many learn through doing, through practical activity, through interaction with the real, the physical world. This is sometimes called **kinesthetic** learning. Kinesthetic learning isn't simply restricted to learning practical skills - It is just another preferred way of learning. The VARK¹¹ model helps us to analyse our learning preferences using this framework. VARK is not a theory - it makes no predictions. It simply provides a tool which has been found useful.

Talking about learning

Beyond the seven things we know, with considerable confidence about learning, synthesised here 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 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

¹¹ See <http://vark-learn.com/>

how we 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. Which we must do.

What do we know about digital capabilities for the future?

1. Ways of thinking about digital technologies and capabilities

New technologies, new websites, new programmes, new apps are launched every day. Far more than we need or have time for.

How to choose?

A good way is to find a few sources that we come to trust - perhaps a website, a magazine, friends and colleagues, online communities ...

When faced with any new technology, we probably should ask questions including:

- What might it do for us? Read the reviews, talk to friends or colleagues who use it.
- How might we assimilate it with, or accommodate to make use of it, the other systems and processes we use? The quickest and best way may be to try it.
- Will it earn its keep on our hard drive or in our cloud? If you have tried it and like it so far, live with it for a month or two.
- Much more important, will it earn its keep in our brain? Will it be worth the effort it takes, first to learn to use it appropriately, and then to actually use it? The learning curves for the new technologies are generally getting shorter and flatter, but some time and effort are always needed. We can't know until, again, we try it. We need to get better, both at trying technologies faster and at deciding when not to bother. Rejecting is a digital capability.
- Might it be fun to use? This is a serious question!

We need to make at least some progress on these questions before we can talk sensibly about digital capabilities, about the qualities we need to function effectively in the digital world and in the digital classroom which prepares us for it. We need to know what we want to achieve, what we want to do, before we can talk sensibly about the capabilities we need.

The list below is called by its authors, for obvious reasons, the 5 Cs framework¹². The authors suggest that most of what we want to do with digital technologies can fit under one or more of these (obviously overlapping) headings.

1. Connecting
2. Communicating
3. Curating
4. Collaborating
5. Creating

¹² Nerantzi, C. and Beekingham, S. (2014). 'BYOD4L – Our magical open box to enhance individuals' learning ecologies'. In Jackson, N. and Willis, J. (Eds.) Lifewide learning and education in universities and colleges. Lifewide Education. E-book available online: www.learninglives.co.uk/e-book.html.

For example:

- The web enables us to locate and then **connect** with Ideas and individuals;
- Email and social media enable us both to **communicate** and to **collaborate** with others;
- Evernote lets us assemble and then **curate**, interpret, information in many forms (whether alone or **collaborating** with others), perhaps as a first step to **creating** something.

5 Cs provides a checklist for looking at a new technology. Which one or more of these five functions could this new technology help us to achieve? And how could it do it better than the technology we use currently? It is also a useful checklist for thinking about a new undertaking you are about to start. Which of these functions will be involved, and therefore what kinds of technologies might you consider using?

2. Digital capabilities

Once we know what we are trying to achieve or learn, and once we have at least an idea of the digital technologies we shall be using, then surely all the digital capability we need is the ability to use each of these technologies properly? What's the problem?

Here are two approaches to thinking about the capabilities, the qualities that we need to function effectively in a digital age¹³.

“Digital literacy defines those capabilities which fit an individual for living, learning and working in a digital society.” (JISC / Beetham 2010)

“I am digitally fluent when I confidently, critically, skilfully and appropriately select and use digital technologies to achieve my goals.” (Baume 2011-12)

Of course neither account is complete.

In both accounts, ‘those capabilities’/‘digital technologies’ constantly need to be updated, as new technologies emerge and old ones die, and also as our goals and our methods change.

The second approach explicitly encourages us to start with what we want to do and achieve. It also suggests how we should approach and use technology, and it emphasises the emotional/personal as well as the technical aspects of digital fluency.

But we will never find out there *The List* which accurately and completely describes the digital capabilities that we need to lead our particular lives and do and achieve the particular things that we want to do and achieve, now and in the future. The responsibility for making and then achieving *The List* lies, and will always lie, with each of us. We need to work out what it is that we need to be able to do, and then find the technology, the training, the support, to help us to be able to do it - “confidently, critically, skilfully and appropriately” as above. We can unpack each of these four terms for ourselves. *The List* has to be *Our Own, Constantly Evolving, List*.

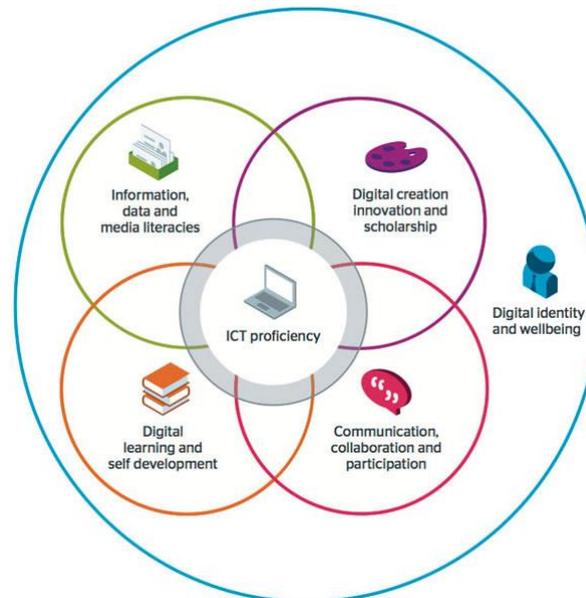
There have been several accounts of digital capabilities. The European Computer Driving Licence (ECDL), launched in 1995, did pretty much what you would expect it to do from the name. ECDL¹⁴, through many iterations and elaborations, is still going strong.

¹³ <https://sedasig.wordpress.com/2012/11/14/digital-literacies-and-digital-fluency-a-process-of-development/>

¹⁴ See <http://www.ecdl.com/>

A contemporary digital capabilities framework is provided in this diagram¹⁵: The diagram suggests that digital capability requires:

- Starting in the outer circle, whatever we are doing digitally, we must protect our digital identity and ensure our digital wellbeing. Of course, we each have to decide what this means for us, what our standards and limits are. If our identity is never stolen or compromised, and if we don't let our use of digital technologies damage our physical, mental or social health or well-being, then we probably have this under control.



- Moving to the centre of the diagram; whatever technology we are using, we need to be able to use it confidently, critically, skilfully and appropriately, which includes safely (safe to the technology and safe to us!). We have to be able to turn it on and off, connect it, generally get it to do what we want it to do.
- The four intermediate circles suggest different kinds of uses of technology. Another approach to this model is to write our own intermediate circles, to describe the kinds of things and then the particular things that we want to use technology for, as suggested earlier, perhaps prompted by the titles of the four intermediate circles here, or the 5Cs model above, or something else. With the constant reminders to ensure our safety and well-being, and to use the technologies at least competently.

Conclusion - developing our digital capabilities

Let's bring two sets of ideas together. How can we (continue to) develop the digital capabilities we decide or discover that we need? In terms of the seven principles;

1. We can do it socially. Contrary to the cartoon image of the man (for some reason it is usually a man) alone at his keyboard, much of our computer time is spent online, and much online time is spent in communication with others. We suggested earlier that online communities are sources of information. They can also be sources of advice, of support, on safety and on proficiency and on our particular enthusiasms.

¹⁵ See <https://www.jisc.ac.uk/rd/projects/building-digital-capability>

2. We have to learn actively. The technology almost demands it, and we should go along. The technologies have to be learned from the inside, by using them - not ignoring the instructions (more likely these days the context-specific help file), but by jumping in. Good technologies welcome and reward this approach. That is part of what makes them good.
3. Mostly, the technology gives us feedback. It either does what we want it to or it doesn't, and sometimes it tells us why. We can ask friends, colleagues, or the user group around the technology for help. "How can I make it ...?" is a common question in such forums. Often, your question will already have been answered. Search the FAQs.
4. You learn the technology by using the technology, and seeing how it goes. Time on task.
5. You set your own goals. Of course you want to do it well - or, at any rate, well enough.
6. There may be three sources of structure or scaffolding:
 - a. The structure of the task you are trying to undertake. This may involve a sequence of activities, or a number of things to be done more or less together, or perhaps some other structure.
 - b. The structure of the programme, the app, the device. This may include the way it defines data and asks or tells you what to do, the form of data it outputs.
 - c. Your own mental model of the task, of what is needed.

Things will go best in the short term if these three structures are similar, congruent, aligned.

7. Prior knowledge can be a blessing and a curse. It can get us operational very quickly. But it's the tacit knowledge that can bite us, the things we didn't know that we knew but were part of our daily practice. Anyone who has moved between Mac and Windows, in either direction, will understand this. It's quicker to learn a new technology that we can assimilate into our current worldview, our current ways of thinking and working. But our next task may need us to use a new technology that forces us to think and act in a new way, to accommodate our world view to take on board something quite different. And that's where the important innovations may come from.

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. Absolutely worth the effort.

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