



Open Education Technology for Global Education Infrastructure

Launch Paper

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Introduction

This paper presents an initial vision for a complete, global system of education technology that can support quality education (for humans and AI) in every sector.

This vision is in very early stages, and the details will require input from a wide variety of stakeholders, but the core structure has been developed from twenty years experience researching and producing open educational technology. As the founder of Moodle, I started examining how internet technologies could be used to improve learner management and to empower educators from 1999 in the context of an Australian higher education institution.

The architecture of Moodle as a truly open source tool sought to meet a critical balance of **standardisation** and **flexibility** needed in education. *Standardisation* in a way that any educator could pick up the tools and know what to do, but *flexibility* in the sense that the modular structure can be easily configured by anyone to work for a wide range of educational scenarios. Moodle has been compared to Lego, or an operating system.

There is evidence this approach has been useful. The most comprehensive recent surveys released by ListEdTech, have shown that Moodle is used by two thirds of all higher education institutions globally, as well as a sizable proportion of secondary schools, and some of the largest corporate, government and military organisations in the world. It is also scalable, being used for open universities that have over 3.5 million students, and for homeschooling where there is only one student.

However, I am the first to say that Moodle is far from finished, and very far from a full solution for education. There are a few easy reasons for that:

1. Firstly, education is much bigger than any internet technology. Education is fundamentally an ongoing daily human activity, and a lot of what makes it work well involves a range of political, cultural, economical and pedagogical factors which are largely out of scope for this document.
2. Secondly, even when focussed on education technology, it's important to place it in the full context of technologies (since writing, probably) that have obviously been part of any education implementation (and wider society) for a long time.

Even in today's digital support environments, a learning management system (such as Moodle) is just one piece of the puzzle, and there are many other aspects that need to be considered when conducting education in any sector, including the definition of skills we deem part of formal and informal education, the production and distribution of content, the many means of having students and teachers interact with content and each other, the

many ways in which we can attempt to assess learning and assign credentials, the creation and storage of recognition and credentials and much more.

Many of these aspects have been, and continue to be, tackled by a variety of companies, institutions, standards bodies and individuals all over the world, however in my experience I feel that there are different kinds of short-sightedness in many of these solutions that introduce all kinds of risks. Some are produced by growing companies with profit-focussed boards that, if they ever had it, naturally drift from an overriding focus on improving human experience. Some are produced by well-meaning short-term academic or development funding projects that don't consider sustainability.

3. Thirdly, Moodle, like all software, has flaws and bugs. One fundamental one is that it is based on a technology stack that also has significant issues when scaling globally, because it is over twenty years old. Computer science and Educational science continues to develop rapidly, and there are better ways to construct software now.

What we clearly need is a fresh start, using all the knowledge we have gained to construct a new infrastructure.

This new infrastructure would be massive, and is not something any one group can build, so it needs to be a widely-agreed set of standard components that retains this balance of being well-defined enough to ensure close and efficient cooperation, and yet loose enough to support any major education scenario, while allowing competition and choice to keep standards high.

It's important, I think, to approach this design from a very high level, as a perfect system for our species, and then drill down into details and technologies from there, rather than the other way around as many standards efforts have proposed.

So to start with, I'll need to take a step back and explain some of the assumptions and context that have led us to this point.

The need for global quality education

Human activity on this planet is progressing ever more quickly, with our population and our technology developing exponentially, and we face many great challenges to achieve sustainability for our species.

These challenges are summarised most succinctly in the Sustainable Development goals, defined and agreed in 2015 by the 193 countries in the UN General Assembly. The SDGs address very serious problems, and in some instances, these problems threaten our very survival on this planet. All the SDGs are explicitly based on one major tenet: **"Leaving no one behind"**.

Sustainable Development Goal #4 addresses the need of **Quality Education** across all ages, and builds upon previous definitions of the right to education in international human rights law in the [International Covenant on Economic, Social and Cultural Rights](#) (1966, ICESCR) and [Convention on the Rights of the Child](#) (1989, CRC). (It's important to note that almost every country in the world has ratified all these treaties, with the notable exception of the United States)

The right to quality education should make intuitive sense to anyone, of course. With our limited lifespans as individuals, education is how we pass on our culture and our humanity down through time. The process and the power of education is integral to our existence and any progress that we make.

Further than that, however, I would argue that Quality education is actually *necessary* to achieve every single Sustainable Development Goal. None of those goals can be achieved without education of both the professionals working on solutions, nor the education of the wider population.

Thus, it seems to me that the goal of quality education across the board is literally the most important thing we can all be working on right now.

Additionally, because the SDGs affect every single human being, and involve every single human being, and we want to maximise the impact of our sustainable development goals - every single human being should have equal opportunities to experience and benefit from the very best available education, education that includes all the knowledge and skills to promote sustainable development.

In fact, since the introduction of the SDGs there have been many attempts, often by UNESCO-related bodies, to push these ideas out into the wider world beyond UNESCO. However, I would argue that these have so far not managed to filter down into state education systems and throughout popular media enough, and that the total impact on society has not been enough to make real differences.

One of the main ways our behaviour is affected on a large scale is through the affordances of software technology - just look at how the internet has already completely transformed the way we learn, communicate and live in just a decade or two. It's clear that a better coordination of efforts in this education area would really help us all, and that is why it makes sense to consider new education solutions on a global scale.

The qualities of a global education solution

Assuming that a universal education technology framework is possible, let's define what **high quality** means by imagining some of the ideal qualities that we collectively would want to see it have, and not have.

Desired qualities that we want to maximise

Accuracy

In a world where increasing amounts of the information that is available is produced by amateurs or automated AI systems, or as propaganda from governments and corporations, there is an increasing amount of questionable information to be found. Even critical thinking can sometimes not distinguish the real from the fake. In any future education scenario, it's essential that teachers and students have direct access to the most accurate resources available, which generally means using scientific methods wherever possible.

Scalability

The ideal learning technology should support quality learning scenarios of any size, from a single learner up to a billion learners. This means scalability both in the interface of the software, as well as the performance of the underlying services.

Inclusivity

The ideal learning technology should be accessible for people with any budget (including none), in any country, in any language, no matter what their abilities, gender or age.

Human-centered

The ideal learning technology should seek to keep human beings (teachers) in the loop. It may be argued that AI in the future could do a great job at being a teacher, but I believe the importance of education to the very meaning of humanity means it's wise to keep humans in the teaching system, even if they rely on AI assistants to support them in an ever-increasing number of ways.

Efficiency

When talking about a global scale, it's important that the infrastructure does not place too onerous a burden on us to support. Thus it should have low running costs both in creation and maintenance, which generally points to the KISS principle (keeping it simple and reliable).

Trust

The design of this system should be one that maximises trust, even if you choose to undertake detailed research into the ownership and processes and the privacy of data in the system. Because they can trust the system, people can choose to invest themselves into the system, which means they'll use it more and it will contribute to the overall usefulness of the system.

Enjoyability

We all know learning can be enjoyable, and I'm sure we can all point to examples when it was not. Ideally it should all be enjoyable (whatever that means to you), which will lead to more learning and higher quality. As well as content and style, this includes important technical aspects such as usability, consistency and accessibility.

Free for life for teachers

If a person is prepared to spend their time helping to educate our society, that is an admirable and desirable thing and you should be well-supported. Our societal support for teachers (in terms of pay etc) is not in the scope of this framework, however, one thing we can do is to optimise our framework to make it free for life. The last thing educators should be worrying about is budgets. This maximises the chance it can be helpful for the widest range of teachers, which itself maximises a lot of other things in this list.

Free for life for students

Especially importantly, all of us, as learners, need a single place on the internet where we can keep records of our learning, assessments and achievements for life. By keeping it together we can maximise how technology can help us manage our learning. And the only way to maximise the number of people using such a system is by making it completely free forever, and not subject to the future goodwill of any specific organisation.

Separation of services from software

Wherever there are systems, there are services. People will need help, and there will always be people prepared to provide help as a service, even as it seems likely that AI will improve so much that the nature of those services will tend to become higher-level over time. Regardless, the key idea here is that any services in the system should not only be available from the people creating the software. There should be options for services, in other words, which leads to the greatest range of flexibility and benefits to users.

Safe from organisational collapse

Many of the tools that we all use on the Internet today are proprietary software running under the complete control of one organisation (usually a profit-focussed company or a non-profit dependent on ongoing fundraising, or a government).

This model is convenient for the provider, but presents unacceptable risks in the education world. It's difficult to trust that these systems can continue if the organisation happens to fail or lose interest in that product (and there are many good examples of the disruption this can cause, such as Edmodo's sudden closure for 100 million teachers this year).

Especially for larger frameworks, we need to design them in a way so that no organisation is able to take the system down. Examples include the Internet itself, email, or BitTorrent.

Simplicity

There are already many standards bodies in the EdTech industry, including 1EdTech, IEEE, SIFA, etc. There is a lot of good work done in these bodies, however they can also suffer from trying to cover so many corner cases that the standards become practically impossible to implement in products. A great majority of such standards are regrettably not in general use among education technology providers because there is either little demand or they are too complex to implement.

In the meantime, systems that do actually perform a lot of public education and have huge adoption, such as Youtube, Instagram, TikTok, Twitter, WhatsApp, WeChat and Facebook are extremely simple to use with very simple data models.

Education Technology platforms of the future need to focus on providing a similar level of simplicity, while allowing more complex scenarios through the combination of these simple building blocks.

Undesirable qualities that we want to minimise

These qualities are facts of life inherent in any system, but which we want to minimise:

Costs and Maintenance

Life seems to be 80% maintenance, which brings a lot of cost. An important principle in design is to reduce maintenance at every level: platforms, courses, content, learning records etc. Things should upgrade cleanly, and there should be as much automation of repetitive tasks as possible.

Fragmentation of people/software/experience

An Open EdTech framework should focus on consistency and standards at the right levels to help a lot of different participants interact with an agreed set of rules, to provide solid user experience as well as making it easier for people to learn and build careers around it.

Control by centralised power

As mentioned above, for longevity it's important that we design frameworks that do not rely on particular organisations to be supporting them. The more we can spread the risk across multiple organisations the more robust our education frameworks can be to the constant winds of change, corruption and greed.

In particular, it seems best that rather than any company providing software to education sectors,

which is the dominant method now, it would be best if major stakeholders such as Universities, schools, education ministries and others across the globe **all had a share in supporting the framework** into the future. There are over 90,000 higher education universities alone who could participate.

Architectural principles

The architecture of a new system should follow some basic principles of system design that we know support many of the qualities defined above.

Modularity

Firstly, the system should consist of components that are themselves simple and easy to understand, but that combine with other components in interesting ways to allow more complex functionality.

As well as improving usability, this principle allows the components to be upgraded or swapped over time with new technologies without affecting the overall system unduly.

Open standards

Secondly, these components should connect using open standards, that are developed and evolved according to the OpenStand principles, where the standard is developed and maintained by a clear process and five fundamental principles:

1. **Due process.** Decisions are made with equity and fairness among participants. No one party dominates or guides standards development. Standards processes are transparent and opportunities exist to appeal decisions. Processes for periodic standards review and updating are well defined.
2. **Broad consensus.** Processes allow for all views to be considered and addressed, such that agreement can be found across a range of interests.
3. **Transparency.** Standards organisations provide advance public notice of proposed standards development activities, the scope of work to be undertaken, and conditions for participation. Easily accessible records of decisions and the materials used in reaching those decisions are provided. Public comment periods are provided before final standards approval and adoption.
4. **Balance.** Standards activities are not exclusively dominated by any particular person, company or interest group.
5. **Openness.** Standards processes are open to all interested and informed parties.

An important point to note is that Open EdTech does not need to define **new** standards itself. There are many standards bodies out there. Open EdTech can help spread new standards by:

1. Choosing to use a subset of existing core standards, and by doing so, help lend weight to them and further drive their adoption.
2. By taking part in the processes of standards bodies where it makes sense to advocate for our Open EdTech needs in the development of old and new standards.

Upgradeability

Finally, data should always be protected, so that whenever a module or a standard is upgraded, older data is either upgraded or otherwise converted to be compatible in the newer system.

This helps the trustworthiness of the system when it comes to long-term use as an infrastructure.

Six major components of Open EdTech

The following is a sketch of some of the basic components proposed as important parts of an Open Edtech framework.

For each of these components, there may be many different solutions proposed by different open organisations, as a kind of healthy competition that spurs quality and choice. I know Moodle will tackle some, for example, but we fully support and expect many others to create alternatives as well.

1. Artificial Intelligence - supporting every aspect

The exponential rise of AI in recent years and particularly large language models and neural networks have made it abundantly clear that it will be part of almost everything in our future that involves creation, communication, research and analysis. Special-purpose AI is already easily outperforming human intelligence in specific tasks and the range of tasks is increasing daily.

There are three main angles to this that are relevant to education and Open EdTech:

- 1) Clearly we need to integrate AI as part of every education process, and it's very important that the education community be the ones driving this by working together and owning it, rather than relying on profit-focussed external companies. Many are working on integrating AI into the creative process, the assessment process, analytics, coaching and

more.

- 2) In addition, our education system needs to be thinking on how to prepare our population for being able to deal with the many intelligent machines (both on the internet and in the physical world) that we'll be working with in the future and who will redefine the very nature of work and society (eventually there will be more of them than humans).
- 3) Finally, the research into AI and how we teach and guide these new systems can inform our educational models in general, because we ourselves, the learners, are also neural networks. Our education in the future is going to involve educating BOTH humans and AI systems in our increasingly mixed environments.

2. Federated Cloud - safe free hosting of data and apps

A key part of the vision is that everything is available everywhere all the time, with low cost and maintenance. Self-hosting is just not the future here - we need to find ways to create a cloud-like service that does not have the downsides of corporate-controlled clouds of today.

Fortunately there is a lot of work being done on just this - sometimes under the web3 moniker although that is often very tied in with blockchain, which is just one example of a federated or distributed technology.

Projects like Bittorrent and [IPFS](#) show ways to store files. [Matrix](#) shows how to create federated messaging. The internet itself is not centralised, different parts are owned by different organisations and anyone can build on and extend it.

As devices and CPUs proliferate in everyone's homes, as well as concepts such as edge computing, Internet of Things and ever faster pervasive connectivity, it seems clear that we'll have ample amounts of processing and memory to handle all the tasks ahead.

A simple starting point would be to create a server distribution that thousands of Universities (for example) could install on a server, and when it starts up, it connects to, and is absorbed by, a federated network that intelligently uses those new resources to store copies of data and apps as required.

It is critical of course, for everyone's trust, that any personal data stored in a distributed system is encrypted appropriately and serves our privacy as much as is desired.

3. OER repositories - reliable storage and curation of OER

A very key part of education is the content that we use, and Open Education Resources (OER) are the future of education content. This was determined by a UNESCO Recommendation in 2019 that every country in the world (except the US) agreed to.

Wikipedia is one example, created and checked by many volunteer editors, but there are a lot more resources that are needed when you are truly learning something: videos, audio, models, learning plans, simulations and much more.

However, we are rapidly heading towards a world where the amount of available content generated by machines is going to vastly outweigh all the content we've generated up to this point, and it's going to be a real issue for even AI-powered search engines to separate truth from fiction and especially to favour our education with ethical content that helps put humanity on a strong course for the future.

This is a problem that the education community really needs to solve itself. The education community should be empowered to determine and assess the quality and accuracy of the content that they're using.

One way to do that is by using the concept of webs of trust, built around reputation. For every resource or fact, someone at some point is going to put a quality value judgement on it (for a given context) and that person themselves is subject to a quality value judgement by other people, and so on, and through these reputations you can develop a web of trust to help us determine what is quality and what isn't. It's similar to what we do now, when we "check sources" but would be more programmatic and able to support AI checking in real time.

It's also important that our OER be designed with a view to be handled by machines, as it's likely we'll be converting it from one mode to another continuously. A video can be converted to a text, a text can be converted to a VR space, a person's writings can be converted into an intelligent simulacrum of that person so you can have a conversation with them in that VR space, and so on (all of these things are happening already).

It all hangs on accuracy and quality.

4. Learner dashboard - a space for lifelong learning

One of the most critical functions that Open EdTech should include is the concept of a learner dashboard.

A learner dashboard includes a few things:

One part is the “learner wallet” - a space to store credentials that have been earned from learning experiences. Whenever you're issued with some recognition of a learning experience, such as a badge or a certificate, you need a place to store that in a system that is machine-readable.

The storage of these credentials in your private wallet needs to be done in a trustworthy way so that it's very clearly and unambiguously tied back to the reputation of the issuer. You need to know where certifications come from - this is part again of the web of trust I talked about earlier in the OERs. Those certifications can now reliably indicate what you already know, and your existing skills. Once this is done, you can now prove you know these things, and can share them with others as appropriate, perhaps when applying for a job.

Another part of your learner dashboard is a personal AI tool (agent/assistant) that is helping you navigate your future, by connecting you with some of the many education opportunities about the direction you want to go.

Once you've made some decisions, the system actively helps you learn those things. It might connect you with actual institutions to get a degree; it might connect you to a growing number of micro-credential providers; it can just also connect you directly to quality OER on YouTube and on the open web that are interesting for you.

The connection need not just be links - your dashboard produces a customised and transformed feed from these things. Concepts are carefully layered in learning pathways, and that feed is designed to fit in with your daily life via your personal devices (computers, phones, headphones, AR glasses, other wearables, personal robots).

Because It knows you're trying to learn particular things and it's feeding you these things, it can learn how to fit them into your life. It knows when you're busy and it's not going to bother you by sending you possible videos then. Instead it can send them to you when you have some downtime or when you've indicated you want to be studying, transformed into whatever format makes sense for that content and your availability. So it could be converting things to audio and conversing with you through your wearable headphones or a robot, or it could be superimposing information on top of your real world through AR glasses.

For example, if you're learning to be an engineer, it can automatically start adding engineering information on top of the real world around you. You would start seeing information overlaid on roads and structures so that you can understand the forces involved, the cost, history or design parameters. In that way you're given a personal (and quality!) flow of information that really supports your learning all of the time.

This could be a very engaging and interesting way to learn as you're immersed in that subject as you walk around the real world.

The third key part is that your smart dashboard could interface with classrooms and organisations to share data both ways according to your policies. For example it can enrol you into a group automatically, or it could help you find a job that suits your skills and ambitions. Automation (or semi-automation) of recruitment (somewhat similar to what you can see today on fiverr.com and platforms like that) could vastly simplify opportunities in the future world of work.

5. Classroom - a space for lifelong teaching

Just as the learner dashboard would support all of us as learners for life, a connected functionality should exist for those of us interested in bringing others together to learn around a topic.

Generally the best teachers are some kind of experts in their field who are themselves on a learning journey and as they learn they want to bring others with them. They may have basic introductory courses to introduce people to the topic and they might scale all the way up to very advanced courses where the teacher is sharing their latest research and thoughts with their followers. You can see this common progression with professors in Universities already with undergraduate and then graduate and then post-graduate perhaps as part of a research group. That natural human dynamic works, it makes sense and is well understood.

However we also see a lot of that happening on social media such as YouTube or Instagram, where a YouTube creator is on a journey of discovery. They may have millions of followers. But they're bringing those followers along on their journey - there is definitely an educator and learner dynamic going on. Learners are collaborating and talking together and sharing and commenting and feeding back to the teacher, and the teacher is encouraged to keep pushing forward and improving.

Unfortunately, this is mostly happening in silos. They're happening on commercial platforms which have risks, or inside relatively expensive institutions. An Open EdTech classroom is to provide a risk-free online space that the teacher owns where they can do all these kinds of things. In the Open EdTech ecosystem, they can be found and learners can connect directly. And they can also connect to the corpus of quality OER mentioned earlier to make development much easier, especially with the help of AI - it can become a curation process (which feeds back to the OER system). Education organisations will be a place where teachers can dock or connect their classrooms to join and group with other teachers.

The classroom environment itself is essentially a shell, similar to a Moodle course, where you can link to a variety of tools of all kinds. But the use of standards means that data is shared safely and effectively between tools, that student data is protected, that any assessments that occur flow from the classroom environment to the learners environment and so on.

The classroom space will of course contain AI that is working with the teacher as an assistant to help design and maintain the course, manage potentially very large numbers of students and helping with assessment, helping identify problems that might need human intervention, making sure that students are engaged through prodding and bringing them into feedback loops and all those kind of things that we normally would give to a assistant tutor. AIs could also handle administration and other boring things that the teacher doesn't really need to be occupied with.

6. Organisation tools - supporting org development

A key reason for having skills is to join an organisation, whether it be for work or some other reason. People group together into organisations to get things done. Not only does an organisation need people who have learned things, but as it develops, it will be expanding and changing and needs to manage learning internally on a constant basis. This is workplace learning.

The organisation module in Open EdTech should support that lifelong organisation development. It's owned by the organisation, it develops with them. It knows about the skills of the people at that organisation. It is something that you work with, feeding it strategy and future plans. There will also be people coming and going as usual.

The AI tool that is inside this organisation module helps sort through that to propose solutions to the problems that come up daily in every organisation. So, for example, if someone is leaving, then it could help decide whether to move somebody from another part of the organisation to fill that gap, with just two bits of training, or to start recruitment and search among all of the learner dashboards (those that have set themselves to be available to such a search) to find some people who also fit the criteria and would fill the gap.

To some extent this could all be fairly automatic, although you'd probably have people making final decisions about culture fit and things like that, but that would really simplify the entire process of managing the organisation and helping it grow and finding out whatever it needs in terms of people.

It connects with classroom tools. that may be owned by teachers. So if there's internal training that needs to be done, perhaps onboarding, you would immediately enter Open EdTech classrooms connected with the organisation, and that would obviously link with learner dashboards.

When you join an organisation, there might be information you need to share with that organisation and that would be handled automatically between those two systems through the Open EdTech standards.

In the future, other things could be added to support Organisation needs. There's a lot that can be added there and there's lots of examples of tools like that around the world already that do pieces of this. But the idea here is to make something open and fully integrated with the rest of the Open EdTech ecosystem to realise the full power.

Building the dream

The Open EdTech framework described above does not yet exist, of course.

Different small pieces of it exist in different ways, and certain trends are becoming obvious. I hope I've shown how they can be put together into a new framework that supports a lot of people collaborating together to produce something that is truly useful for the future of humanity.

Open EdTech is proposing to be a place for working groups to come together around these components, to amplify good ideas and principles, to work through some of the thorny issues and to produce prototypes and specifications for the community to actually start building.

To make these things a reality is a combination of policy and funding.

We've pointed out a few of the UNESCO and EU policies that are friendly to this approach. Agreements across all governments across the world lead us to these kinds of solutions.

However, detailed policy is often directed by available technology. Having actual working prototypes of these things will help drive policy development, help decisions be made, and that in turn will help direct funding.

In addition, the use of open methods helps the funding scenario because we are promoting open sharing of content through OER, the use of open source software, the use of open standards for easier connections, and the reuse of existing funding that is already going into hardware and software around the world.

We can efficiently use or bring together funding and get it behind these kinds of initiatives. So a key role for Open Ed Tech is not only to do the technical work but to help support the policy and funding work so that it becomes a sustainable reality.

Our roadmap

1. This launch paper to be validated among a wide variety of stakeholders.
2. Working groups collaborate on researching existing projects and standards in each area
3. Development of a more detailed **UX framework** that demonstrates how it all works
4. Creation of formal Open Edtech Association to support organisations developing into this framework
5. Formalisation of the framework and standards as the Open EdTech Framework.
6. Creation of development projects

This paper was written September 2022.

We've moved forward since this.

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