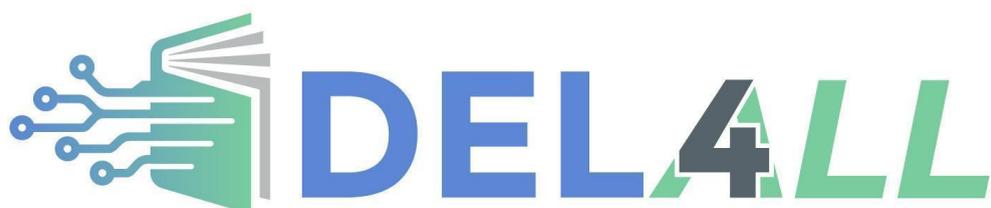




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D1.5 BEST PRACTICES

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Abstract	The COVID-19 pandemic has exposed widespread issues with the use of educational technology at scale. We present a qualitative analysis of community perceptions of digital best practice, grouping the results thematically as <i>Pedagogical</i> , <i>Personal</i> , <i>Public</i> , and <i>Practical</i> . The conclusions suggest that systemic differences in assumptions and approach to technology in education could, if resolved, lead to significant benefits to the practice and resilience of online and hybrid education.
Keywords	Best Practices



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DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc.





EXECUTIVE SUMMARY

In the early months of 2020, public health measures in many countries globally included a range of "lockdown", or quarantine, restrictions involving the closure of schools and universities, and various limitations on non-essential movement, to limit the spread of COVID-19. These measures clearly had a huge effect on the education and lifelong learning sectors, and their activities. Prior to this, the vast majority of formal learning, and a great deal of informal and non-formal learning, took place face-to-face physically, using established methods and pedagogical approaches, and with supporting infrastructure such as classrooms, lecture halls, and so on. Digital and online education, or blended and hybrid forms partially online and partially face-to-face, were certainly widely-used, with technology and digital education playing increasing roles in face-to-face teaching, but were by no means the norm.

This forced mass adoption of online and hybrid learning globally due to the COVID-19 pandemic. This document describes the implementation and results of qualitative research into understandings of best practice, and the barriers to it, among the community of the DEL4ALL project and beyond.

Based on recordings and shared digital whiteboards recording the discussions and conclusions of seven online events held or joined by DEL4ALL project participants, participants' views were analysed into four main subthemes of best practice: *pedagogical*, *personal*, *public*, and *practical*.

The studies found that:

- There is a gap between systems and policy, and requirements and implementation, with regard to assumptions about best practice,
- Best practice is fundamentally open, shared, and collaborative, and
- Barriers to widespread use and understanding of digital best practice are systemic, relating to policy, infrastructure, and scale.

Best practice for digital education is to put pedagogy first, and consider the educational goals and context of the use of technology, rather than starting from the technological perspective and treating pedagogy as an afterthought. Reference to specific technological implementations may be helpful in the limited sense that they display elements of the above-mentioned subthemes of practice as examples, but this approach does not serve to showcase best practice.





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ABBREVIATIONS

ADHD	Attention-Deficit Hyperactivity Disorder
BYOD	Bring Your Own Device
NLP	Natural Language Processing
OER	Open Educational Resource





1 INTRODUCTION

We present the final report on best practice with digital educational technology of the DEL4ALL project. DEL4ALL is a Coordination Support Action under the European Union's Horizon 2020 framework programme, initially intended to run from January 2020 to December 2021, but extended to April 2022 in light of the global COVID-19 pandemic. The aim of the project has been to map the landscape of advanced technology in digital education in Europe - technologies such as blockchain, augmented and virtual reality, and others.

The significant change to the education environment that came alongside COVID-19 was that, of necessity, distance and online education became the *default*, and often only, forms of teaching and learning for most formal and non-self-guided purposes. One of the consequences of this shift in the immediate term for DEL4ALL was a change in the topics of informal conversations project partners found themselves having with their respective wider networks in education, and seeing in the public discourse. The overarching theme was that many educators were struggling with knowing how best to achieve their teaching goals, due to

- Unreliable or unavailable infrastructure or technology
- Unfamiliarity with digital pedagogies
- Lack of time, energy, resources, and materials
- Difficulty with engagement and feedback, and with formal assessment.

The combination of these often seemed to lead to, or be related to, the replication of face-to-face methods in an online environment. Similar issues with regard to engagement, fatigue, and access to reliable technology were reported by students.

Of course, the COVID-19 measures were in response to an emergency, but one that, at the time of writing, is still having significant global effects on society more than two years later, and there is reason to be uncertain about how the education world would be able to respond to future crises, whether other pandemics, climate crises, or something else. In short, what has been exposed is a lack of *resilience* in education.

Perhaps the clearest observation to strike home to a project intended to focus on advanced technologies is that "advanced" turned out to have a different meaning in wider practice than we (and, anecdotally, the wider technology-enhanced learning community) had previously thought. "Advanced" was not only virtual reality, but also reliable videoconferencing; not only cryptographically secure distributed ledgers, but also shared interactive workspaces, and so on. It became quickly apparent that the pandemic response had brought to light, and prominence, significant open questions and issues in the real-world large-scale use of technology for education. We therefore set out to explore how digital and hybrid educational best practice is perceived and understood by the educational community, and what difficulties and opportunities they perceive for it. This qualitative analysis, drawn from workshops and focus groups held during the project, complements the DEL4ALL Technology vs. Education Matrix [1], which contains a structured catalogue of digital education activities, categorised by various aspects of learning context, and feeds into the DEL Roadmap and Policy Recommendations [2].

We begin by presenting our methodology and initial exploratory study, whose findings informed the input to later activities. We then describe these more in-depth qualitative data collection activities and analysis, and group the responses into four themes representing participants' collective understandings of best practice, and the barriers to it, in the light of COVID-19 and beyond. We consider best practice as *Pedagogical*, *Personal*, *Public*, and *Practical*.





2 METHODOLOGY

Our approach to the topic of best practice, and how to understand it, has evolved in response to input from the DEL4ALL community, a response which itself was noticeably affected by the COVID-19 pandemic and the associated crisis response.

2.1 DATA COLLECTION & ANALYSIS

We intended from the outset to take a bottom-up approach, aiming to develop a picture of best practice by aggregating community input, rather than a top-down approach which may have relied on assumptions which did not in reality hold. The core methodology, at a high level, is as follows:

1. Solicit input from the community about digital education topics
2. Organise the responses by:
 - a. The Technology vs. Education data model, and
 - b. Thematic grouping by content (as themes emerged in the data)
3. Analysis of lessons learned.

At a more concrete level, a range of specific methods were used at each of these steps, depending on the type of data, questions, etc. Specifically:

1. (Structured)
 - a. Surveys
 - b. Crowdsourcing
 - c. Landscape scanning
- (Narrative)
 - d. Interviews
 - e. Workshops
 - f. Focus groups and small group discussion
 - g. Shared whiteboard mapping
2. (Technology vs. Education model)
 - a. Web form/spreadsheet (for structured data only)
 - b. Manual annotation and cross-checking by project partners

(Thematic)





- c. Manual analysis by project participants
 - d. Automatic topic modelling using Natural Language Processing (NLP) methods
3. (Structured, modelled data)
- a. Automated aggregation & quantitative analysis
- (Thematic data)
- b. Automated topic modelling using NLP methods
 - c. Qualitative discussion and analysis

Each of these activities were planned and designed across the project as a whole to maximise the effectiveness of data collection while minimising the time and effort requested of the community.

As might be expected, the effects of COVID-19 on education, and in particular, the mass need to move education to online and digital means, had consequences on the topics of concern to the community at all levels, and from all perspectives. Early feedback from the community about the effects of the pandemic made it extremely clear that the overarching issues and concerns about best practice were not related to catalogues of technology *per se*, but rather with structural and contextual issues. An increasing focus on qualitative data was therefore thought to be necessary as the most informative path.

1. ACTIVITIES AND IMPLEMENTATION

Based on the concerns and questions being raised, we used the following as a framework for discussion with attendees of an interactive workshop organised by DEL4ALL at the EC-TEL conference.

A. Best Practice

- A1. What constitutes best practice in digital education?
- A2. What changed or did not in the COVID era?
- A3. What are the challenges and barriers to best practice adoption?

B. Stakeholders

- B1. What are stakeholders mostly looking for? (Details of projects, people, communities)
- B2. What are the important use cases?
- B3. What are the important community groups and forums?
- B4. How do you identify relevant use cases, communities, best practice ?
- B5. What factors are important in searching for use cases, communities, or best practice?

C. Goals

- C1. What are the gaps that affect you most in research/evidence/understanding?
- C2. What are the gaps that affect you most in policy?
- C3. What is the relationship between the commercial landscape and policy requirements/roadmap(s)?





The questions under C (Goals) are shown here only for completeness; the input provided from them was not significantly relevant to best practice – as noted, events such as this were planned as unified activities across the project. We summarise the workshop outcomes, by question, below.

A1. What constitutes best practice in digital education?

The responses on the nature of best practice almost all had two common themes: pedagogical strategy, and community social interaction, with the exception being a recommendation for a learning analytics platform. On the pedagogical front, there was significant focus on synchronous and conversational interactions – the social links between educator and learner. Multiple responses referred to the pedagogical concept of the "flipped classroom" – if not always by name – the idea that instead of contact time being used to share knowledge, and reflection/consolidation happening in a learner's own time, learners can explore topics and take in new information by themselves, and contact time can be used for discussion and understanding. Participation and feedback and the idea of a sustainable learning community, were seen as important.

A2. What changed or did not in the COVID era?

Responses have backed up what the informal perceptions mentioned earlier had said: difficulties with "Zoom fatigue", time management and communication, rigidity of learning materials, the move from offline to online tools, and determining student attention were all mentioned. There were also forward-looking responses: a greater appreciation of online teaching as distinct from face-to-face, and the potential to use dynamic and multimodal forms of interaction; and aspirational goals such as to reduce screen time. Adaptive pedagogy and development were acknowledged as goals.

A3. What are the challenges and barriers to best practice adoption?

There were many responses on the subject of barriers, as might be expected from, during, and in the immediate aftermath of, a crisis, with a mix of concrete and broad concerns identified. These included the sudden change of environment and its effects on students, and the lack of leadership and training. Lack of capacity and resources was also noted, particularly learning materials and Open Educational Resources (OERs) adapted for online teaching. Concern at the time requirements for digital teaching were accompanied by pastoral concerns about the lack of friendship and networking environments and social interactions. Finally, problems with supporting infrastructures and availability and reliability of devices were raised, and with the levels of societal technical literacy. At least one respondent acknowledged that students often have a significant advantage over their teachers when it comes to technical literacy.

B1. What are stakeholders mostly looking for? (Details of projects, people, communities)

The responses regarding stakeholder goals include multiple points about learning and sharing from relevant communities, and organisational leadership and training, with change management. Overwhelmingly, however, the interest was in adaptable and reusable learning materials, with the majority of responses identifying these as the goal.

B2. What are the important use cases?

The particular use cases reflect the concerns identified above for pedagogically-motivated approaches, subject-based learning recommendation of resources, secure assessment, social education, and learning with physical elements. There were multiple answers suggesting that Artificial Intelligence (AI) could provide assistance in teaching and learning, but without details of how or with what. There were also specific suggestions such as video editing on tablets, and technology for teaching psychomotor skills.





B3. What are the important community groups and forums?

Noteworthy points beyond named groups and forums, and types of forum, such as StackOverflow, European bodies, lifelong learning platforms and student-teacher associations, were some suggestions towards local community support and inclusion, in the form of student feedback and more social lecture notes.

B4. How do you identify relevant use cases, communities, best practices?

The identification here seemed very much to have a “sharing” flavour; expert input and sharing experiences were suggested alongside focus groups, community meets, interactive storytelling, and other social means. Notably absent was mention of authority or public policy and guidelines as sources here.

B5. What factors are important in searching for use cases, communities, or best practice?

Relevant factors range from feasibility, practical requirements, usability, and compatibility, to wider concerns such as pedagogical soundness and purpose, discovery from different contexts, and the availability of community feedback from any resources found. At suitable volumes of data, the feasibility of recommender systems was also mentioned.

Across all questions, the themes which emerged included pedagogy, materials and resources, technology and practicality, social, community, and pastoral concerns, participation and feedback, and policy and organisation.

Based on the input above, we refined a smaller set of questions focusing more explicitly on best practice. These are grouped together to give the following:

Imagine any educational goal (e.g., learning design):

1. What criteria do you use to determine best practice?
2. How do you discover what other people do?
3. If you identify a use case that matches your criteria,
 - a. what factors do you consider to fit it to your own context?
 - b. how do you adapt it? What barriers are in your way?

The goal here was to narrow in on how educators perceived and understood the nature and realities of best practice, drawing from the strong message that best practice is shared and social, and also pedagogically-grounded and contextual.

These questions formed part of the inputs to six further events for discussion with experts and members of the larger educational community. Four of these were termed “coffee chats” with DEL4ALL experts, themed around the three strategic priorities identified in the Research Agenda, and one an overview session; the other two were workshops held by the DEL4ALL project, and externally at the ICEDU conference. The topic of the latter was explicitly that of rethinking best practice in the aftermath of COVID-19.

TABLE 1 EVENTS ORGANISED OR JOINED BY DEL4ALL FOR THE FULL STUDY

Event	Topic	Abbreviation
Coffee chat 1	Reconstructing the student experience	CC1





Coffee chat 2	Building digital competencies	CC2
Coffee chat 3	Towards a high-quality digital ecosystem	CC3
Coffee chat 4	Connecting the dots	CC4
DEL4ALL Workshop: Ways forward – resetting digital education in Europe	Policy recommendations	WF
ICEDU Workshop: Learning from experiences on hybrid and online teaching during COVID-19 pandemic and beyond – consequences for future teaching and research	Best practice	ICE

Participation in these events came, in the case of the coffee chats, from the DEL4ALL expert community, and were essentially focus groups with 3-4 attendees (excluding project partners) which enabled in-depth discussions, while the policy workshop was drawn from the wider DEL4ALL community. The International Conference in Education (ICEDU) workshop¹ was an open event. Attendance was around 20 people and consisted largely of practising K12 teachers from across the world, with majority representation seeming to be from outside Europe, primarily from Africa.

The coffee sessions were recorded, and in the case of the two workshops, the discussions were captured using an online shared whiteboard. These outcomes were analysed to identify qualitative themes and examples relating to the best practice questions. The following section discusses the overall findings for each question.

¹ <https://educationconference.co/special-event/>





3 WHAT IS BEST PRACTICE?

Analysis of the discussions across the events mentioned above led to four themes which together summarise the evidence we gathered. What is best practice, according to our respondents? It is:

- Pedagogical
- Personal
- Public
- Practical

We discuss each of these in turn, covering both the themes themselves as well as any barriers, issues, or questions our participants identified. We have labelled different claims with the abbreviations of the events in which they were made.

3.1 Pedagogical

There was a strong focus among participants on the purpose and goals of adopting educational technology in practice. The intended educational purposes should come first, and be the explicit priority; technological factors are very much secondary. That is to say, technology is applicable as a part of a best practice only if it serves the pedagogy, and not vice versa - there needs to be a “why” for technology use, and it must be integrated in learning objectives (CC2, WF, ICE). Learning design needs to be focused on the target cohort, and be oriented on their goals and situation (WF), pedagogically-grounded and learner-driven (CC1), connected across all kinds of learning, including lifelong learning (CC3, WF) and with engaging content delivery (CC4). Technological approaches such as gamification can be effective if they are not a “gimmick” (CC1).

However, there was agreement that digitally-relevant and hybrid pedagogical approaches were not widely enough known or understood outside of contexts where distance learning has been a norm, and that COVID had highlighted this fact, and given educators a fresh appreciation of distance pedagogy. The recurrent theme of issues arising from attempts to recreate F2F methods in an online space backs this up. Educators and learners are aware that these attempts are difficult, time-consuming, and exhausting, but do not feel they have the training or resources to address this. Particularly as the world moves from a crisis response to a more considered longer-term change, there was a strong view that this should change. It is revealing, from the DEL4ALL perspective of being familiar with certain distance-learning pedagogies, that participants across the events (including those at EC-TEL mentioned earlier) independently described the flipped classroom methodology, in most cases seeming to have arrived at the idea without having been already aware of it or knowing that it has a name. Relatedly, an ICE participant posed the question of whether pandemic learning had led to an increase in autonomous learning, while a CC2 participant described experiencing teacher enthusiasm for a flipped assessment approach, in which oral assessments were performed using recorded video. The focus on using contact time for discussion and understanding feeds into the seemingly widespread concern that interaction and engagement are significant problems for them online, and that learners and educators are exhausted by this, and would benefit from more social activities.





Participants across all events expressed frustration that the pedagogical and purposeful elements of education are overlooked or missing at organisational and policy levels, which tended to prioritise technologies, perceptions of novelty, or political priority over educational purposes. It was felt that policymakers take little note of pedagogy when it comes to educational technology, considering the provision of hardware, infrastructure, or software licences to be enough (CC2, CC3, ICE), without enabling educators with the flexibility to drive technology use *from* pedagogy, and sometimes hampering that. Novel approaches can be seen as “dangerous” (WF) and be held back by formal processes or rules. Across all backgrounds of participant (CC2, ICE), for example, the common policy of banning K12 learners from using their own, e.g., smartphones or tablets in school (“Bring Your Own Device”, BYOD) on the assumption that this could only be a distraction from learning, was felt to be limiting in terms of pedagogical options, as well as having practical and equality issues with regard to availability of infrastructure and focusing of resources on providing devices for disadvantaged learners. The sheer volume of regulations concerning AI was reported as making innovation difficult (CC1); not from a lack of care about ethical use, but purely from time required to parse the rules.

There was also concern that the economics and politics of education are affecting the ways in which innovative pedagogy, and evidence for or against its effectiveness, are being learned, with potentially significant evidence for novel pedagogies generated by, e.g., startups, not reaching policymakers due to the greater visibility of larger players in this space (CC4).

An idea which gained strong consensus among DEL4ALL experts in CC1 is that the COVID-19 crisis had exposed assumptions among all stakeholders about how pedagogy is understood and considered in education. Specifically, traditional face-to-face (F2F) education has assumptions of pedagogical purpose embedded in the working practices and physical infrastructure - assumptions which have become implicit. The changes accelerated by COVID-19, then, and the need for a mass shift towards online and hybrid learning, offer an opportunity to rethink this and to make it explicit.

3.2 Personal

The personalisation of learning is a large topic, and came up several times throughout the discussions. Following from the contextual nature of pedagogically-grounded education, there are seen to be benefits to taking this contextualisation down to the individual level. What constitutes best practice for one learner may be inappropriate for another. The example given in CC4 was that of a learner with Attention-Deficit Hyperactivity Disorder (ADHD), where expectations of what may be effective and positive for a neurotypical person might turn out to be harmful for someone with ADHD. There was also discussion (CC1) of the potential for personalisation based on individual motivations for learning, and the selection of relevant pedagogies and supporting technologies to address different subgroups of learners. It is in the area of personalised learning that digital technology is perceived to offer advantages that are more difficult or impossible to achieve F2F. For example, the ability to reuse existing resources more easily in a digital setting makes it possible to use relevant materials for an individual’s needs even when those needs are different from those of their peers. This is potentially especially valuable for learners with *rare* needs: to research, and create, high-quality resources for those with (for example) different forms of neurodivergence or disabilities where the relevant population within a particular region may be too small for appropriate evaluation to be meaningful. Learning analytics in particular, over a long term, could contribute here (CC3).

There were, as might be expected, concerns too about the risks of learning analytics, with the need for transparency in how it is used (CC3, WF) to prevent misuse and mistrust, biases





in datasets (WF), and privacy and data protection (CC4, WF). Some participants (CC1, CC4) were also concerned about data protection legislation being *too* limiting to innovation; one participant in CC4 was strongly in favour of allowing individual control of their data protection limitations, suggesting a “lever” from making data completely open, to completely private, depending on interest in or need for innovation based on personalisation. More sophisticated approaches to data analytics may be able to address this idea in a more nuanced way (CC4).

3.3 Public

Throughout all of the conversations (CCs 1-3, WF, ICE), the need for best practice to be open, accessible, shareable, and adaptable came up over and over - not only in the form of training and discussion with experts, but also in the form of resources that could be reused and adjusted to fit a context. There was a recognition that creativity in the production of learning materials is taking place, including “happy accidents” (CC2) but that there is no guarantee that individual creators of resources would be able to share them, or if they can, would be able to do so in a way that lets them be discoverable and adaptable by others. Platforms for sharing, reviewing, and adaptation of best practices (or problems - CC1), including adaptation to different cultural contexts (WF) were proposed by multiple participants (CC1, CC2, WF, ICE). Open Educational Resources (OERs) were discussed, with questions raised about their quality and how to determine it. One suggestion was that quality measures from *community* use of OERs - ratings, reviews, and so on - would be beneficial to have, although it was also noted that quality is very contextual (CC3). Advanced technologically-based learning materials may also be expensive or specialist to produce - for example, three-dimensional environments for virtual reality, or sound design (CC3, WF, ICE). Individuals or small institutions may lack the capacity to create these, and therefore leave the way open for a smaller number of large actors to dominate. Participants suggested, therefore, that sharing models could be helpful in this regard - if a technologically-sophisticated OER is to be open or usable across a larger population, then development of it can scale, and the costs and availability of the relevant skills can be shared (CC3). This is particularly the case for examples of the use of digital and online pedagogies, where access to reusable resources is perhaps taken further than documents or videos as OERs, but are shared with pedagogical context and goal information, perhaps as templates for time-starved educators to use (CC3, ICE).

3.4 Practical

Knowing, understanding, and sharing pedagogically-grounded best practices in digital education is of course very little use if they are not practical to apply and use in whatever educational contexts it makes sense to use them. There are, of course, many factors going into practicality - technical compatibility with existing solutions, skills to make use of them, and accessibility of resources and infrastructure on which to access them. An argument made for BYOD policies is precisely that they are practically taking advantage of existing available technologies with which learners are already familiar (CC2, ICE), minimising institutional or governmental unsustainable and out of date hardware, and allowing resources to be better spent on equal access to technology (CC2, CC3, ICE). Interoperability on a technical level was argued as a means to improve scaling and reuse (CC3).

An open topic which repeatedly came up (CC1, CC3, CC4, ICE) was about the possible future practicality of technological support for pedagogical methods which involve physical modalities of interaction as well as informational - what a CC1 participant described as “wellies in the mud” learning - from the availability of support for virtual laboratories and experiments to more hands-on activities and subjects.





As with pedagogy, there were concerns that practicality is approached at too low a level (CC3, CC4, WF) of hardware and infrastructure; while important, conceptual practicality in terms of skills and ideas matters too, in terms of the usefulness of, e.g., materials and learning object repositories (WF) for educational goals, or the delays between having ideas and being able to put them into practice. A CC3 participant gave the example of robotics courses being unable to include the most up to date and engaging concepts because of the slow approvals process to buy licences for the latest versions of relevant software. More generally, participants (CC3) wondered whether some of these barriers might arise from misunderstandings about technical literacy, with institutional (generally older) decision makers underestimating the technical fluency of younger “digital native” learners.





4 CONCLUSION AND LESSONS LEARNED

We have presented the motivations, methods, activities, and outcomes of DEL4ALL's analysis of best practice in digital education. Via input from community members and beyond, we have identified four themes of best practice which run across their responses, which are *pedagogical*, *personal*, *public*, and *practical*. Within these, we have considered what is perceived to be relevant and helpful, and what barriers are in the way.

These conclusions reflect only the situation at the time of writing, of course. It might be expected that, during, and in the possible aftermath of, the COVID-19 pandemic, there would be a heightened sense of instability and uncertainty. This does indeed seem to be the case. However, participants generally clearly distinguished, in discussions, between crisis responses and long-term topics, and those with expertise in digital education also reflected that their COVID-19 experiences seemed in many cases to be a strong intensification of existing issues rather than new ones.

The primary conclusions to be drawn from these studies are threefold: firstly, that, while participants in the practice of education held targeted contextual learning design and pedagogical methods as central to the effective use of learning technologies, there is widespread frustration that they do not occupy the same centrality in the landscape of educational policy. And secondly, that best practice is ultimately a shared endeavour, which benefits from openness, adaptation, and analytics at scale, in order to be both effective, efficient, and also contextualised and personal to the learner. Finally, and following from these two conclusions, the changes required to employ digital best practices at scale seem to be systemic. A lack of responsiveness at institutional and governmental levels hampers innovation and spreading of best practice, and that a rethinking of the assumptions behind policy relating to educational quality and practices has the potential to make significant differences. Some of the policy recommendations in [2] reflect these issues.

There was optimism among participants too. Although COVID-19 has posed major difficulties to the education sector beyond its more apparent human cost, the lessons learned from it also provide a chance to improve - to consider radical methods of evidence-based learning, and potentially overhaul a model of education that has been in use for more than 1000 years, to achieve something more flexible, sustainable, and resilient.





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