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WHITE PAPER
DEL4ALL TECHNOLOGY VS. EDUCATION MATRIX

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Abstract

In order to map the landscape of digital education activity in Europe, we describe the data model for the crowdsourcing of activities and actors in this area and present a first version of a mapping between technologies and the various aspects of educational context in which they are being used. This data model will provide a basis for the bottom-up modelling of the best pedagogical uses of technology, in order to update this mapping, and to help clarify and prioritise research agendas and policy recommendations to maximise impact.

Keywords Digital education, online pedagogy, resilience, decentralisation

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1 INTRODUCTION

Education is lifelong and must be inclusive and effective. The COVID-19 pandemic has highlighted these points in a number of ways. While the difficulties in moving to online education for professional teachers and institutions have been clear, it has also been necessary for those who are not professional educators, from all kinds of background and in all kinds of context, to take on some teaching activities themselves – parents, neighbours, content producers, and so on – which in turn requires further learning on their part. And in all cases, it has been important to reflect on teaching well in difficult circumstances. Now, perhaps more than ever, it is important to ensure that digital education is *learner-focused*, *inclusive*, and *resilient*, and that technology is applied effectively and appropriately.

It is a fundamental requirement for moving forward that tools for digital education have the potential to support these principles. In particular, a *learner-focused* digital education landscape, with *pedagogical principles first*, is needed to provide inclusivity and effectiveness. Decentralisation supports flexibility across different contexts and requirements, therefore also bolstering inclusivity and supporting learning throughout life. We argue that such an approach to digital education supports the crucial notion of resilience.

The DEL4ALL Technology vs. Education Matrix, whose first version is described in detail in [2], aims to support the mapping of that landscape. Over the course of the project, it will be used to cluster activities, actors, use cases and best practice, to identify synergies and complementary developments, and to determine where (and why) there are gaps in the ongoing efforts. The resulting mapping will help to clarify and prioritise research agendas and policy recommendations to maximise impact.

This paper sets out the concepts and thinking behind the DEL4ALL Technology vs. Education Matrix.

1.1 METHODOLOGY

DEL4ALL aims to coordinate stakeholders and developments across Europe in the sphere of Digital Education, with the objective of promoting collaboration, best practice, and resilience.

In developing the Technology vs. Education Matrix and the model behind it, under the framework of the DEL4ALL project, we take as a starting point the notion of “learning context” and consider pedagogy and technology as they relate to the various aspects of such a context. A decentralised and resilient model of lifelong learning can be constructed by considering best practices in transferring educational technology effectively across contexts.

The overall method is to identify a first model based on the project goals, and a small number of “seed” activities and actors, and to develop a workflow for classifying new ones identified during the project, refining the model where necessary, in order to support clustering of related topics and collating use cases and best practices. The model will be represented in a very lightweight semantic framework, supporting convenient integration of related data.

The primary effort in refining the model, populating the catalogue of activities and experts, and deriving the contents of the Matrix will be generated by crowdsourcing from experts and stakeholders across Europe. By collecting self-reported profiles of current activities and expertise, and areas of application, from experts, we will be able to identify common themes and issues and

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add or refine relevant dimensions and sets of values to the model, improving its ability to represent the space of digital education in Europe.

The model beneath the Matrix must of necessity be a living model; digital education is a fluid landscape, particularly at the time of writing when face-to-face education globally is made impossible due to the COVID-19 pandemic. We can say from the outset that factors such as *technology type* and *readiness level*, *pedagogical context* and *intended audience* are important, but, as digital education activities are identified and classified "in the wild", it is to be expected that we will develop new understandings of what is relevant to supporting them, and what new contexts and approaches are emerging. The model proposed here cannot therefore be static and will be revised throughout the duration of the project in an iterative and incremental process.

For the sake of clarity and interoperability, we aim to use standardised terminology wherever possible for terms relating to education. These will be drawn, where possible, from public terminologies, such the CEDEFOP terminology [3] for education and training, the Computer Science Ontology [5], or the Digital Learning Glossary from the Wisconsin Department of Public Instruction [6]. Where appropriate terms do not exist in these terminologies, we choose new terms appropriate to the focus of DEL4ALL.

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2 TECHNOLOGY VS. EDUCATION MATRIX

The purpose of the Matrix is to provide a framework for grouping related digital education activities and actors and enabling the mapping of technologies to educational contexts. The following sections describe the main concepts, and the subsequent Figure 1 visualises the model constructed from them. The first version of the resulting detailed Matrix can be seen in [2]

2.1 CONCEPTS

2.1.1 Requirements, Affordances and Resilience

Specific technologies, and specific learning contexts, have specific requirements and affordances. That is to say, there are prerequisites relevant to a technology or learning context, as well as potential actions on them. A technology such as virtual reality requires particular hardware but affords the possibility of interacting in a simulation of a face-to-face environment; a university lecture hall requires that people be able to get to it physically but affords the possibility of real-time face-to-face interaction.

When considering the transfer of a technological or pedagogical solution from one context to another, then as a minimum, the affordances of the new context must meet the requirements of the solution, and vice versa, or relevant and effective adaptations must be possible (and must be done). Resilient digital education solutions are those capable of being effectively transferred between multiple contexts.

To give an example, a traditional university lecture requires participants to be present simultaneously and affords real-time verbal and visual expression of educational material, with some real-time interaction. A technology such as a video conference has similar features, and therefore can be used to implement a similar pedagogical approach. This does not imply similar levels of effectiveness, merely the possibility of transfer.

2.1.2 Learning Context

“Learning context” is a complex concept, with a number of elements. Broadly, we take it to mean a setting in which (digital) education takes place. More concretely, we can interpret it as comprising the answers to a set of simple questions:

1. **Where?** The setting or location of education, e.g., in a university, secondary school, home, online, etc.
2. **Who?**
   a. Who is learning?
   b. Who is teaching?
   c. Who is involved in another role (and which role)?
3. **What?** The activity taking place, e.g., content creation, content delivery, assessment, etc.
4. **How?** The pedagogical framework or learning design employed, e.g., learning by doing, project-based learning, etc.

For completeness, we could also add the goals of stakeholders (the “why?”) and the time of learning (“when?”). However, practically speaking, the goals for learning and education are highly variable even within a context, and largely inaccessible to outside the context, and, beyond the

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distinction between synchronous and asynchronous participation in learning, time is closely related to the setting.

A task for the analysis of particular learning context data, as it is acquired over the course of the project, is to determine the requirements and affordances of each.

2.1.3 Technology

As discussed above, technology often has specific features - requirements or affordances - and these, in conjunction with those of learning contexts, can inform about the potential to transfer technologies from one context to another, and contribute to the interpretation of resilience. By recording both requirements and affordances, we enable the clustering of technologies by application to different contexts, either better to identify features which are particularly beneficial (or otherwise) for certain pedagogical uses, or to identify where (for example) there may be productive or exploitable gaps in the current space of activities.

Technology readiness level is, of course, highly significant for determining the timescales and likelihood of impact of a technology on digital education.

2.1.4 Activities and Experts

The relationship between a particular learning context and a particular technology becomes concrete where there is some entity connecting them. In particular, in the context of DEL4ALL, we consider the application of a technology to a learning context, and expertise or interest in the combination of a technology and learning context.

We therefore need to represent such connecting entities in terms of either *activities* or experts – more generally, *actors* – as appropriate.

An *activity* represents a project or initiative in the digital education space: a research or commercial project, university/school/regional activity, etc. Activities in particular may be associated (or claimed to be associated) with particular benefits in either technological or educational dimensions, or particular challenges, and evidence (e.g., links to papers detailing studies in efficacy, or evidence for wide-scale use) for both.

An *actor* represents a stakeholder in the digital education space: an individual, group, or organisation active as an expert, producer, consumer of digital education.

2.2 THE MATRIX

Given a data model and appropriate data capture services, the online catalogue of activities and actors can be populated to provide a data-driven basis for the Matrix, ensuring that it accurately represents the current landscape, and therefore validating subsequent analyses performed with it. The crowdsourcing of this data will feed into future versions of the Matrix.

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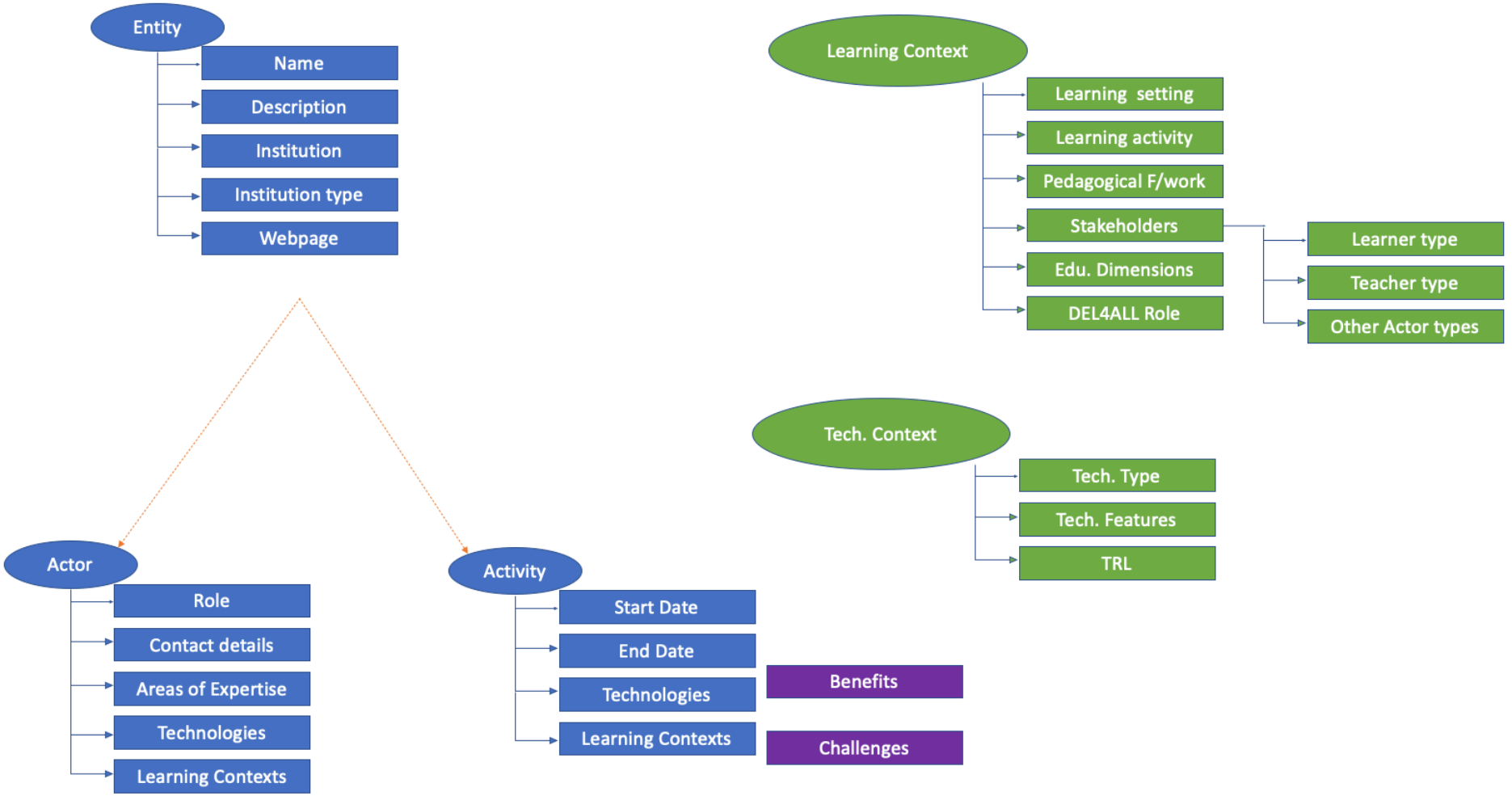

FIGURE 1 INITIAL MODEL FOR TECH. VS. EDUCATION MATRIX

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3 CONCLUSION

We have presented the basis for the DEL4ALL Technology vs. Education Matrix supporting our efforts to map and analyse of the digital education landscape needed to refine and expand the Matrix, and to support the work of DEL4ALL in promoting resilience in education across Europe, which is a particular priority at the time of writing and is likely to remain so going forward.

As discussed earlier, the question of resilience, always important, has been highlighted globally by the COVID-19 pandemic, in particular by the very short term need for very large numbers of learners and educators to transition to new contexts for learning. The outcomes of, and public conversations about, this transition have been dominated by the practical and pedagogical difficulties, and the availability of information about each.

The pedagogical approaches in online learning are not simply transferred versions of face-to-face pedagogies, and the possibilities online do not match one-to-one with the physical. By making learning context (and the elements which make that up) the heart of our modelling and analysis, and recording and analysing technological and pedagogical requirements and affordances, we enable the future construction of a map between approaches to education and the contexts in which they have been, and, more importantly, could be, applied. The design of the model presented here is intended to support the identification of resilient practice, to enable us to direct attention to the technologies, pedagogies, and the smartest uses of both, to provide better support for digital education in the current crisis, and in the future.

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