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A new dynamic for EdTech in the age of pandemics

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Abstract: During the course of the corona crisis and the extensive quarantine regulations, educational institutions, companies, and individuals have reacted by shifting teaching and learning activities to virtual spaces. Even though e-learning has increased in the last years, it has not yet been able to achieve the transformative effect that has long been promised. This crisis could boost online education, or at least enable the system to be better prepared for the next crisis. This paper focuses on the perspective of EdTech companies and how they are using the current crisis to establish their digital solutions on the market. Using the sub-areas Learning Management Systems and Language Learning Platforms, we illustrate that EdTech companies are able to adapt their business models to the changing market conditions and customer needs in a situational way. Furthermore, with the help of user behavior data, they have an opportunity to sustainably innovate existing EdTech systems.

Keywords: education; EdTech; innovation; learning analytics; artificial intelligence; business model; Learning Management System; Language Learning Platform

1 Introduction

The sudden outbreak of the coronavirus has led to serious disruptions throughout the global community. Educational institutions, similar to many public institutions, are experiencing massive cutbacks due to the corona pandemic. The impacts of this have led institutions to adapt to the highly dynamic environment and select alternative approaches to their services. Although learning with new technologies has been around for many decades, it has not yet had the transformative effect that has long been promised, especially in the education sector. Experts assume that this pandemic could act as a

catalyst for the long-term development and transformation of education and the digitalization of society [Renz & Vladova, 2020]. In media discourse, the crisis is seen as having the potential to spark the sustainable innovation of numerous business models. The educational technology (EdTech) sector is currently regarded as one of the industries that may experience a sustained boost as a result of the crisis.

The use and spread of innovations are influenced by various factors. In the case of EdTech innovations, an important factor is how well the innovations can be observed and tested [Rogers, 2003]. As a large number of educational institutions, companies, and private users are currently experimenting with a range of EdTech solutions for teaching and learning, both factors are in play. As a result, the crisis may trigger a boost to the online education system and drive the use of EdTech in educational institutions such as schools and universities – or at least ensure that the system is better prepared for the next crisis.

Most articles look at the user's perspective on the relevance of EdTech solutions to education and training. In this impulse paper, we focus on the EdTech companies and how they are using the corona crisis to establish their digital teaching and learning solutions on the market and to adapt their business models to the dynamic market conditions. Furthermore, we examine the potential for further development of learning analytics (LA) and artificial intelligence (AI) in education. Until now, such development has been slowed down for various reasons [Renz, Krishnaraja & Gronau, 2020]. Since the spread of the corona virus, a significant increase in demand for digital teaching and learning solutions has been observed in many countries around the globe. With the changeover to digital teaching and learning offers (and the associated changes in the user behavior of the EdTech offers), the quantity and quality of measurable learning behavior data is also increasing. The knowledge gained from the learning behavior data collected can in turn be used in the development and innovation of EdTech offers. In this paper, we present insights into two EdTech sub-sectors – Learning Management Systems and Language Learning Platforms – and their current business model innovations.

In the following section, we briefly define the terms EdTech, LA, and AI, which are essential for this paper. Next, we explain why crises were considered tipping points for the EdTech industry even before the corona pandemic. Before we turn our attention to business model innovations in the crisis and the two case groups, we sketch an overview of the development of the EdTech market. The article concludes with a summary and an outlook on future research expansions.

2 Definition of EdTech, LA, and AI in education

The term EdTech refers primarily to startups and other organizations working to change education and quality through the use of technology [Startup Genome, 2019]. In the context of this impulse paper, we understand EdTech as "the digitization of educational services and business models" by software companies offering technology solutions for educational institutions or companies [Startup Genome, 2018]. The educational landscape is increasingly influenced by business-driven companies such as the major tech firms, SMEs, and startups. Thus, technological developments such as AI, machine learning (ML), and LA inevitably find their way into teaching and learning methods and require the development of digital, data-based business models [Renz & Hilbig, 2020]. In the context of this paper, the terms LA and AI are important. Although there are different views on the definitions of LA and AI in education, for the sake of simplicity, we follow consensus or the most common approaches. LA is "the measurement, collection, analysis

and reporting of data on learners and their contexts for the purpose of understanding and optimizing learning and the environment in which it takes place" [Long & Siemens, 2011]. The term AI in education follows one of the most common definitions formulated by Popenici and Kerr [2017]. These authors define it as "computing systems that are able to engage in human-like processes such as learning, adapting, synthesizing, self-correction and the use of data for complex processing tasks."

3 Tipping points for the EdTech industry

The history of schools being closed due to epidemics is nearly as long as that of higher education itself [Carlton, 2020]. It is interesting to see how educational institutions have transformed over the years and become resilient, especially in times of crisis. As examples of this, two crises are listed below. Each had an impact on the work of educational institutions similar to that of the current corona pandemic. During these crises, educational institutions were able to maintain teaching activities with the help of digital teaching and learning tools. Moreover, during both crises, decisive moves towards further innovation in digitalizing education were made.

- An outbreak of Severe Acute Respiratory Syndrome (SARS) hit China in 2002, and quickly spread to 29 countries around the world. In China, the internet industry received a lasting boost from this epidemic. In addition to e-commerce and numerous platforms, several measures including online learning, distance learning, and personalized learning were introduced and innovated [Fox, 2004].
- Swine Flu, also called H1N1 flu virus, hit in 2009, causing students, mainly in China and Mexico, to stay home for extended periods. Policymakers began to ask how technology could be used to enable schools to continue teaching during crises. Although the status quo of EdTech at that time did not bring a change in the education system, the innovation dynamics of the EdTech industry were stimulated. The federal leaders of education cooperated with EdTech companies to create their curricula online. Schools that already used some kind of online teaching tools further enhanced their products [Trucano, 2014].

China has faced dramatic changes in learning and teaching due to the impact of COVID-19. School's Out, But Classes On [Chinese Ministry of Education, 2020] is one initiative that China has implemented in response to the current crisis, with the notion of transforming the learning and teaching models in education. This large-scale online education exploration has stimulated online teaching models and promoted the reconstruction of ecological teaching models [Zhou et al., 2020]. It is highly captivating as its benefits students, teachers, and schools. Students have the ability and space to choose their own platform for home-based self-learning. Teachers have the advantage of transforming their teaching methods to more sophisticated software and tools. This reduces the burden of repetitive tasks, allowing teachers to focus on rebuilding the curriculum. Schools have the benefit of managing teaching and learning methods more effectively.

Innovation is also taking place elsewhere in the world. In Hong Kong, an initiative called 'read together to prevent the novel coronavirus' began on February 17, 2020. This initiative is an online platform that provides reading materials and videos to educate people during the crisis. The consortium involved plans to continue and maintain the platform after the crisis ends [World Economic Forum, 2020].

Technology and education have drawn closer together over the past 20 years. Crises such as SARS, swine flu, and the corona pandemic can function as catalysts in this process of convergence and positively influence innovation. In the next part, we briefly present the main features of the EdTech market. We then look at the corona crisis as a catalyst for the development and innovation of existing business models.

4 Development of the EdTech market

As a result of the pandemic, more and more EdTech companies are offering low-wave and often free access to their digital teaching and learning solutions. Users have the chance to benefit from real points of contact and positive experiences with online-based teaching and learning methods. This creates an immense opportunity for strengthening the market position of EdTech companies. Although the global market volume for EdTech is estimated at USD 8 trillion in 2020, the market is growing much more slowly than other markets with the dynamics of digital transformation. A major reason for this slower growth is the number and complexity of decision makers involved in the market – educators, teachers, traditional textbook publishers, and politicians, to name but a few [Renz, Krishnaraja & Gronau, 2020; EdTechXGlobal, 2016].

In the context of the market and development dynamics of EdTech, Renz and Hilbig [2020] analyze drivers and barriers that EdTech companies face when implementing innovative teaching and learning solutions in the education market. Identified barriers such as concerns and fears, low budgets for IT equipment, and a lack of understanding of the applications can be dissolved or reduced by the current efforts of EdTech companies. However, it remains to be seen whether other barriers identified by Renz and Hilbig [2020], such as the lack of data sovereignty, data security, and trust in the use of data, will be overcome in the course of new EdTech experiences.

One of the biggest opportunities is to advance the development of LA and AI in education. Renz, Krishnaraja and Gronau [2020] note that the innovation potential of using algorithmic and AI-based elements in education already exists, but often has a subjunctive character. The authors show in their research that currently, there are hardly any AI-based teaching and learning solutions in the EdTech market. During the corona crisis, almost all educational institutions have been using digital teaching and learning elements. This is precisely where the opportunity to collect comprehensive learning data lies. The generated data can be analyzed using LA and directly applied to further developing EdTech solutions and business models [Hilbig, Renz & Schildhauer, 2019]. Renz and Vladova [2020] characterize the corona crisis as one of the biggest live experiments for online teaching and learning. Furthermore, the authors see significant potential for a sustainable transformation in the digitization of education. In addition to companies taking advantage of positive market positioning, we observe a second effect in the market: EdTech companies are innovating their business models and flexibly adapting to customer needs. In the next section, we take a closer look at this effect.

5 Business model innovation in the age of the corona crisis

We are currently observing exciting movements in the market. More and more companies are reflecting their business models in the virtual space and thereby (sub)-consciously innovating their existing business models. For example, birth preparation or yoga courses are being offered online, theatre and concert organizers are switching to the virtual stage,

and therapists are offering online consultation hours. This movement of unique and creative innovation is also evident in industries that have already implemented digital business models. Current economic forecasts indicate that e-commerce could witness a decisive turning point. Due to the coronavirus, the already well-established change in shopping habits has accelerated [McKinsey, 2020]. The EdTech industry, which for a long time was only a niche market, could also experience a considerable boom due to the crisis.

Although many industries see opportunity in crisis, it is often difficult to react quickly and agilely to adapt business models to the (often radical) changes in environmental conditions. Adapting and innovating business models usually requires intensive analysis. Schallmo [2020] illustrates with his framework how companies can quickly and flexibly adapt their existing business model in a crisis and still follow a structured decision-making process.

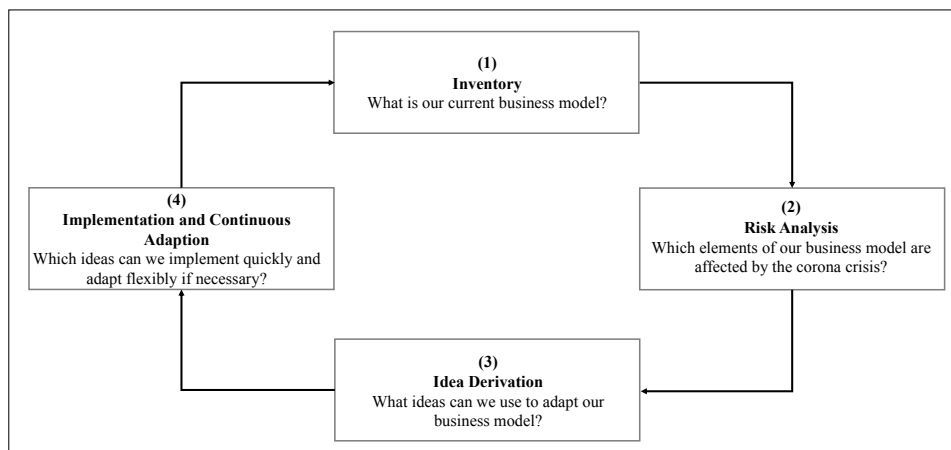


Figure 1 Control loop for the alignment of business models in crisis situations [Schallmo, 2020]

The framework follows a typical business model grid to guide the reorientation of companies in a targeted and structured manner. The elements of inventory, risk analysis, and idea derivation refer to the dimensions of customers, benefits, value creation, partners, and finances. The fourth element – implementation – requires above all a quick prioritization of the ideas previously created and a high degree of flexibility [Schallmo, 2020].

In addition to the general adaptation and innovation of existing business models, we are observing a second phenomenon: a shift towards data-based business model innovations. With the relocation of many activities into the virtual space, new opportunities are arising for companies. In addition to obvious opportunities such as increasing productivity, reducing operating costs, strengthening and enhancing the brand, opening up new market opportunities, improving the customer experience, and facilitating internal processes, companies can benefit from a key feature of digital technologies – data. Although many industries have discovered the potential of user data in innovating their business models, implementing data in existing business models is still in the early stages. This is particularly evident in the area of education [Renz, Krishnaraja & Gronau, 2020]. The question of how data driven the current business models of EdTech providers are is also addressed by Hilbig, Renz and Schildhauer [2019]. The results of their study show that

only a few providers have access to user behavior data in further developing their products and services. From interviews with 23 EdTech companies, it was discovered that only 12 companies offered services such as LA, as a result of limited data access. Similarly, Viberg et al. [2018] provide a comprehensive overview of the current status quo of LA in higher education. Their analysis of 252 contributions revealed that only 9% of the research showed an impact of LA on improving learning support and teaching in higher education. In a follow-up study, Renz and Hilbig [2020] identify three levels at which data are currently being converted into EdTech solutions. In combination with a taxonomy on the usage intensity of data, three types of business models can be derived, as shown in Figure 2.

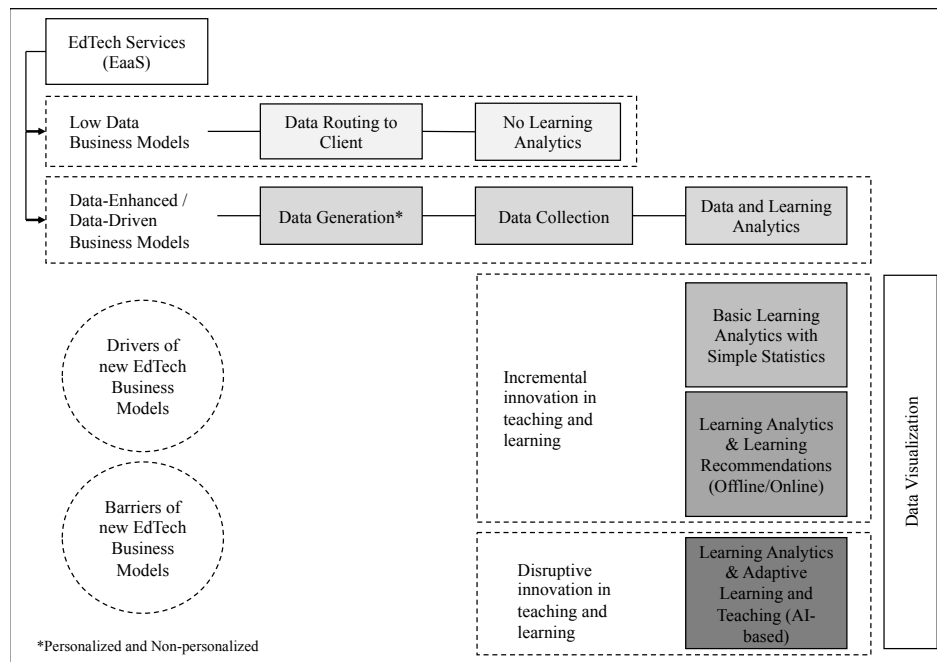


Figure 2 Data paths and levels of data analytics [Renz & Hilbig, 2020]

In light of the current situation, it can be assumed that the use of digital tools in educational institutions will increase much faster than previously forecast. Consequently, more data on user behavior will be available for the development of existing and new EdTech solutions. In the coming months, it will be exciting to observe whether the type of data-driven business models classified by Renz and Hilbig [2020] in the EdTech sector will shift towards more data-enhanced and data-based business models. To enable this shift, it remains to be seen whether the reluctance to provide user behavior data for further development and innovation of corresponding business models will decrease over the course of the crisis. However, even during the crisis we have already observed that EdTech companies are developing their existing business models and adapting them flexibly to the current needs of their customers. This observation of two specific sub-sectors will be illustrated in the following section.

6 Insights into the latest developments

Much of the EdTech community is cautiously optimistic about their products, as the current crisis is causing a radical shift in the way that their products are perceived and accepted. We are observing that many EdTech companies in the market are adapting their business models quickly. The barriers to entry are being kept as low as possible so that educational institutions have high incentives to attempt the often-difficult transition from classroom teaching to virtual solutions. For instance, as already mentioned in section 4, many EdTech companies (e.g. Sofatutor, StudySmarter, Duden-Learnattack or Simpleclub)¹ are offering their teaching and learning solutions free of charge and are providing more support for a smooth start. Platforms such as EduTechMap Berlin² connect user and provider groups of EdTech products and thus offer a quick overview of current digital offers. These and similar platforms are experiencing a surge in popularity in the current crisis. The EdTech industry is showing that it has developed ready-to-use solutions for teaching and learning in the virtual space that can avert a total breakdown of educational institutions, particularly during the coronavirus pandemic.

As the pace of change in the education sector is considerably higher than before, the industry is facing inevitable challenges in remaining agile and adapting long-prevailing business models. This has imposed the need for parallel innovations in higher education's business models and value networks. According to Bower and Christensen [1995], who have studied the evolution of many industries, there is a need to distinguish between sustaining and disruptive innovation. Christensen [1997] defines the latter as “the notion that certain innovation can improve a product or service in such a way that it creates new markets that displace existing ones.” Sustaining innovation targets customer needs and market demands, thereby improving products and services in an incremental fashion. In other words, a sustaining innovation is a consequence of a change in customer behavior, needs or situation. The current crisis-driven technological advancements and adoptions in the education industry are competing and collaborating with the traditional actors in education, thereby redefining the roles of traditional versus digital business models. Hereafter, we analyze two sub-sectors – Learning Management Systems (LMS) and Language Learning Platforms (LLP) – of the EdTech market and their business model adjustments over the course of the corona crisis.

¹ <https://www.sofatutor.com>, <https://www.studysmarter.de>, <https://learnattack.de>, <https://simpleclub.com/de/unlimited-basic>.

² <https://edutech.technologiestiftung-berlin.de/info>.

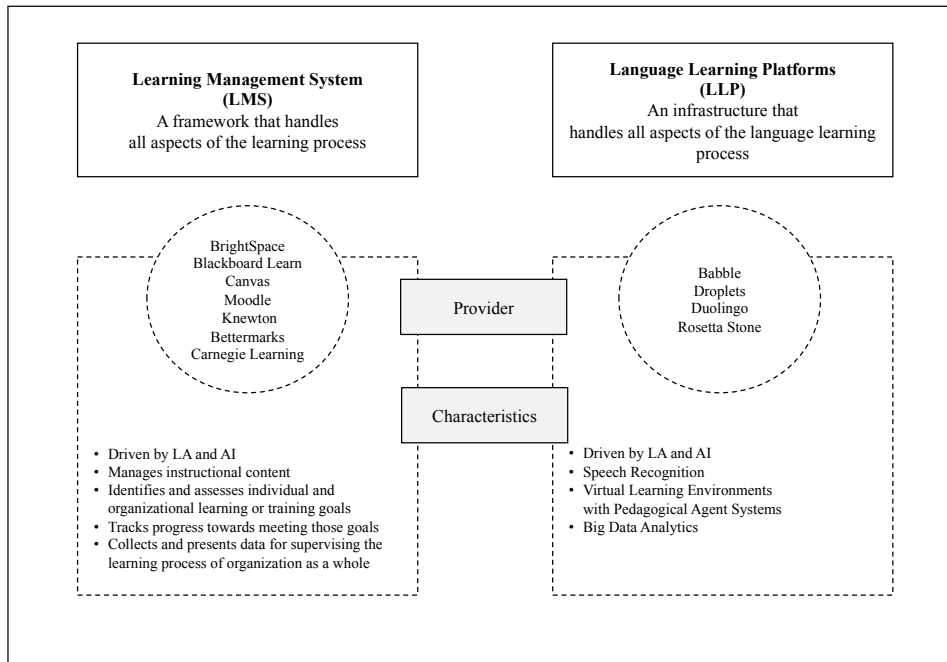


Figure 3 Overview of EdTech sub-sectors LMS and LLP

LMS is one of the platforms that has received the biggest coronavirus-related spikes, on March 23 and March 30 [Inside Higher Education, 2020]. An LMS is a web-hosted software application for posting assignments and hosting online materials, interactive learning, quizzes, and so on [Watson & Watson, 2007]. As we can see that schools are adapting well to the situation by integrating LMS into their institutions, many LMS providers such as Canvas, Moodle, BrightSpace, and Blackboard Learn are providing additional features such as video conferencing support, built-in messaging systems, customized student and teacher profiles, and support for organizing and preparing digital content.³ The most popular LMS in European countries is Moodle (50% market share in Europe, Latin America, and Oceania), as it offers the flexibility of integrating third-party plugins, for example, WordPress. Canvas LMS usage has increased more than 60% in terms of maximum concurrent users. D2L's BrightSpace saw 25% increased usage in virtual classrooms. Blackboard increased its virtual collaborative classroom activity by 36% and the number of Blackboard LMS log-ins increased fourfold. According to insights from the report *Inside Higher Ed* [2020], synchronous video and virtual classroom usage have increased more than the usage of LMS. This shows that teachers prefer to replicate their face-to-face classes in virtual environments. Renz, Krishnaraja and Gronau [2020] identify algorithmic and AI-based solutions in data-driven business models such as Knewton, Bettermarks, and Carnegie Learning.⁴ These business models exhibit features of multi-sided business models. Some observers believe that these business models have the potential to dramatically change how instruction and teaching are provided to expand access, reduce costs, and facilitate learning [Center for American Progress, 2020].

³ <https://www.canvas.net>, <https://moodle.de>, <https://community.brightspace.com/s/>, <https://www.blackboard.com>.

⁴ <https://www.knewton.com>, <https://de.bettermarks.com>, <https://www.carnegielearning.com>.

Amid the crisis, LLPs are also gaining increased attention. Language app providers are using the situation to market their products, which are digitized, personalized, and offer a gamified experience for a new and fun way of learning. Language apps such as Rosetta Stone, Droplets, Babbel, and Duolingo are providing free services to their customers.⁵ Rosetta Stone is expanding its services by incorporating features such as providing live tutors for virtual sessions as a means of replicating the traditional physical environment and real-time feedback. Duolingo, one of the most popular apps in the field, provides services for teachers to assign remote work to their students and view the status of the current learning situation of each student. According to the statistics from Duolingo, the number of new Duolingo users has grown sharply, with a 107% increase in usage in France, 109% in Spain, 108% in Italy, and 80% in Germany. The UK had seen a 296% spike in the number of new users as of March 16. Duolingo has also shown that the student population, apart from other language enthusiasts, is also adapting to complement their school lessons [Duolingo, 2020]. Babbel, which uses a subscription-based business model, was named one of the world's most innovative education companies in 2016 [Fast Company Business Magazine, 2016]. Babbel maintains its reputation by optimizing its environment and improving the user experience and is currently considered one of the best language apps to provide a more school-like experience and curriculum [CNET, 2020]. Droplets is flexibly innovating its business model due to the situation by adding new value propositions to support distance learning. To facilitate virtual classroom instructions, Droplets expanded its class limit from 2 to 50 student profiles. These innovation stories can be seen as transitions in the business models, from providing digital language learning to fitting classroom activities. However, whether these platforms will be used post-crisis is questionable, as face-to-face communication is the primary skill that is needed for language learning. It will come down to how well the LLP providers adapt to customer needs.

Both, LMS and LLP have already become data-based and even data-driven, and implement LA and AI elements in their systems to develop adaptive business models. In the course of the current crisis and the increasing demand for corresponding EdTech solutions, it can be assumed that business models will be adapted to customer needs not only during the crisis. Rather, we assume that LA and AI applications in particular can be further optimized by the increasing collection of user behavior data and that new, innovative business models can be developed as a result.

7 Conclusion and future research

The rapid spread of COVID-19 has shown the importance of strengthening resistance to various threats. This pandemic has led to an acceleration in technological development in many areas. With regard to the EdTech industry, it is important to understand that technological innovations are directly linked to the skills and readiness of users. Moreover, previous research by Viberg et al. [2020] shows that, despite EdTech tools' high potential for improving learning practice, educational organizations have been reluctant to implement digital learning and teaching strategies, because they needed solid evidence of how useful EdTech tools are for students, teachers, and organizations. However, due to the sudden closure of schools, educational institutions are forcing themselves to use digital tools to maintain student education. With this change in society, EdTech actors are using the data generated by students and learners with the goal of

⁵ <https://www.rosettastone.de>, <https://languagedrops.com>, <https://de.babbel.com>, <https://de.duolingo.com>.

transforming it into new knowledge that can benefit students, teachers, and administrators.

This paper provides an overview of the impact the corona crisis could have on the further development and innovation of existing business models. Current market observations show that companies are prepared to make fast and customer-oriented adjustments to their business models. This flexibility is accepted by customers, as seen in the strongly growing EdTech market [Renz, 2020]. Further exciting observations will be possible in the coming months. It will be interesting to see whether the change to digital business models will also necessitate a change to data-enhanced and data-driven business models. Such a shift will also substantially increase the dynamics of LA- and AI-based EdTech applications. Thus, existing EdTech applications can be significantly innovated and new business models can be developed. Highly relevant in this context are the developments of hyper-individual EdTech applications, which promise an even more intensive interaction and learning experience for the individual. However, for such development to be possible, it remains important to understand that technology is only as good as its usefulness. For example, the benefits of LMS can only be realized if the data generated by students is used in a utilitarian form. LA is seen as a promising approach to improving our understanding of the learning process [Gašević, Dawson & Siemens, 2015]. Although the possibilities offered by technological progress in education have been obvious, there has always been a clear tendency towards conventional methods. This is one of the main reasons why EdTech was limited in terms of collecting a large amount of data about learners, which hindered its ability to innovate. Now that the situation is changing, it is inevitable that organizations and teachers will adapt and benefit from these digital platforms. One way in which teachers and organizations can benefit is by not simply repeating face-to-face lessons in the virtual space, but by adapting to changes in the medium of education and perpetuating new approaches. The measures taken by educational institutions have been seen as a sign of progress towards a digitalized society.

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