Digital Transformation and Education DX

~Series: Theories and Practices of Learning to Support Education and Training DX (1) ~

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In recent years, the importance of Digital Transformation (DX) has been widely emphasized. DX is not merely about digitizing business processes but involves leveraging digital technologies as a foundation to transform services and organizational culture. This requires careful consideration and design of how technologies are applied to meet their intended purposes. For the DX in the field of education and training, it also demands a clear definition of objectives for introducing digital technologies to enhance the effectiveness and fascination of learning. This involves designing and redesigning educational and training content based on sound theories. This series will explore the theories of learning psychology and instructional design, as well as practical examples based on these theories. In this first article, we will review the concept of DX and explore the meaning of Education DX.

Reviewing Digital Transformation (DX)

Although much has already been explained about DX, let us briefly review its core concept. Below is the definition of DX provided by the Ministry of Economy, Trade, and Industry (METI, 2024):

"DX refers to the process by which companies respond to rapid changes in the business environment by leveraging data and digital technologies to transform products, services, and business models based on customer and societal needs. This also involves transforming business operations, organizational structures, processes, and corporate culture to establish competitive advantages."

The key point here is that DX goes beyond merely introducing digital technologies into business processes. It aims to transform business models and organizational culture while ensuring competitive advantage by effectively utilizing data and digital technologies.

The process leading to DX is often explained in three stages: Digitization,

Digitalization, and Digital Transformation (DX).

Digitization refers to the stage where digital technologies are applied to improve operational efficiency. Examples include replacing paper-based approval documents with digital formats or using barcode scanners instead of manual cash register operations. Transportation IC cards like Suica, which replace tickets and commuter passes, also fall under this category. The use of transportation IC cards eliminates not only the hassle of purchasing tickets and retrieving commuter passes but also the complexities of transferring between different railway companies and adjusting fares when exceeding the coverage of a season pass. These examples demonstrate benefits such as reducing operational errors, shortening processing time, and improving convenience.

The second stage, Digitalization, involves the creation of new value through the application of digital technology. Let's take the example of the digital camera, a technology developed in Japan. Traditional film cameras required film development and printing on photographic paper to view photos, but digital cameras eliminated this process. Up to this point, it represents operational efficiency improvements (digitization). However, digital cameras have gone further to create new value. For instance, the digitalization of image data allows for photo editing and retouching, which can now be easily performed using image editing software on a computer or directly on the camera itself. Moreover, features like image recognition enable automatic adjustments, such as focusing on people in the frame. Additionally, network connectivity has enabled seamless sharing of images via SNS. These advancements offer entirely new values that were impossible with analog film cameras, and this innovation has since been carried forward to smartphones.

The third stage, Digital Transformation (DX), transcends new value creation. It refers to a state where organizations continuously transform by leveraging digital technologies to adapt to changing societal conditions. A well-known example is Amazon. One of the key strengths of online shopping is the elimination of physical space constraints, allowing for an exponentially larger product selection compared to physical stores. In addition to this, Amazon leverages customer data to provide powerful recommendation features. Users of Amazon are likely familiar with messages such as "Frequently Bought Together" or "Customers Who Bought This Item Also Bought." These messages are precisely the result of Amazon's system analyzing purchase history data. By identifying customers who have bought the same item—essentially those with similar preferences—the system automatically recommends other products that these users tend to purchase in common.

This mechanism benefits users by recommending appropriate products tailored to

their preferences from the countless options available on the site. Many users may have experienced being tempted into purchasing additional items due to these recommendations or being introduced to rare products that are difficult to find in stores. On the other hand, for sellers, this system offers the advantage of effectively providing recommendations that reflect the diverse preferences of users without any manual intervention, ultimately boosting sales. Although this concept is simple, implementing such a system in a physical store with human staff would be impossible. It is a feature uniquely enabled by a fully online platform.

Amazon initially started as a bookseller but has since expanded its product offerings to include clothing, electronics, groceries, as well as digital goods such as e-books, music, and video streaming services. The essential element of this mechanism is the large-scale utilization of customer purchasing data, which drives the creation of value. This is precisely what can be called Digital Transformation, a continuous transformation leveraging "data and digital technologies."

What is Education DX?

In the previous section, we reviewed the concept of DX with examples. Now, let us consider Education DX in comparison. The Ministry of Education, Culture, Sports, Science, and Technology (MEXT, 2024) has outlined policies targeting primary and secondary education. These focus on the utilization of educational data and consist of three steps: (1) Standardization of educational data, (2) Development of tools adhering to these standards, and (3) Analysis and utilization of educational data. Here, we will discuss Education DX in line with the stages of DX introduced earlier, broadening the perspective beyond school education.

The first step of DX is Digitization—improving operational efficiency through digital technology. In the context of education, this includes digitizing textbooks, teaching materials, and student performance records. Digitized materials reduce distribution effort and make content easier to search. Digitalization of performance data reduces transcription errors and simplifies aggregation tasks. Together, these enhancements contribute to greater efficiency, fewer errors, and increased convenience.

The next step is Digitalization, which involves creating new value through digital technology. A prime example is building a learning environment based on a Learning Management System (LMS). With an LMS, course content, learner information, and learning history are integrated into LMS. Content such as instructional materials, videos, quizzes, assignments, and communication tools for group work are all available within the LMS. This enables learners to access the

necessary learning resources anytime and anywhere. Additionally, by referencing learners' learning history data, instructors or systems can provide personalized feedback. For instance, based on quiz results, the system can automatically and immediately offer hints or relevant explanatory materials. Such capabilities create an interactive and adaptive learning environment that responds to each learner's understanding. Recent advancements in AI technologies further enhance such interactions, enabling richer responses and improved learning outcomes. It is extremely difficult to achieve such a learning environment in a face-to-face training setting where a single instructor teaches multiple learners. However, the adoption of digital technology like an LMS enables the realization of a new value proposition: a learning environment that is "accessible anytime, anywhere," "interactive," and "personalized."

The third stage is Digital Transformation (DX)—continuous transformation in response to changes in the social environment. This stage involves not just individual learning but also organizational change. For organizations like corporations to undergo continuous transformation, it is essential to improve individual skills. Achieving this requires providing learning opportunities aligned with organizational goals. Using Amazon's business model as an analogy, digital technology could provide opportunities by utilizing detailed individual data to offer learning tailored to the organization's goals.

For example, integrating an LMS with workplace operational support systems and incorporating micro-learning features equipped with recommendation functions tailored to job content and individual skills would enable the seamless integration of on-site tasks with micro-level learning. Furthermore, by utilizing employee work behavior data and the learning history accumulated in the LMS, it becomes possible to gather evidence on how to design macro-level learning, including training, to enhance the skills required by the organization. This creates a cycle: "micro-level on-site support" → "skill assessment and evaluation" → "macro-level skill enhancement strategies aligned with organizational objectives" → "improvement of workplace capabilities." If this cycle can be effectively implemented, training would move beyond being "training for the sake of training" and evolve into training aimed at driving the organization's continuous transformation. Recent trends such as reskilling and human capital management can also be understood from this perspective.

What becomes crucial here is determining the methods and types of data to collect in order to understand individual behaviors and skills. Examples of such data include communication data, such as conversations and emails with colleagues,

supervisors, or clients, as well as work reports and records. While analyzing such data was challenging in the past, advancements in natural language processing and generative AI now make this possible. Once again, the importance of "data" cannot be overstated. Data collected through workplace systems and LMS platforms is essential for driving continuous transformation through the application of digital technologies—this is the essence of Education DX. Similar to how Amazon began with book sales and gradually expanded the range of products it handles, this framework can also initially focus on tasks where the collection and evaluation of behavioral data are relatively straightforward, gradually broadening the scope of applicable tasks over time.

In this article, we compared corporate DX and Education DX, exploring the three stages of efficiency improvement, new value creation, and continuous transformation. In subsequent installments, we will introduce theories and practical examples from learning psychology and instructional design, focusing on enhancing the effectiveness and fascination of education and training.

References

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