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Review Article

Artificial Intelligence in the Education Process

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Abstract: Many fields show remarkable progress in the application of technology. Technology in work environments has moved from limited use in accomplishing specific tasks to broader use in accomplishing multi-tasking work in full. This situation may be evident in some fields and may decline in other fields such as education. Can technology perform the education process completely, i.e. manage the education process instead of (or partial of) the teacher, or does it remain limited as functional tools to assist the teacher? In this paper, we will discuss this gap, which is the extent of our need for human interaction and the extent of the efficiency of modern technology in covering this aspect. After discussing the needs and necessity of the human element in the education process within the framework of direct interaction, we will then discuss the reasons for the ongoing controversy on this topic, and then we reach a conclusion that technology can play this role, but we attribute this decision to the goal of education in the environment in which education is applied. The tools and application differ according to the educational goals.

Keywords: Instruction, learning; Education; AI; Business Process; Business Function; Google Scholars;

1. Introduction

Education is one of the most important ways people use to share knowledge, values, and skills. It helps people grow and supports the development of society. We can see how important education is by looking at how it continued in different times and places. Over time, the tools and methods of education have changed. In the past, people used things like leather and ink to write. Later, they used paper and pens. Education also moved into schools and universities.

These changes made new ways of teaching and learning. For example, books helped students' study at home. Teachers used blackboards in the classroom. Today, technology has brought another big change. Students and teachers now use computers and the internet. Because of this, we ask: how is education process today different from the past?

1.1. Education process

We can understand the change by looking at the admission process from 1950 to 2024. In the past, students had to go to the university or send papers by mail to apply. This took a long time and a lot of effort. Today, students use websites to apply. They send their papers online and get answers by email. This is much faster and easier. If technology changed the "process of" students apply, then it also could change "the process of" how they study and learn.

1.2. Technology in education process

Technology has a great contribution in education, starting from creating lessons using presentations and submitting assignments via platforms like Blackboard, to delivering lectures from behind screens. Despite these advancements, technology brought us new challenges. The direct guidance and interaction of the teachers in education has been negatively affected. Efforts like gamified learning and creating engaging content aim to solve these issues, but technology still functions under the guidance of teachers. Even with the abundance of information available online, students rely on educators to guide them in how to search and access resources.

1.3. Why Artificial Intelligence (AI)?

This raises the question of whether technology remains limited in education or whether there is a gap in our education system with technology. Although we did not tend to talk about technological benefits in education, it is clear that education technological tools evolved rapidly. We are referring here to the capability of technology to simulate the student's needs, just as teachers do. And when we talk about technology at this level (like simulation the student's needs), we tend to speak about artificial intelligence (AI) where technology at this level is capable to handle complex tasks and process.

This paper discusses few points regarding to the technology in education ending with the discussion of the gap of interactivity of technology and the ability of AI to handle this gap or not by discussing two questions: what is the difference between "Technology as function" and "Technology as process"? and ₀s technology capable of taking the teacher's role in the learning process?

2. Review Methodology

Education has many criteria such as learning, instructing, and administration. In this paper, we discuss the application of Artificial intelligence specifically in instructing and learning, not education as a whole system.

Keywords for the research include: instruction, learning, AI, ITS and education process. The term "Process" is included since the paper discusses the implementation of AI as a process within learning system.

Papers related to Intelligent Tutoring Systems (ITSs) have been included to assess the impact of AI systems on students and learners. Sources were selected primarily through Google Scholar, using combinations of keywords such as "AI in education," "intelligent tutoring systems," and "technology in learning." Only peer-reviewed papers and academic publications published after 2010 were considered. Articles focusing on unrelated AI applications (e.g., AI in business or logistics) were excluded.

Additional references include [1] and [2], which discuss the application of technology and AI in organizational processes.

A future step in the research may include conducting a survey with a limited sample to compare knowledge gained through AI-based technology versus traditional interactive teaching.

3. Related Work and Research Contribution

There are numerous research papers in the field of AI in education, as both education and AI are rich areas for exploration. Education is deeply embedded in societies and, consequently, has been extensively studied and researched. On the other hand, AI has been advancing and growing and getting interested by many fields because of the features and services that AI could provide. Anyway, the spread of AI systems and their services help to increase research in this field. Figure 1 shows the rising number of papers published in the topics "AI" and "Education" from 2017 to 2021 by Google Scholar engine.

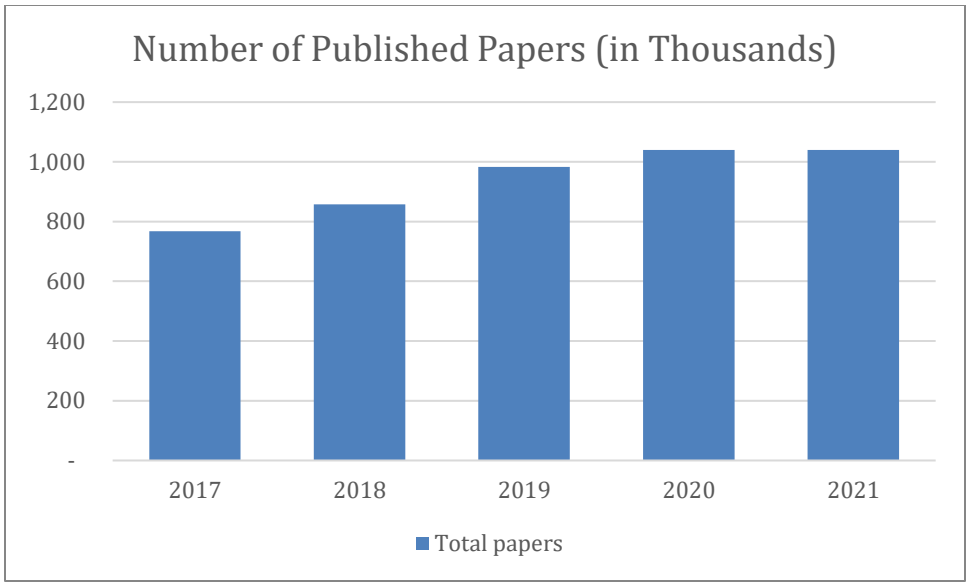

Figure 1: Number of papers published (Search results) in Google Scholar over the past ten years with key words "AI" and "Education"

One example of these systems is Intelligent Tutoring Systems (ITSs) which are AI-based and designed for learning purposes.

The paper *"Artificial Intelligence (AI) in Education: Using AI Tools for Teaching and Learning Process"* by Tira Nur Fitria [3] presents various forms of AI application and discusses these implementations. Another paper, titled *"Towards a Design of an Intelligent Educational System"* by Valentina Terzieva and her colleagues [4], focuses on intelligent education systems (IES), which are AI-based tools designed to support specific field in learning. These and other studies provide an overview of AI applications in education, highlighting AI's potential to perform tasks related to teaching and learning. This literature review aims to explore the development of technology and its capability and feasibility of applying these applications in the educational institutes as organizations.

Since this paper focuses on the capability of the application of technology (particularly AI) in the education process, we will benefit from the reviewed papers in aspects related to AI applications. As for the use of technology in systems, including education, I refer to the studies [1] and [2] to discuss how technology or AI is applied as a process in organizations.

The second part of knowledge construction for this literature review, is understanding organization process which is secondary as this paper focuses mainly on the impact in education and the capability of AI in this field.

4. Literature Review

4.1. Technology from functions to processes

Technology has gone through different eras, and the way these eras are divided can vary depending on the point of view. In the paper "History, Features, Challenges, and Critical Success Factors of Enterprise Resource Planning (ERP) in The Era of Industry 4.0", they divide technology into four eras based on the development of technological systems in the context of ERP [5]. ERP is a new era of functionality where tasks and functions. A similar classification concept is also mentioned by a paper titled Enterprise Resource Planning: Past, Present, and Future by Shadrack Katuu [6] but with more range of years. However, Rainer et al. in their book [7] "Introduction to Information System 5th edition" do not follow this classification due to a different research focus, the authors mention two earlier eras called the "functional eras" in information

systems. There are also two common terms in the business field that match this classification of technology: Business function and Business Process.

In the “Business function”, technology is limited to interior departments to perform their job within their scope such as record entries or making reports using spread sheets for financial department.

Later, technology developed to a higher level, where it could handle multiple tasks within one process. At this point, technology became part of an integrated system which led to ERP systems. ERP system is a new considered to be a new era of technology that implement the concept of “Business Process”. Ellen Monk and Bret Wagner [8] in their book “Concepts in Enterprise Resource Planning” have good example explaining the relationship between these two concepts (function and process). The book shows how a group of tasks are connected in two integrated processes. The first process represents a customer order process, starting from the sales function to the logistics function. The second process represents a material order process, which use functions in different way. A function might be shared by both processes but the implementation within the process defers. Therefore, we understand from the figure 2 that process is not only collection of functions but also a method of implementation.

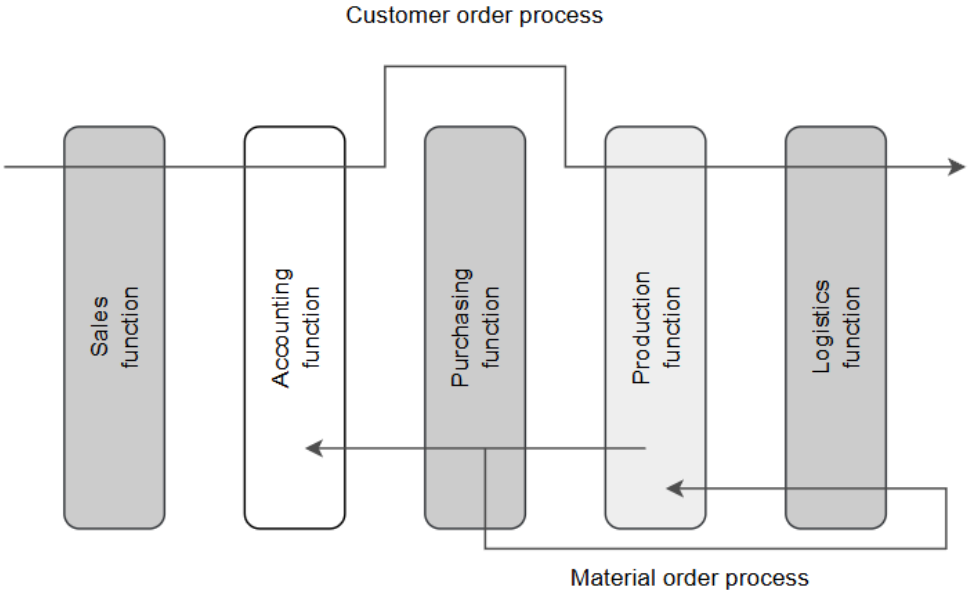

Figure 2: A process view of business operations from Ellen Monk and Bret Wagner (edited version) [8]

In the second chapter, the author explains ERP systems as one of the technological models that helped companies in the past adopt the concept of business process. In the same section, he also highlights the technological limitations of the 1970s and 1980s, and how advancements in data storage contributed to overcoming those limitations.

This demonstrates the clear impact of technology and its ability to perform at a much higher level than in the past. From here we would like to point out that the development of technology to the stage of work as a process and its capability to handle a complete job does not necessarily mean dispensing with humans, but rather it is the entry of technology into a new stage of managing work.

4.2. Application of technology in education

Technology today is widely used. As mentioned earlier, it became part of the organization's process. Platforms like Blackboard and Edmodo are examples of having technology as a core work of their business.

Educators can use these services as a primary piece of their course. Google classrooms is also a great tool where it offers creating embedded documents, so learners do not need to set up word processing apps to write their essays and store them locally and upload them later to the platform.

Same as other fields, the technology in education is not just about improving teacher tools, but it has expanded to some administrative aspect of administrating the learning that even changed the way education looks. For example, designing some courses to be delivered remotely, like the courses on platforms such as Udemy and Udacity. The spread of technology did not stop at this point, there are other shapes and styles of education that show how technology applications are growing in this field such as online learning, e-learning, web-based training, and computer-based training. However, these are general examples not to be discussed in detail in this paper, but it is just mentioned as examples of the technology applications in the education field.

These services are capable of processing particular jobs. They can be used as tools to support instruction, but they are limited to processing submissions and contents upload and download. Other educational tasks are performed by other services or by the educator themselves such as preparing or grading quizzes and homework. Some tasks are more complex such as understanding learners' needs. AI is the capable part of technology to perform such complex tasks.

Fati Tahiru et al. in their review of "AI in Education" [9] identify three types of AI technologies, one of them is Automating Administrative Tasks where it takes the role to grade quizzes and homework.

Tira Nur Fitria, in her paper "*Artificial Intelligence (AI) In Education: Using AI Tools for Teaching and Learning Process*" also [3] highlights various types of AI technologies that can perform different tasks, such as:

- Virtual Mentor: virtual mentor in online education by giving students feedback and helping them review materials.
- Voice Assistant: similar to virtual mentors but focus on voice interaction. They help students find learning materials easily by speaking keywords, and they respond using natural language.
- Smart Content: helps users find, organize, and access digital books and learning materials quickly and easily.
- Intelligent tutoring system (ITS): aims to provide personalized education and feedback.

The paper "*Towards a Design of an Intelligent Educational System*" [4] also discuss a later version of ITSs, known as the Intelligent Educational System (IES). The IES is a wider concept of ITS where "*students interact with interfaces that are customizable and personalize the learning experience based on their preferences and current learning status*".

4.3. AI as a learning process

We discussed the difference between technology as a "function" and technology as a "process" in term of business, and how technology has evolved from simply performing specific tasks (functions) to managing entire processes. For example, in the field of commerce, technology used to serve limited roles such as accounting (like using a cashier system) or inventory tracking (like using MS Excel), especially in traditional stores. However, technology has now advanced to the point where it can transform the entire store into a digital platform, handling the full sales process—from displaying products, to completing transactions, to managing inventory—just like what we see with modern e-commerce websites.

In education, there are good attempts to benefit from technology. However, education is one of the fields where human interaction plays a big role; therefore, it might face more challenges in benefiting from technology compared to commerce or many other fields. Web pages with some technologies to store and process data might be good tools for performing processes like selling and buying, but these tools are limited in matching and imitating human intelligence in interactions, evaluations, or managing the deep learning process that aligns with the learner's thinking. However, with the help of AI, websites like Exercism.org and other systems such as ITSs can now imitate human intelligence and understand educational needs. They

can even handle a “complete process", where AI in these systems provides personalized and adaptive instruction for students [10].

However, intelligent systems in education are not necessarily dedicated to tutoring learners, but they can be a partner to the educators in providing better experience in their field. AI could be implemented in different areas level of integration. This is at least a good stage in involving AI in the educational process. From here it becomes clear that AI can be applied and benefited from in the field of education on more than one level: full accreditation as is the case with ITSs, or partial accreditation as a tool to assist teachers, which requires human supervision in the educational process.

4.4. The need for human interaction in education

When we talk about direct human interaction in education, it goes beyond just knowledge. In his review in the paper *Artificial Intelligence in Higher Education* [11], Sana Abu Safi Al-Qudah explains that universities have a role that goes beyond traditional education. They play dynamic, multi-dimensional roles, acting as channels to develop social skills, communication abilities, interaction with others, emotional intelligence, ethical and cultural values, and a sense of personal responsibility. This is achieved through involvement in cooperative learning experiences and diverse educational environments.

This shows that even with advanced AI solutions, providing good learning systems, may still fall short of the full purpose of direct interaction between teachers and students in term of social experience. These AI systems are primarily focused on learning in terms of learning skills and knowledge delivery. When reviewing papers on Intelligent Tutoring Systems (ITS), we see that they mostly discuss learning outcomes and the effects of learning on students. To understand the scope of these intelligent educational systems, we can read more int the article *Intelligent Tutoring System* by HandWiki [12], as well as the research paper *Artificial intelligence (AI) in education: Using AI tools for teaching and learning process.* [3].

5. Results

The involvement of AI in education, technology tools has advanced more. ITS systems, which is AI-based systems, can be combined with other educational systems to take on bigger roles in education. With ERP (Enterprise Resource Planning) and ITS systems, they can play an integrated role by connecting systems, collecting and analyzing data, and then understanding the learner’s needs to create educational materials based on these needs. This way, technology can play a more comprehensive role in the educational process.

The need for human interaction might go beyond the delivery of knowledge where social and other subjects might be involved in education. However, this field is wider than the goal of AI systems like ITS systems. AI learning systems aim to measure student needs and enhance learning outcomes.

6. Discussion

In the introduction of the research, three main points were presented for discussion: procedural work (process), technology, and AI. The first point was about the concept of the procedural work (Business process), which is a broad topic that includes both business and technical aspects. This was a starting point to talk about technology, which became the most important focus of this research. Then, we narrowed the discussion to AI to better explore the research questions.

At the beginning, two questions were raised: the first was about the difference between technology as a function and as a process. This question led to a discussion of two business-related management concepts (business function and business process), but as we explained, the purpose was not to study business fields in general, but rather to look at technological progress in managing work processes inside organizations. Education, like any other field, works within an organizational and administrative context. So, in this paper, we claim that technology in education can go more just functions to perform processes. One of these processes is educating.

In other words, when we say "educational process" we mean the interaction between the instructor or teacher and the student, not the whole education system. Previous examples (like customer order and material order processes, the banker and transferring money) all show that the concept "process" means doing multiple tasks inside a system, not managing the whole system.

Looking at how technology can manage the teaching process brings us to the second research question: Is technology capable of taking the teacher's role in the learning process? This question introduces many challenges, including the technological ability to interact while delivering information. During the COVID-19 pandemic, tools for online learning often missed this important interactive role, which showed us how important teachers are in the teaching process.

However, from our point of view, the real problem is not the absence of the teacher, but the lack of their interactive role. So, we think the main difference between face-to-face learning and online learning is the absence of "interaction". After reviewing the capabilities of AI systems (like identifying student needs and offering simulations), we think that technology today has reached a level close to human teachers in interacting with information, or at least in a big part of it.

This leads us to another challenge: will technology replace teachers? This may come to mind after reading the second question of the research, but it's a misunderstanding. This paper is not talking about the risks of losing teaching jobs. We emphasize repeatedly that our discussion about the possibility of technology taking the teacher's role is actually a discussion about its effectiveness. The ability of technology to take on the role of the teacher does not necessarily mean eliminating the teacher's role. Just as the expansion of technology in the banking sector has enabled it to perform tasks such as transfers and deposits (tasks typically done by bank employees) this has not necessarily led to the elimination of banking staff.

Returning to the ability of technology to take the teacher's role, we may enter into a broader comparison with the teacher's role itself. This also raises a number of questions and discussions, including social and psychological topics, as mentioned in the paper. However, the discussion here focuses on the aspect of teaching and learning (learning process)-that is, the transfer of knowledge. After this review, we argue that it is possible to compare the teacher and technology in this context, given that AI programs specialize in measuring and identifying learners' needs.

7. Conclusion

There are two important parts in this research review. The first aspect discusses how technology is applied in organizations, where it was limited to the scope of "Business Function", and then developed to the scope of "Business Process". This workflow or framework can be applied in organizations based on their needs. However, in education field, it may become more complex because of the presence of human elements that common technological tools cannot address, such as the interaction between the teacher and the student and assessing the student's needs.

The second aspect revolves around AI and its capabilities in simulating human intelligence in term of students' needs. There are already existing AI applications, such as ITS systems, which are AI-based applications related to education.

These two aspects support the idea of developing the management of the education process using AI tools, allowing us to transform AI from being as "education function" to "education process" that work as a central part in managing and guiding the educational process between the teacher and the student.

In the end, it is essential to recognize the gap in comparison between our need for human interaction and technological interaction. Human interaction in education may go beyond just information and knowledge, while technology, especially ITS systems, are primarily designed for that purpose. By understanding the limits of our need for interaction, we can assess the interaction between technology and human interaction more fairly.

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