A Review on Teaching and Learning in Decision-Making Post-Pandemic COVID-19

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Abstract: Universities around the globe have begun implementing outcome-based learning (OBE). The curriculum will be revised, evaluated, and the outcomes of the assessments will be reported as part of this OBE implementation. Due to the importance of the evaluation method, several lecturers are searching for innovative approaches for assessing the effectiveness of the Program Learning Outcome (PLO) and Course Learning Outcome (CLO). This study examined outcome-based education for decision-making instruction and learning in the context of the COVID-19 pandemic. This pandemic has effects on the healthcare industry, such as the exhaustion of the healthcare system, disruption of the educational system, and harm to the economy and several other industries. E-learning platforms played a crucial role in helping schools and universities throughout the pandemic by allowing student learning while they were closed. There is a larger need for lifelong learning as a result of the rising need for qualified professionals in education. On the other hand, current trends favour the paradigms of social and practice-based learning. As a result of digitization, our methods of communication and education are changing. The teaching and learning that took place during COVID-19 had a substantial impact on outcome-based learning. We find it fascinating to show how COVID-19 affects outcome-based education (OBE) in a risk decision support system.

Keywords: COVID-19, DSS, Education, OBE, Teaching and Learning

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Introduction

A final demonstration of learning is called an outcome, and it is what a student should be able to do upon completion of a course (Spady, 1994).Outcome-based education is a method of teaching in which curricular decisions are based on the learning goals that students should demonstrate after the course. "Product defines procedure in outcome-based education" (Harden et al., 1999). The opposite of input-based education, where the emphasis is on the educational process and we are willing to accept whatever the outcome is, is outcome-based education, which can be summarized as results-oriented thinking (emphasis original). The gap between outcome-based education and simply providing results for a pre-existing curriculum is enormous. "Outcome-based" does not mean "curriculum-based with outcomes sprinkled on top" (Spady, 1994). It is a revolutionary method of conducting business in the field of education.

As of March 3, 2022, the World Health Organization (WHO) reports that the Corona Virus Disease (COVID-19) has spread to 180 countries, infected 438,968,263 individuals, and killed 5,969,439 people (World Health Organization, 2022). This pandemic has ramifications in the health sector, including depletion of the healthcare system, disruption of education, commercial and economic harm, and a variety of other businesses. Governments around the world have established policies such as lockdowns, social distance, and psychical distancing to ensure that citizens avoid direct physical contact as much as possible to restrict the spread of COVID-19. It is in their best interests for them to continue their activities, such as in the field of education. As a result, demonstrating COVID-19's impact on Outcome-based Education (OBE) in a Risk Decision Support System is exciting to us. This article discussed a review of teaching and learning in Decision Making-Post Pandemic COVID-19

Teaching and Learning

In reaction to the COVID-19 epidemic, the majority of countries have implemented lockdown and social segregation measures, which have resulted in the closure of schools, training centres, and higher education institutions. A paradigm shift has occurred as educators now provide high-quality instruction through a variety of online platforms. Online learning, distance learning, and continuing education have all shown to be effective treatments for this unprecedented global pandemic, despite the challenges that both educators and students encounter. Transitioning from traditional face-to-face learning to online learning can be a completely different experience, which they must adjust to because there are few or no other options. Through numerous internet platforms, the school system and educators have adopted "Education in Emergency," and are obliged to adopt a system for which they are unprepared (Pokhrel & Chhetri, 2021).

During the pandemic, e-learning tools were critical in assisting schools and universities in facilitating student learning during the shutdown of universities and schools (Subedi et al., 2020). Staff and student readiness must be assessed and supported while adapting to the new adjustments. Learners with a fixed mindset have a hard

time adapting and adjusting, but learners with a growth mindset adapt easily to new situations. For online learning, there is no one-size-fits-all methodology. There is a range of subjects to choose from, each with its own set of requirements. Various disciplines and age groups necessitate various ways of online learning (Doucet et al., 2022). Physically challenged students can also benefit from online learning because it allows them to participate in learning in a virtual environment with limited movement (Basilaia & Kvavadze, 2020; Pokhrel & Chhetri, 2021).

Students, parents, and educators around the world have felt the unanticipated rippling impact of the COVID-19 epidemic as schools have been closed to deal with the global pandemic. While governments, frontline workers, and health officials do their utmost to contain the spread, educational systems strive to provide high-quality education to all students during these tough times. Many students have experienced psychological and emotional hardship at home/living environments and have been unable to interact successfully. The greatest online home-schooling techniques have yet to be discovered (Pokhrel & Chhetri, 2021).

The skills and exposure to information and communications technology (ICT) for both educators and learners may influence the implementation of appropriate online education. Unified communication and collaboration platforms like Microsoft Teams, Google Classroom, Canvas, and Blackboard have been used thus far to allow teachers to design educational courses, training, and skill development programmes (Bozkurt et al., 2020). They contain features such as workplace chat, video meetings, and file storage, all of which help to keep classes organised and productive. They usually let you share a wide range of files, including Word, PDF, Excel, audio, and video. Quizzes and rubric-based assessments of submitted assignments make it possible to track student learning and assessment. The flipped classroom is a simple approach for presenting learning resources before class, such as articles, pre-recorded films, and YouTube links. The time spent in the online classroom is then used to further comprehension by engaging in discussions with teachers and peers (Doucet et al., 2022). This is an extremely successful technique to promote problem-solving, critical thinking and self-directed learning skills. Videoconferencing (Google Hangouts Meet, Zoom, Slack, Cisco, WebEx) and configurable cloud-based learning management platforms such as Elias, Moodle, BigBlueButton, and Skype are becoming more popular in virtual classrooms (Pokhrel & Chhetri, 2021).

Outcome-Based Learning

Spady proposed Outcome-Based Education (OBE) as a way to ensure excellence in the American education system in the early 1990s (Spady, 1994). OBE was eventually expanded to include higher education as well. 'OBE means centring and arranging an institute's entire programmes and instructional activities around the specified objectives we want all students to achieve when they leave the institute,' according to the system's proponent (Rao, 2020; Spady, 1994). OBE is a method of education that prioritises goals, objectives, successes, and outcomes. It is a practical approach to quality assurance that is used around the world today, in which decisions concerning curriculum and instruction are based on the exit learning outcomes that students should

demonstrate at the end of a programme or course (Rao, 2020). Intended Learning Outcomes, Instructional Objectives, Educational Objectives, Behavioural Objectives, Performance Objectives, Terminal Objectives, Subordinate Skills, Subordinate Objectives, General Instructional Objectives, Specific Learning Outcomes, and Competencies are some of the terms used to describe learning outcomes. What a student should be able to do after completing an academic program/course/instructional unit is referred to as an educational outcome. The explicitness in its relevance, the possibility of discourse, intrinsic clarity, accountability, self-directedness, flexibility, and an integrated framework of teaching and learning, as well as assessment, are some of the key advantages of OBE (Davis & Winch, 2015; Rao, 2020). OBE accommodates a variety of learning methods and allows for educational innovation.

Digital Learning

Future manufacturing systems, particularly in the educational sector, will be intelligent, continuously evolving and improving, highly adaptable to shifting environmental conditions, resource-efficient, and creatively combining human and technological systems. Resource efficiency was boosted by adaptability to changing environments, and intelligent human-technology interaction. This progress is aided by recent technology advancements in sensor systems, automation, and manufacturing ICT. This movement is referred to as the fourth industrial revolution, and the term "Industry 4.0" is widely used to characterise it. Flexible Automation, Wireless Sensor Systems, Cyber-Physical Systems, Artificial Intelligence, (Big) Data Analysis, and the Internet of Things form the foundation (Tvenge & Martinsen, 2018). Manufacturing workplaces are shifting toward less manual work and more "brain" work due to Cyber-Physical Manufacturing Systems. Future manufacturing workers will need to be able to analyse, abstract, and invent, and knowledge levels are increasing in general. The growing demand for a skilled workforce has accelerated the need for lifelong learning. Traditional social/practice-based learning paradigms, on the other hand, are being challenged by contemporary trends. The rise of digitalisation will alter the way we communicate and learn (Tvenge & Martinsen, 2018). Individuals work and learn together in teams or Apprentice-Systems in conventional social learning systems in the industry. Communities of Practice (COP), as articulated by Lave and Wenger (Lave & Wenger, 1991), provide "a sense of belonging, commitment, and shared identity" (Brown & Duguid, 1991; Cataldo, 2009; Wenger et al., 2002) as well as a mechanism for employees to learn from one another. Due to increasingly specialised work and fewer individuals doing the same type of work in Industry 4.0, this manner of learning appears to be challenged. New work structures emerge as a result of fewer individuals and more physical distance between them. This necessitates the development of novel learning methods, such as supervision, guiding, and collaborative learning, which can be synchronous or asynchronous and mediated through ICT tools. ICT tools enable the development of new learning approaches across the spectrum, from lifelong learning to students on campus. From more or less crude e-learning schemes to complex serious games (Pourabdollahian et al., 2012), the utilisation of current ICT opens up new possibilities for on-the-job, personalised workplace learning.

ICT has a natural role in Industry 4.0 education and knowledge development, and there are a variety of

expectations for the consequences of ICT-supported lifelong learning (Pouezevara et al., 2014): As a result of having more data and knowledge, there has been an increase in learning, more effective education, learning activities that are centred on the student, innovative learning spaces that foster greater collaboration and cooperation and a greater number of opportunities for critical thinking and analytical methods. However, current implementations of ICT-assisted learning paradigms have not always met the expectations of the participants (Kinchin, 2012). One cause could be the disconnect between formal ICT-supported learning and workplace practice-based learning. Formal learning is currently only a modest part of workplace learning, with informal learning accounting for around 80% of all learning (Cross, 2010). According to research, ICT-assisted learning will not render teachers obsolete. ICT can help to improve the effectiveness and efficiency of learning processes, but only with the right support. Learning activities including social interactions facilitated by a teacher have had the largest influence on learning outcomes, far outnumbering other approaches (Mincu, 2015).

More and more authors are emphasising the fact that ICT-based learning has evolved from being closed off and centred around individuals to being social and requiring sharing: the learner's needs, not the technology itself, are at the centre (Tvenge et al., 2016). However, there is still a need for social and practical training, and technology is just one of many instruments that can help students learn more effectively and expand their learning area (Prinz et al., 2016). Employers value collaboration skills, thus teamwork and communication must be fostered in future workplace learning paradigms. A rising variety of social networks, as well as another web 2.0 and web 3.0 services, can be utilised for flexible and informal learning, as well as providing access to experts and peers. This is also known as the semantic web, and it allows future Industry 4.0 learning to share a limitless number of multi-medial learning resources. Workers can personalise their learning environments (PLEs) based on their interests, learning styles, and goals. For the individual learner, this is both an opportunity and a struggle. SMEs must rely on more or less ready-made solutions (Paulsen, 2009). Large corporations can create internal personal learning environments; SMEs must rely on more or less ready-made solutions to reduce risks. Open educational resources (OER) are papers and media materials that are publicly available for use in teaching, learning, education, evaluation, and research. Implementation risk and impact risk are the two categories of risk we take into consideration when conducting the research. The estimated investment in the digital learning platform may differ from the initial or anticipated requirements, resulting in higher expenses than anticipated. This is the implementation risk. The impact risk, on the other hand, refers to circumstances in which investments in digital learning may fail to meet the commercial or technological requirements of the organisation, leading to a reduction in overall benefits.

Risk Decision Support System Management

A management system is made up of a number of information gathering and decision-making processes, therefore expanding information gathering and enhancing decision-making procedures are both necessary for management to be improved. Prior to deployment in an IT platform, the risk associated with the process should be recognised and identified during analytical workshops. A list of risks, along with their triggers—situations

that suggest the risk has already occurred or will do so soon—should be the end result of the identification and categorization process. For example, the risk of changing requirements in a business process might be indicated by information about adjustments to the decisions necessary for later time-consuming procedural steps. Learning about all relationships and mechanisms, as well as making decisions regarding their direction and outcomes, is extremely important for effective management of business processes. It necessitates the use of tools that make it possible to clearly and completely identify all process components as well as the connections that exist between them.

Risk management is identifying any potential threats that may arise during the speculative process and taking all reasonable steps to eliminate or mitigate those concerns (Yuliantini et al., 2019). Risk management is the process of identifying, assessing, and prioritising threats, followed by the efficient and effective use of resources to restrict, screen, and control the likelihood or impact of disastrous events, or to increase the recognition of risks. Every company and organisation is vulnerable to unforeseen, dangerous events that can cost them money or force them to shut down permanently. Risk management enables businesses to prepare for the unexpected by lowering risks and additional costs before they occur. An organisation can save money and protect its future benefits by implementing a risk management plan and considering the various potential threats or events before they occur (Yuliantini et al., 2019). A risk assessment is simply a cautious examination of what, in the workplace, may cause harm to individuals or the organisation when completed to determine whether enough insurance has been taken or whether more should be done to ensure that no one is injured, becomes ill, or the trust is jeopardised. The goal of risk assessment is to provide a precise and systematic tool for identifying a wide range of risks associated with defiance of the law, clinical dangers, key, and budgetary obligations, and evacuating them where possible or receiving all control and precautionary measures that are reasonable and practicable in the circumstances (Yuliantini et al., 2019).

Every decision-making process always includes the risk, which is most frequently related to the issue of task implementation. Business decisions and related processes play a crucial role in how any institution runs. In the context of business operations, they determine the company's competitiveness, set the pace of activity, or rationalise the core function of a particular entity. That comprises risk assessment for delivery activity, resource investigation, risk performance, risk management in part, and evaluation of risk in terms of financial aspect. The DSS system will offer a range of options that will aid in decision-making while preparing risk management in a management environment for higher education institutions. Additionally, this method offers a number of possibilities for any estimation at the level of top management that takes the educators' risk into account. It is anticipated that the opportunity for risk and the impact of risk on the educational system can be reduced by employing this DSS concepts.

Conclusion

The need for lifelong learning has grown in response to the increased need for qualified and quality talents.

Conversely, contemporary trends are putting traditional social/practice-based learning paradigms to the test. Digitalisation is changing how we communicate and learn. Teaching and learning during COVID-19 give a huge impact on outcome-based of learning. In future work, we will propose a new model of risk decision support system which will give impact outcome-based learning which focuses on Program Learning Outcomes and Course Learning Outcomes. Our DSS aims continue providing administrative support towards planning the educational capacity of the university in terms of the number of students each course might accommodate within in the stated resource constraints. By simulating with the input data, decision-makers can evaluate various strategies and generate forecasts. We choose to emphasize on the teaching staff as the primary bottle-neck resource and the online platform of the educational capacity in order to keep the model simple, clear, and avoid functional explosion. Experience has shown that compared to other resources like buildings, budget, appliances, and materials, staff availability and teaching approach are by far the most important resource restriction. It's also the most expensive and least flexible in the near term.

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References

Basilaia, G., & Kvavadze, D. (2020). Transition to online education in schools during a SARS-CoV-2 coronavirus (COVID-19) pandemic in Georgia. *Pedagogical Research*, *5*(4).

Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., Egorov, G., Lambert, S. R. S. S. R., Al-Freih, M., Pete, J., Olcott, D., Rodes, V., Aranciaga, I., Bali, M., Alvarez, A. V, Roberts, J., Pazurek, A., Raffaghelli, J. J. E., Panagiotou, N., De Coëtlogon, P., … Paskevicius, M. (2020). A global outlook to the interruption of education due to COVID-19 Pandemic: Navigating in a time of uncertainty and crisis. *Asian Journal of Distance Education*, *15*(1), 1–126. https://doi.org/10.5281/zenodo.3878572

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, *2*(1), 40–57.

Cataldo, C. G. (2009). *Cultivating Communities of Practice: A Guide to Managing Knowledge, by Etienne Wenger, Richard McDermott, & William M. Snyder. Boston, MA: Harvard Business School Press, 2002. 284 pages, hardcover.* Academy of Management Briarcliff Manor, NY.

Cross, J. (2010). “They had People Called Professors…!” Changing Worlds of Learning: Strengthening Informal Learning in Formal Institutions? In *Changing cultures in higher education* (pp. 43–54). Springer.

Davis, A., & Winch, C. (2015). *Educational assessment on trial*. Bloomsbury Publishing.

Doucet, A., Netolicky, D., Timmers, K., & Tuscano, F. J. (2022). *Thinking about Pedagogy in an Unfolding*

Pandemic by Education International - Issuu. https://issuu.com/educationinternational/docs/2020_research_covid-19_eng

Harden, R. M., Crosby, J. R., Davis, M. H., & Friedman, M. (1999). AMEE guide No14. Outcome-based education. *Med Teacher*, *21*(1), 7–14.

Kinchin, I. (2012). Avoiding technology-enhanced non-learning. *British Journal of Educational Technology*, *43*(2), E43–E48.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge university press.

Mincu, M. E. (2015). Teacher quality and school improvement: what is the role of research? *Oxford Review of Education*, *41*(2), 253–269.

Paulsen, M. F. (2009). Successful E-learning in Small and Medium-sized Enterprises. *European Journal of Open, Distance and E-Learning*, *12*(1).

Pokhrel, S., & Chhetri, R. (2021). A literature review on the impact of the COVID-19 pandemic on teaching and learning. *Higher Education for the Future*, *8*(1), 133–141.

Pouezevara, S., Mekhael, S., & Darcy, N. (2014). Planning and evaluating ICT in education programs using the four dimensions of sustainability: A program evaluation from Egypt. *International Journal of Education and Development Using ICT*, *10*(2), 120–141.

Pourabdollahian, B., Taisch, M., & Kerga, E. (2012). Serious games in manufacturing education: Evaluation of learners' engagement. *Procedia Computer Science*, *15*, 256–265.

Prinz, C., Morlock, F., Freith, S., Kreggenfeld, N., Kreimeier, D., & Kuhlenkötter, B. (2016). Learning factory modules for smart factories in Industry 4.0. *Procedia CiRp*, *54*, 113–118.

Rao, N. J. (2020). Outcome-based education: An outline. *Higher Education for the Future*, *7*(1), 5–21.

Spady, W. G. (1994). *Outcome-Based Education: Critical Issues and Answers.* ERIC.

Subedi, S. S., Nayaju, S., Subedi, S. S., Shah, S. K., & Shah, J. M. (2020). Impact of E-learning during COVID-19 pandemic among nursing students and teachers of Nepal. *International Journal of Science and Healthcare Research*, *5*(3), 68–76. www.ijshr.com

Tvenge, N., & Martinsen, K. (2018). Integration of digital learning in industry 4.0. *Procedia Manufacturing*, *23*, 261–266.

Tvenge, N., Martinsen, K., & Kolla, S. S. V. K. (2016). Combining learning factories and ICT-based situated learning. *Procedia CIRP*, *54*, 101–106.

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard business press.

World Health Organization, (WHO). (2022). *WHO Coronavirus (COVID-19) Dashboard | WHO Coronavirus (COVID-19) Dashboard With Vaccination Data*. https://covid19.who.int/

Yuliantini, E., Chin, J., Tukhkanen, T. N., Lydia, E. L., & Shankar, K. (2019). The role of decision support system and risk management. *Journal of Critical Reviews*, *6*(5), 111–116.