Teaching Factory as A New Model for Education 4.0

Amiruddin Ahamat[1*], Albert Feisal Ismail[1], Sabri Mohamad Sharif [1]

[1)] Faculty of Technology Management & Technopreneurship, Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia

[*]Corresponding e-mail: amiruddin@utem.edu.my

Keywords: Education; Teaching Pedagogy; Model

ABSTRACT – Current learning models must be modified to enable learners to acquire and assimilate the competencies necessary for the future Education 4.0 scenario. The goal of this research is to present ECLECTIC 4.0@Teaching Factory as a new learning model. Different contexts for different types of analytical, creative, and practical intelligence are proposed in the new learning paradigm. The study will use document review to look at evolving educational trends and their implications for the teaching factory's future role in education 4.0. The expected output of this study is a new Teaching Factory learning model that fulfils educationalists' needs in TVET education.

1. INTRODUCTION

Quality professionals will need methodological competencies to use data to identify the source of problems, access reliable sources of learning, and the ability to use new tools efficiently to solve complex problems, according to a recent study conducted by an electronics manufacturer in Malaysia on competencies in the era of industry 4.0 [1]. In addition, due to the quick changes in technology growth in the industry, teaching and learning demand a more flexible teaching pedagogy. Innovative delivery techniques combined with new, improved courses may help students improve their social skills. In addition, social competencies would be required for communications across multiple sites, suppliers, and customers in new collaborative virtual platforms, as well as the ability to retain tacit and explicit knowledge in a decentralised environment requiring decision-making ability from leaders, according to the study's findings. The goal of this study is to introduce ECLECTIC 4.0@Teaching Factory as a new learning paradigm for higher education.

2. METHODOLOGY

Typically, research design is a technique that is employed objectively to generate various data components for analysis. Research is a method for increasing one's knowledge about something. The research, which is often referred to as the foundation for gathered facts, is pertinent and reasonable. The acquired data were analysed using an inductive technique in this study. This strategy is also utilised to assist researchers in comprehending how the information is gathered during the interview links to other sources of information. Qualitative data analysis methods are divided in deductive and inductive. Interviewing techniques are classified as organised interviews, semi-structured interviews, and unstructured interviews. In structural interviews, questions are constructed from a standardised, or identical set of surveys. Semi-structured interviews are characterised as qualitative research interviews that are not standardised.

Semi-structured interviews are employed to collect primary data in this study since they can be used to both answer questions and collect data. Following that, the researcher may be gathered and documented via audio recording, with all pertinent information being taken note of. The terms "interviews" and "personal interviews" refer to data gathering methods in which researchers provide questions and respondents respond [2]. The researchers recorded and transcribed the full conversation with the responder. A semi-structured interview should include a few questions and can be utilised to accomplish the research objective. Semi-structured interview questions comprise open, probing, basic, and closing inquiries. The open questions were designed to encourage respondents to provide extensive and realistic responses. It may be used to elicit responses or to gather data in this investigation.

Structured interviews were used to elicit perspectives and practises on the teaching factory's problems and critical success elements. Additionally, the interview questions were based on theoretical assertions drawn from the detected gap. Purposive sampling was utilised to identify participants for the interview in order to accomplish the objectives, with judgement employed to select cases that best addressed the research questions and provided rich data, rather than statistically representing the target population [3]. The interviewees chosen from stakeholders to represent three distinct perspectives: students affiliated with teaching factories, lecturers directly and indirectly associated with teaching factories, and teaching factory management. The five phases of research strategies will be implemented in order to address the overall objectives.

2.1. Phase 1: Conceptualizing Ideas

The study begins by reviewing the existing literature on teaching factories and Education 4.0 in general, and on obstacles and critical success criteria in particular, in order to lay the groundwork for the study theoretical viewpoints and context. Additionally, the literature search was performed to determine how this study fits within the context of previous research and to discover pertinent concerns pertaining to the study's research topic. Theoretically, this study is based on Robert J Sternberg's triarchic theory of intelligence and utilises the ECLECTIC 4.0 learning model.

© Centre for Academics Excellence and Scholarship

2.2. Phase 2: Communication and Networking of Research

At this stage, the study group and pick subjects from several subject categories.

2.3. Phase 3: Qualitative Data Collection Approach

The study principal source of empirical data is a series of semi-structured qualitative interviews. Supplementing the interviews are observations of respondents' reactions and interactions with the research subject. The combination of interviews and observations can be advantageous and illuminating for the objective of this study, which is to identify and determine the respondents' ideas. Personal observation, on the other hand, is concerned with the emotions and perceptions that behind the respondent's behaviour. This enhances the process of capturing significant messages and cues communicated by respondents while also contributing to the analysis data richness. Additionally, this study makes use of publicly available government documents and publications, as well as industry reports made available by various agencies, to gather critical information about the past, present, and future of teaching factories and teaching and learning (PnP) in the context of Education 4.0.

2.4. Phase 4: Validation of Model

This stage requires researchers to map and validate the developed model within the same sector. Researchers are to undertake first hand observations of context acceptance during this time. Additionally, this step requires the final ECLECTIC 4.0@Teaching Factory learning model to be reshaped.

2.5. Phase 5: Formulation of Model

During this phase, a new ECLECTIC 4.0@Teaching Factory learning model is developed to address the need for educationalists, particularly in TVET education.

3. RESULTS & DISCUSSION

Cimini et al. [4] highlighted a gap in the literature about the roles and required skills of the workforce for industry 4.0, and this article seeks to fill that gap through the use of a case study and to give recommendations for preparing quality professionals for industry 4.0. This is an exploratory study that is followed by additional research utilising a variety of approaches and greater sample sizes than previous studies. As Evans [5] has suggested, quality professionals may need to become familiar with new predictive and analytical tools. Roblek et al. [6] proposed using "digital thinking" to rethink how processes are managed. Due to the complexity of big data in smart factories, quality professionals may be required to collaborate with a variety of skill sets, including IT practitioners, statisticians, and process subject matter experts (SMEs), such as resource managers responsible for AI content, in order to comprehend and analyse data and optimise resource utilisation [7, 8, 9].

According to Schulz et al. [10], three distinct elements influence teachers' motivation to use ICT: human factors, intrinsic values, and influencing factors. Human variables include an educator's ideals and attitudes about e-learning, media, and computer technology [11]. Additionally, it encompasses the educators' confidence, proficiency, and skills in using ICT tools [12], as well as their attitudes towards ICT tools and their incorporation into the classroom setting [13]. Additionally, intrinsic values include educators' happiness, their degree of interest, and the joy and entertainment associated with the teaching and learning process [10].

One of the issues considered is the availability of resources such as the internet, computers, multimedia, and smartphones, as well as the benefits of using ICT [14]. Furthermore, Mahdum et al. [13] have argued that teachers' motivation to use ICT is only motivated by their willingness to use ICT, which is influenced by two elements: internal and external influences, therefore motivating teachers to integrate ICT into the teaching–learning process. In many countries, education is neither a method of advancement nor poverty prevention. It is also critical for the growth of knowledge-based societies and economies [15]. The knowledge-based economy enables the acquisition of knowledge and ideas while also encouraging innovation, talent, and technology [16].

Teaching factories expose students to real-world industry processes, particularly in design prototype, manufacturing, and quality control. It enables students to develop a more nuanced grasp of what they have learnt through application to real-world situations. Universities may develop graduates that are competent, world-class, and globally minded through extensive and continual learning based on this application and practise method. Today education and learning systems are deficient in action-based learning. Fardinpour [17] defined action-based learning as "experience or learning that prepares students to apply their skills in real-world and problem-solving scenarios." These problem-solving activities might serve as an alternative method of learning through exchanging experiences with others. The real-world training experiences then take the role of the virtual environments in which students develop and practise these skills. Thus, academic, and industrial objectives are aligned in order to increase graduate employability [18]. The research issues for this study are the difficulties associated with teaching factory establishment and the factors that contribute to its success in the context of education 4.0.

4. CONCLUSION

To compete and prosper in the future work environment, new talents (such as agility, mindfulness, collaboration, co-creation, and design thinking) will be necessary. To facilitate the acquisition and assimilation of these competencies, present business school learning and teaching approaches must be modified. The proposed new ECLECTIC 4.0 learning model incorporates eight learning characteristics: integration into business; collaborative learning; linking humanities and management; encouraging non-linear thinking; complementary insight enabling co-creation; problem-solving technology; and innovating in response to demand. As a result, the new suggested learning model is anticipated to bridge the gap between universities, business, and the community by supplying relevant

© Centre for Academics Excellence and Scholarship

learning features that may help students achieve better learning outcomes.

5. ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Centre for Academic Excellence and Scholarship (CAES) for sponsoring this article and to the Faculty of Technology Management and Technopreneurship at Universiti Teknikal Malaysia Melaka (UTeM) for supporting its publication in the Proceedings of the 2021 Innovative Teaching and Learning Research Day.

REFERENCES

[1] Kannan, K. S. P. N. & Garad, A. (2020), Competencies of quality professionals in the era of industry 4.0: a case study of electronics manufacturer from Malaysia. *International Journal of Quality & Reliability Management*, https://doi.org/10.1108/IJQRM-04-2019-0124.

[2] Burnard, P., Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Analysing and presenting qualitative data. *British Dental Journal 204*(8), 429–432. https://doi.org/10.1038/sj.bdj.2008.292

[3] Saunders, M.N.K., Lewis, P. and Thornhill, A. (2015), Research Methods for Business Students, Pearson, Education Limited, Essex, available at: http://www.myilibrary.com? ID5819487.

[4] Cimini, C., Pinto, R. & Cavalieri, S. (2017), "The business transformation towards smart manufacturing: a literature overview about reference models and research agenda", IFAC-Papers Online, Vol. 50 No. 1, pp. 14952-14957, doi: 10.1016/j.ifacol.2017.08.2548.

[5] Evans, J. R. (2015), "Modern analytics and the future of quality and performance excellence", Quality Management Journal, Vol. 22 No. 4, pp. 6-17, doi: 10.1080/10686967.2015.11918447.

[6] Roblek, V., Mesko, M. & Krapez, A. (2016), "A complex view of industry 4.0", SAGE Open, Vol. 6 No. 2, pp. 1-11, doi: 10.1177/2158244016653987.

[7] Boulanger, M., Chang, W., Johnson, M. & Kubiak, T.M. (2017), The deal with big data. *ASQ Quality Progress 50(9)*, 26-33.

[8] Longo, F., Nicoletti, L. & Padovano, A. (2017), Smart operators in industry 4.0: a human-centered approach to enhance operators' capabilities and competencies within the new smart factory context. *Computers and Industrial Engineering 113*, 144-159, doi: 10.1016/j.cie.2017.09.016.

[9] Farr, F. & Murray, L. (2016), *The Rutledge Handbook of Language Learning and Technology*, Rutledge.

[10] Schulz, R., Isabwe, G. M. & Reichert, F. (2015), Investigating Teachers motivation to use ICT tools in higher education. *Proceedings of the internet technologies and applications (ITA 2015), IEEE,* 62-67.

[11] Player-Koro, C. (2012), Factors influencing teachers' use of ICT in education. *Education Inquiry 3(1)*, 93-108.

[12] Ounis, T. (2016). Addressing the integration of ICT into teaching and identification of the potential factors motivating teachers to use ICT. *International Journal of Humanities and Cultural Studies (IJHCS) 3(1),* 1099-1114.

[13] Mahdum, M., Hadriana, H. & Safriyanti, M. (2019), Exploring teacher perceptions and motivations to ICT use in learning activities in Indonesia. *Journal of Information Technology Education 18*, 293-317.

[14] Pima, J. (2019), Factors that motivate teachers to use ICT in teaching: a case of Kaliua District secondary schools in Tanzania. *The International Journal of Education and Development using Information and Communication Technology 5(1)*, 179-189

[15] Butt, R., Siddiqui, H., Soomroro, R. A., & Asad, M.M. (2020), Integration of Industrial Revolution 4.0 and IOTs in academia: a state-of-the-art review on the concept of Education 4.0 in Pakistan. *Interactive Technology and Smart Education 17(4)*, 337-354. https://doi.org/10.1108/ITSE-02-2020-0022.

[16] Talpur, M. (2019, January 10). Knowledge economy. *The Express Tribune*. https://tribune.com.pk/story/1884852/knowledge-economy.

[17] Fardinpour, A. (2016). Taxonomy of Human Actions for Action-based Learning Assessment in Virtual Training Environments [PhD Thesis, Curtin University]. Espace Curtin's Institutional Repository. Retrieved from https://espace.curtin.edu.au/handle/20.500.11937/2.

[18] O'Leary, S. (2013). Collaborations in Higher Education with Employers and Their Influence on Graduate Employability: An Institutional Project. *Enhancing Learning in the Social Sciences 5(1)*, 37–50. https://doi.org/10.11120/elss.2013.05010037

© Centre for Academics Excellence and Scholarship