

CURRENT TRENDS IN EDUCATION 4.0: A LITERATURE REVIEW

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ABSTRACT

Education 4.0 is the new buzzword that has everyone talking about. It is aligned with the new industrial revolution which focuses on smart technology and learning. It is the result of the Data-driven Industrial revolution 4.0. IR 4.0 is interchangeably used with Industry 4.0. This term was initially coined at the Hannover Fair in the year 2011. Industry 4.0 is the digitization within the manufacturing industry and its trends towards automation, big data, IoT, Cloud, etc. The COVID era arose the need to change our approach to learning altogether. Institutions had to be driven away from the traditional methods of teaching. Online Learning and Technology have to be a part of the teaching-learning process. This paper discusses and tries to find out the trends in 2022 of Education 4.0 along with its evolution, latest and recurring trends, and what to expect in the future with technologies like AI/ML on the rise. A literature review has been attempted with the use of PRISMA methodology with a total of 35 Research papers and Articles have been thoroughly conducted via a selected database to bring out the latest for this paper.

Keywords: *Education 4.0, Industrial Revolution, Latest trends, 21st century skills, Blended Learning*

INTRODUCTION

The term ‘Industry 4.0’ was initially coined at the Hanover industry fair in 2011, in the context of the German Government’s project on equipping traditional manufacturing technology with high technology (Deloitte, 2014)[47]. IR 4.0 is shaping the future of education. The fourth industrial revolution is fueled by data and machine learning enhancing the smart systems. Shifts are underway and IR 4.0 is changing the way we communicate, work and live. Advanced technology such as Automation and Artificial Intelligence is changing business models and employment trends.

To understand Industrial Revolution 4.0 we use an example provided by shwab (2016) [45] which provides an explanation to understand it across time. The first industrial revolution marked the transition to water power and steam powered manufacturing methods. The second industrial revolution was the beginning of electrification. It was characterized by the increased use of telegraph, petroleum to name a few. A modern production line began which increased the productivity of workers. It is also known as the Technological Revolution which brought out standardization and industrialization. The third industrial revolution known as digitization of the industry began in the late 20th century. The fourth industrial revolution affects not only business and Government but also education. As a result, the name education 4.0 marked its presence (Anealka Aziz Hussin, 2018)[2]

The 4th IR is beyond an enhancement of the 3rd IR, in which the advancement of new technologies blurs the lines between the physical, digital and biological worlds. The new technologies evolve at exponential pace and there is no historical precedent that marks the beginning of the evolution, hence being called disruptive technologies. These advancements are led by the emergence of artificial intelligence, robotics, the internet of things, autonomous vehicles, bio and nanotechnology, 3-D printing, material science, quantum computing and energy storage (Diwan, 2017)[48]

Education 4.0 is the new buzzword which is the result of the data driven and disruptive Industrial revolution 4.0. Education 4.0 is the response to meet the needs and requirements of IR 4.0. It focuses on smart technologies and learning. Just as the industrial revolution, education has gone through its own phases as well. Education 1.0 was seen as dictation teaching conducted in a brick and mortar building. Like the initial generation of internet, 1.0 is

a unidirectional method where teacher induce/teach and students receive. Education 2.0 has more interaction between students and involves a mixture of offline and online to a certain degree, like a brick and click. Yet, 1.0 and 2.0 have been viewed as a daycare by parents for their children. Education 3.0 talks about a digital universe where there is a stress in teaching learning process. As against 1.0 and 2.0, the teachers in 3.0 are everywhere and everybody. It is more socially constructed and contextually reinvented.

Through the evolution from Education 1.0 to 4.0, the following has been understood : Students are individuals and active learners as opposed to passive, learning can be done anywhere anytime, Technology has become an important part of teaching learning process, a well designed educational structure is desirable, move from summative to formative assessments is necessary, Quality over quantity matters, one-on-one interaction or personalized learning takes precedence over community learning with more practice or project based learning.

OBJECTIVES/ RESEARCH QUESTIONS

The Paper aims to address the following questions:

1. What is education 4.0 and its trends?
2. What is the latest research on the trends for Education 4.0 as of 2022?
3. Which recurrent trends are explored frequently in education 4.0?

METHODOLOGY

The methodology or the protocol followed is conducted on the (Machi & McEvoy, 2016)[8] , a foundational basis that has helped serve the purpose of identifying papers, and contributed to answering the research questions posed. Additionally, for the reporting and developing the paper, the author has also attempted the use of PRISMA statement 2020. The PRISMA statement is a guide and a template which helps in either the rejection or selection of the articles used for the Literature review. It also provides a standard per accepted methodology for literature review and meta analysis. A research protocol was developed which describes the article selection, search strategy, and data analysis procedure. This study is limited to only published literature in select electronic databases across various disciplines found relevant to the paper. Databases such as Google Scholar, and manual search have been used. Whitepapers and News articles from reputed companies/Institutions have been used and cited. The keywords used were [“education 4.0” OR “trends”] AND [“Education 4.0” OR “latest” OR “trends”] For the latest research on the trends the duration was restricted to January 2018 - February 2022. The language of the papers/ articles selected is English only. The references provided in the papers have also been manually searched. Abstracts and titles have been read by the author [C.G.] in terms of the aforementioned criteria to determine the eligibility of the papers. Later, the full text of the papers were reviewed for the full inclusion by both the authors into the study The discrepancies, if arose, were resolved by the authors with mutual consensus in accordance with the protocol set.

For the article quality assessment and proper data extraction, a table was generated and data recorded in the summary table like the nature of the studies, trends found and relevance to the topic etc. No discrepancies were recorded.

The selection of the papers/articles for the review was conducted in 3 rounds : The first two rounds were carried out by the author [C.G.] The first round consisted of screening the articles based upon their title and abstracts as well as valid and reliable resources. The second round’s selection criteria were established by the research questions and a summary table was organized. The studies where full text was not available were eliminated along with duplicate records. The third round consisted of both the authors whereby both the authors reviewed the studies in a comprehensive manner which addressed our research questions and were categorized. The search

process was also expanded to conference papers, articles, and news to increase scope via the manual selection (includes scopus indexed articles) as well. The final listed papers had been listed by their year of publication, source and alphabetically by the first author’s last name. The final articles were coded with a number and an Alphabet like G2, M3. A simple qualitative thematic and content analysis was conducted on the papers. The search yielded a Total of 84 papers and articles as per criteria were identified for the review. After the screening and inclusion criterias (Fig. 1), 34 papers/articles were selected and categorized as per research questions. Appendix A contains all the papers and articles included in the review along with the codes which have been used to identify the source (G= Google Scholar, W = Web Articles, C= Conference Papers and M = Manual Search, includes scopus indexed articles) and the number of papers.

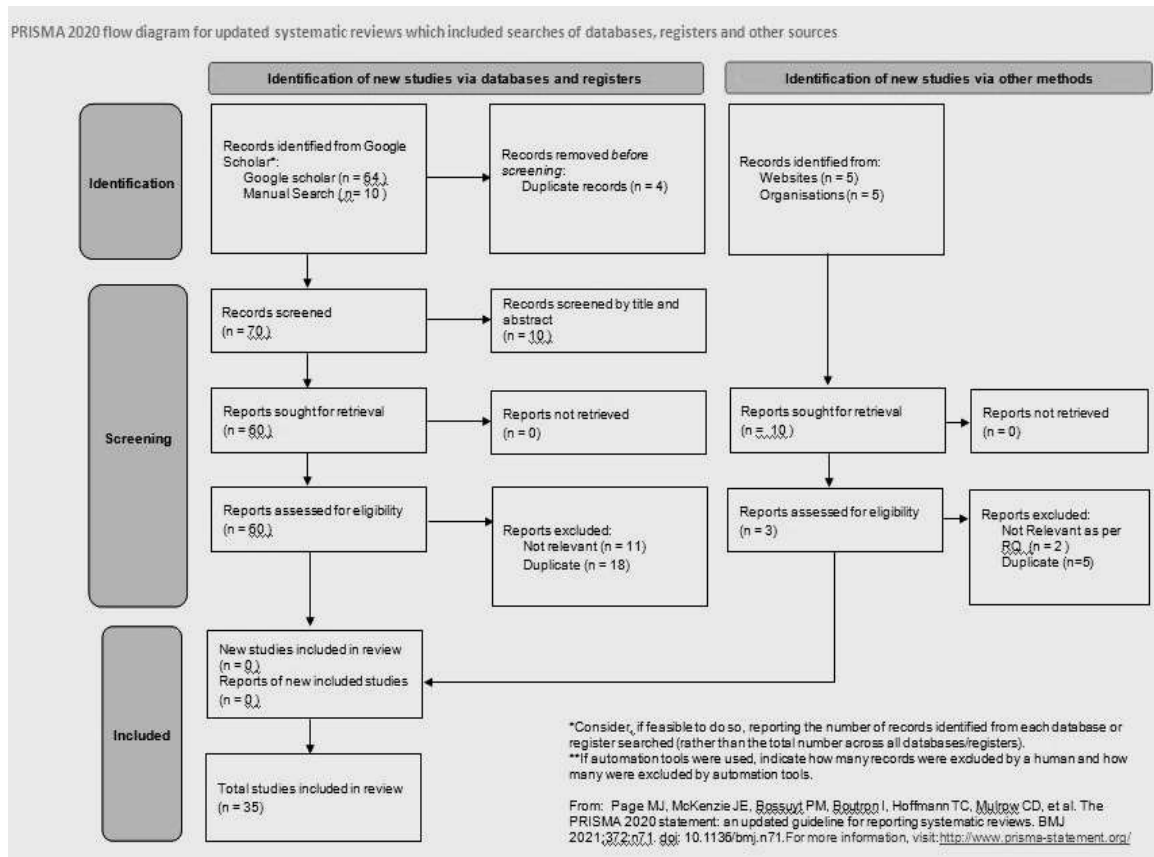


Figure 1 : PRISMA DIAGRAM Reporting Items for Systematic Review

In terms of the characteristics of the papers and articles included in the research, the research in trends has increased in the last 5 years albeit slowly and it still needs more research. Most of them are in 2019 & 2020. This study has found a predominance of qualitative studies. With regards to the journals, who have published papers for the trends in Education 4.0, 25 journals have been found. The trends in Education 4.0 have been mainly found in the following fields so far : Education, Engineering, Social Sciences, Economics, finance, Humanities.

We also found studies where the trends are not the main topic of research but they do mention the trends in general. After a review of the paper, the trends presented themselves to us. More journals and papers/articles could have been added to the review, but they were excluded as the trends kept on being repeated.

In this Literature review, we have used the PRISMA methodology and have tried to identify the latest trends in Education 4.0. The research is limited to only recent 5 years as our main aim has been to find out the latest as of 2022 and what can one expect in the future with regards to tools and trends in Education 4.0. The data base used has been Google Scholar search along with manual search from the references of the papers selected and certain reliable sources like World Economic forum and news articles from experts. Despite the limitation in literature,

care has been taken to include papers of rigor and quality to guarantee their quality and contribution to the study. The search can be definitely extended to different databases and the scope of the duration increased as well. The following are the top trends from the analysis of the literature from the readings and investigation of the same.

DISCUSSION AND RESULTS

In this section of the paper, the following are the top trends from the analysis of the literature from the readings and investigation of the same.

4.1 What is Education 4.0 and its trends?

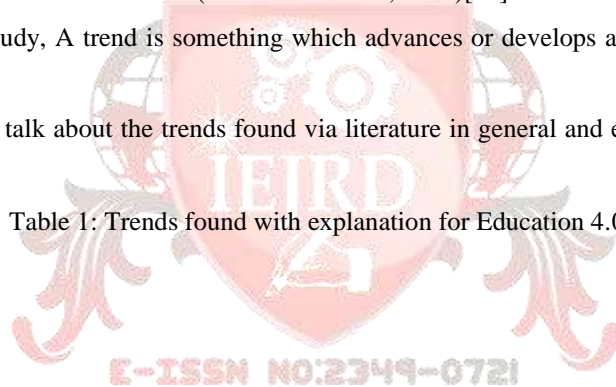
Education 4.0

Education 4.0 has been a response to the demands of Industrial Revolution 4.0, and as result, a new impetus has been given to the transformation of pedagogy, curriculum, content and educational management (Kin & Kareem, 2019)[11]. Education 3.0 needs revision with education 4.0 so that the skills of the future generation are developed in tandem to the growing expectation of the industry. An education 4.0 model has been talked about which includes managerial, entrepreneurial, social and practical skills for the students in terms of employability. Universities and colleges are called upon to revise the educational paradigm and adopt a flexible learning structure (Singh & Tilak, 2020)[12]. Education 4.0 is a period where digital transformations and innovations are starting to dominate in education as well as other fields (Keser & Semerci, 2019)[13]

For the purposes of this study, A trend is something which advances or develops a certain way or in a general direction.

Trends: In this section we talk about the trends found via literature in general and explain them(in no order of importance)

Table 1: Trends found with explanation for Education 4.0



Sr. No.	Trend	Explanation	Papers/Articles
1	Personalized Learning	Adapted to the needs of the learner. A learner will also be able to choose how they want to learn. It can be self paced and gives them the flexibility to modify their learning process	M2, W2, W2, W3, G6, M5, G8, G9, G10, C4, C5, C6, G12, M7, G14, G15, M8, G16, G17, G18,
2	Assessments	This trend talks about formative assessments, personalized assessment and using digital experiential learning as well.	M1, M2, W2, G6, G7, M5, G8, G9, G10, G11, M7, G14, G13, G15, G16, G17, G18,
3	Teacher as guide/mentor	The teacher acts as a facilitator. As the students become more independent in this trends, the teacher's role becomes of a mentor and a guide to the student in their journey of knowledge	G8, G9, G10, G14, G13, G16, G18,
4	Project Based Learning	This centers on the student and allows them to explore and acquire knowledge via the real exposure to the concepts learned and taught in class. This also means gaining experience from the field.	G1, W2, W3, G8, G9, G10, G15, G11, G16, G17, G18,
5	Technology	Technology speakeasy about the use of different kinds of technology like ICT in Education 4.0	M3, C1, G1, C3, G2, W2, G5, G6, G7, G8, G9, G10, C6, G10,G11, G12, M7, G14, G13,G15, G16, G17, G18,
6	AI/ML, IoT	Artificial Intelligence/ Machine Learning concepts and application used in Education 4.0 along with the Internet of Things	M3, G1, C1, W3, G5, G6, G7, M5, C4, C5, M7, G14, G16,
7	Virtual Learning	Online learning, MOOCs, use of LMS etc	C1, G2, G6, G7, G8, G9, G10, C6, G11, G12, G14, G15, M8, G17, G18,
8	Big Data & Analytics	The world’s data and knowledge base is increasing. Analytics will play a role in deducing future trends, and help make decisions as technology becomes more adept at handling complex and difficult problems. It can also be called Data Interpretation.	M3, C1, G1, C3, G2, W2, W3, G5, G7, G8, G11, G14, G15, G16,

9	Blended Learning	This is an umbrella term. It can be a blend of school site and other physical environments OR blending different digital and non-digital learning tools. BL has many different types of perspectives.	G2, C3, W3, G6, G7, M5, G8, G9, G10, C5, G11, G14, G13,G15, M8, G16, G17, G18,
10	Student input/ Ownership	Here the student inputs will be considered in curriculum design and updates. This also talks about the student ownership in the formal learning process.	G8, G9, G10, G11, G15, G26, G17, G18,
11	Development of 21st century skills	Education 4.0 demands that students be adept in 21st century skills.	G6, G8, G9, G10, C6, G13, M8, G17,
12	Flipped Classroom	An instructional strategy where the roles of teacher and learner are reversed	W2, G6, G9, G10, G11, M8, G16, G17,
13	Learner centric education system	A system which is centered around the learner/ student	G1, W2, W3, G6, G7, G9, G10, C6, G12, G13, G16,
14	Teacher Training & Skills	It talk about the emphasis on the training of teacher and reskilling them	G1, G6, G7, G9, G10, G12, M7, G18,
15	Practical applications	Internships, collaborative projects, Co-Op, mentoring projects, opportunities to gain real world skills	G8, G9, G10, G11, G12, M8, G17, G18,
16	Cybersecurity	Security against threats and data leaks	G16
17	Product/Service Customization	N/A	G16

4.2 What is the latest research on the trends for Education 4.0 as of 2022?

As per the literature review done the following are the top 5 and the latest trends for 2022: Blended Learning, Technology, Personalized Learning, Virtual Learning and Assessments.

The following are the trends to watch out for in the coming days: The following trends have also been generally found during the screening and exclusion process. Here we have also added in the final 34 coded papers where there is a mention of them as well. We can also expect to see a rise in cybersecurity and Data Privacy measures as we use more and more data and analytics to get insights. We are surrounded by disruptive and innovative technologies and methods which demand our attention and adoption in the coming time to stay relevant with the changing trends of Industry.

1. E-Learning platforms with gamification and simulations [M7, G11, G17]
2. The use of AR/VR [G11, M7, G13, G14, G16, G17]
3. Game based Learning [M7, G11, G13, G17]

4. Mobile and Cloud Computing [G11, G14, G17]
5. Implementation of 5G in India [G14]

4.1 Which recurring trends are explored frequently in education 4.0?

The following are the trends which keep on recurring and have been explored frequently in many papers/articles: Papers with more than 10 mentions are considered for this section.

Table 2 : Recurring Trends for Education 4.0

Trend	Papers	#N
Personalized Learning	M2, W2, W2, W3, G6, M5, G8, G9, G10, C4, C5, C6, G12, M7, G14, G15, M8, G16, G17, G18	21
Assessments	M1, M2, W2, G6, G7, M5, G8, G9, G10, G11, M7, G14, G13, G15, G16, G17, G18	17
Project Based Learning	G1, W2, W3, G8, G9, G10, G15, G11, G16, G17, G18	11
Technology	M3, C1, G1, C3, G2, W2, G5, G6, G7, G8, G9, G10, C6, G10, G11, G12, M7, G14, G13, G15, G16, G17, G18	25
AI/ML, IoT	M3, G1, C1, W3, G5, G6, G7, M5, C4, C5, M7, G14, G16	13
Virtual Learning	C1, G2, G6, G7, G8, G9, G10, C6, G11, G12, G14, G15, M8, G17, G18	15
Big Data & Analytics	M3, C1, G1, C3, G2, W2, W3, G5, G7, G8, G11, G14, G15, G16	14
Blended Learning	G2, C3, W3, G6, G7, M5, G8, G9, G10, C5, G11, G14, G13, G15, M8, G16, G17, G18	18
Learner centric education system	G1, W2, W3, G6, G7, G9, G10, C6, G12, G13, G16	11

CONCLUSION

Education 4.0 has the ability to bring significant innovation and is clearly evident that its role will be crucial now and in the future for/in the educational systems and models. Many countries and authors across the world, through our Literature Review, have started to accept Education 4.0 as necessary. It is also clear that Education 4.0 is a good reflection of Industry 4.0. The literature review on the topic of latest trends has given out a great consensus in technology, Blended Learning, Personalized learning and new age assessment methods along with virtual environments being the frequent and top trends and drivers in Education 4.0. The Covid-19 era has been one of the biggest reasons for the emergence of these trends. Blended Learning basically is considered as an integral part of education 4.0.

Innovative concepts like Learning Analytics and Academic Analytics were found during the literature review. Although concepts like these can't basically be cited as trend now, it seems that as the future of education moves more towards digital transformation and the usage of Big Data and Analytics, we would be able to see the application of business intelligence and practices of higher educational institutions clubbed together to gain more meaningful insights into the teaching learning process. Utilization of said strategies will help institutions and universities to track student performance and optimize their teaching learning strategies. The future is all about unlearn, relearn, and learning where Education 4.0 has a vital Role to play. We also need trends in Education 4.0 which can address some of the pressing challenges we face today like Climate Change, Sustainability, ecosystem degradation. We need pedagogical practices and curriculum to include that go-green mentality within learners. Some of the necessary skills are socio-ecological skills, sustainable mindset, and energy efficient systems. (Cabrita & Safari, 2020)[37] Teacher as an important mentor and a facilitator is also emphasized, although if not a major trend. (Himmetoğlu, 2021)[40] It is also possible that like blended learning, Education 4.0 might also see a trend of interdisciplinary approach where the student just does not pick one or two subjects but has the ability to pick up modules from multiple programs.

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APPENDIX A

Table A1. Codification of Papers included in the Literature Review

Code	Year	Authors	Journal Name/ Organization	Title	Reference
M1	2019	Tai Mei Kin , Omar Abdull Kareem	international journal of Academic research in Business and Social Sciences	School Leaders’ Competencies that make a difference in the Era of Education 4.0: A Conceptual Framework	[11]
M2	2020	Dheeraj Singh, Geetali Tilak	Humanities & Social Sciences Reviews, Vol. 8 No. 2 (2020)	Implementation of Education Model 4.0: Developing Industry 4.0 skills in graduates for improving employability skills	[12]
M3	2019	Hafize Keser , Ali Semerci	Contemporary Educational Researches Journal Volume 09, Issue 3, (2019) 39-49	Technology trends, Education 4.0 and beyond	[13]
C1	2019	Irina Neaga	Proceedings 2019 Canadian Engineering Education Association (CEEA-ACEG19) Conference	Applying Industry 4.0 and Education 4.0 to Engineering Education	[14]
M4	2020	Benjula Adhikari , Udbohd Bhandari , Kabita Adhikari	Quest Journal of Management and Social Sciences, 2(2), 379-388	Enhancement of education 4.0 in Nepal: A review from school level technology change	[15]
C2	2020	Ilislar Pgoreskaya , laszlo Varallyai	The annals of the university of Oradea, Oradea University Publishing house, Oradea, Romania	Trends in Education 4.0	[16]
G1	2022	Laura Icela González-Pérez and María Soledad Ramírez-Montoya	Systematic Review. Sustainability 2022	Components of Education 4.0 in 21st Century Skills Frameworks: Systematic Review	[17]
C3	2020	M. Ioniță Ciolacu, P. Svasta, D. Hartl and S. Görzen	2020 International Symposium on Electronics and Telecommunications (ISETC)	Education 4.0: Smart Blended Learning Assisted by Artificial Intelligence, Biofeedback and Sensors	[18]
G2	2019	Lopez-Garcia, T. J., et.al.	Computer Reviews Journal	Review of trends in the educational model of distance education in Mexico, towards an education 4.0	[19]
G3	2019	Muhsin, M. A. A., & Ahmad, N	international Journal of Psychosocial Rehabilitation	he emergence of education 4.0 trends in teaching Arabic Islamic finance curriculum design: A case study	[20]
G4	2020	Keser, H., & Semerci, A	Contemporary Educational Researches Journal	Technology trends, Education 4.0 and beyond	[1]
W1	2022	World Economic Forum	World Economic Forum	Accelerating Education 4.0	[21]
W2	2020	Clotilda Suvin	Creatrix Campus	Why should higher education institutions focus on Education 4.0?	[22]
W3	2021	Susan Fortane	Fierce Education	9 Trends to Look for in Higher Education 4.0	[23]
G5	2019	Jesus Alvarez-Cedillo, et.al.	International Journal of Evaluation and Research in Education (IJERE)	Actions to be taken in Mexico towards education 4.0 and society 5.0	[24]

G6	2020	Arif, F. K. M., Affendi, F. R., et.al.	International Journal of Scientific and Technology Research	Innovative trends and practices in ESL for education 4.0 among higher learning institutions	[25]
G7	2021	Aruna Pavate	European journal of volunteering and community-based projects Vol.1, No 4	Innovative trends that influence on teaching and learning process towards the revolution education 4.0	[26]
M5	2020	Duncan Peberdy	Preparing for Education 4.0	The World University Rankings	[27]
G8	2019	Delipiter Lase	Journal Handayani, Indonesia	Education and Industrial Revolution 4.0	[28]
G9	2018	Anealka Aziz Hussin	International Journal of Education & Literacy Studies	Education 4.0 Made Simple: Ideas For Teaching	[2]
G10	2019	Mohd Adnan, Airil Haimi et.al.	Arab World English Journal (AWEJ)	Education 4.0 Technologies, Industry 4.0 Skills and the Teaching of English in Malaysian Tertiary Education	[29]
C4	2018	M. Ciolacu, A. F. Tehrani, L. Binder and P. M. Svasta,	2018 IEEE 24th International Symposium for Design and Technology in Electronic Packaging (SIITME)	Education 4.0 - Artificial Intelligence Assisted Higher Education: Early recognition System with Machine Learning to support Students' Success	[30]
C5	2019	Monica Ionita Ciolacu, et.al.	2019 IEEE 25th International Symposium for Design and Technology in Electronic Packaging (SIITME)	Education 4.0 – Jump to Innovation with IoT in Higher Education	[31]
C6	2018	Maria, M., Shahbodin, F., & Pee, N. C	Proceedings of the 3rd International Conference on Applied Science and Technology (ICAST'18)	Malaysian higher education system towards industry 4.0– current trends overview	[32]
G11	2018	Mogoş, R. I., et.al	Revue Roumaine des Sciences Techniques–Série Électrotechnique et Énergétique	Technology enhanced learning for industry 4.0 engineering education	[33]
M6	2020	European Commision	European Commision	Education and Training 2020 Working Group on Digital Skills and Competences, Education 4.0	[34]
G12	2019	Priya Sharma	International Journal of Engineering and Advanced Technology (IJEAT)	Digital Revolution of Education 4.0	[35]
M7	2020	Ochoa G Carlos Fernandez	One digital consulting	Virtual Reality and Education 4.0	[36]
G13	2020	Maria do Rosário Cabrita, et.al.	International Journal of Innovation, Management and Technology	Preparing for Education 4.0: Skills Facing Economic, Social and Environmental Challenge	[37]
G14	2021	Ramesh Chandra Sharma et.al.	Revista Da FAEEBA - Educação E Contemporaneidade	Technology 4.0 for Education 4.0 : Innovations, challenges and opportunities for India	[38]

G15	2021	Uei, P. C., & Ho Vui Shing, J	Global Business and Management Research: An International Journal	Industrial Revolution 4.0: Are Students Ready for Education 4.0?	[39]
M8	2020	Himmetoğlu, Beyza et.al.	Turkish Online Journal of Distance Education	Education 4.0: Defining the teacher, the student and the School Manager aspects of the Revolution	[40]
G16	2020	Caballero-Morales, S. O. et.al.	International Journal of Entrepreneurial Knowledge	Education 4.0 to support Entrepreneurship, Social Development and Education in emerging economies	[41]
G17	2018	Mogoş, R. I., Bodea. et.al.	Revue Roumaine des Sciences Techniques–Série Électrotechnique et Énergétique	Technology enhanced learning for industry 4.0 engineering education	[42]
G18	2020	Das, S., Kleinke, et.al.	2020 ASEE Virtual Annual Conference Content Access	Reimagining engineering education: does industry 4.0 need education 4.0?	[43]

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