

Enhanced Learning Environments

Enhanced Learning Environments:

Technology and Innovation

Edited by

Zeynep Taçgın and Andrew Hagan

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TABLE OF CONTENTS

List of Illustrations.....	ix
List of Tables	xii
Preface	xiv
Acknowledgements.....	xvi
Summary of the Chapters.....	xvii
Chapter I	1
Back to Basics: An Essential Refresher on the Concepts of Education and Technology	
Can Mihçı	
Technology According to Educators.....	3
Technology as a Myth	7
Educational Technology as a Myth	9
The Political Economy of EdTech	15
EdTech as Ideology.....	18
References	23
Chapter II.....	28
Learning Methods and Digital Technology for Tackling Social- Ecological Aspects in Entrepreneurship Education	
Ileana Hamburg	
Introduction.....	28
Entrepreneurship	29
Entrepreneurship education.....	32
Learning methods and digital technology in entrepreneurship education	35
Example.....	40
Conclusions.....	42
References	43

Chapter III.....	49
Evaluation of an Immersive Virtual Reality Learning Environment from Subject Experts and Instructional Designers Zeynep Taçgın and Barney Dalgarno	
Introduction.....	49
Aim.....	52
Research questions.....	53
Expected outcomes.....	53
Project Design.....	53
Methodology.....	54
Participants.....	54
Description of the data gathering tools.....	56
Description of the data analysis processes.....	57
Description of participant recruitment strategies and timeframes, including measures to be used to ensure informed consent.....	57
Findings.....	58
Q1. How do the participants' evaluations of design components change over different sessions?.....	59
Q2. How did the participants evaluate the simulation effectiveness of myVOR?.....	61
Q3. Which components of myVOR help to decrease the levels of stress, disorientation and confusion of users?.....	62
Q4. What is the review of participants regarding myVOR?...	64
Results.....	77
Discussion and Conclusion.....	79
Practical Implications and Theoretical Contributions.....	82
Future works.....	82
References.....	82

Chapter IV	88
The Development of the Compromised Neonate: A Virtual Reality Neonatal Resuscitation Program	
Donovan Jones, Darrell Evans, Michael Hazelton, Zi Siang See and Shanna Fealy	
Introduction	89
Design Approach	92
Software and Hardware	94
Implementation and Evaluation	99
Discussion	101
Conclusion	104
References	104
 Chapter V.....	 109
Hollywood at Home: Democratising High-Quality Content Creation for Enhanced Learning Environments	
Andrew Hagan	
Introduction	109
Measures of success	111
Sight	115
Sound.....	121
Sound & Sight.....	123
Enter the Digital Realm	123
Digital Pictures	128
Raster Images	128
Vector Images	131
Scanning	132
Lossy vs Lossless	132
Objective Assessment	136
Digital Video.....	137
Colour Correction and Colour Grading.....	139
Digital Audio.....	139
360° Environments.....	140
Three Dimensions	144

Animation	149
Digital Characters.....	153
Interactivity.....	156
Production.....	158
AI	160
Metaverse.....	162
Artistic Value.....	165
Conclusion	168
References	168
Chapter VI	173
Defining the Metaverse for Educational Environments	
Zeynep Taçgın	
Introduction.....	173
What is the metaverse?.....	174
Definition.....	174
Short history.....	176
Architecture.....	177
Features.....	181
Types.....	183
Social impacts of the metaverse	187
Using the metaverse in the education.....	192
What about the future?.....	195
References	196
Abbreviations.....	200
Index.....	204

LIST OF ILLUSTRATIONS

Figure 3.1. Methodology.....	55
Figure 4.1. Guided and unguided mode of Compromised Neonate Care Simulation	95
Figure 4.2. Users are guided by a series of technical information and instructions	96
Figure 4.3. Users interacting with medical instruments (e.g., pick-up and relocating required items).....	97
Figure 4.4. Users assist the neonate to breath using Continuous Positive Airway Pressure (CPAP) with the aid of an oropharyngeal airway mask and Neopuff™	98
Figure 4.5. Users are able to interact with a medical specialist and parent avatars.....	99
Figure 5.1. 'A Trip to the Moon' - a comparison of storyboard art to the final film.	112
Figure 5.2. Dramatic of different times at the same location.	117
Figure 5.3. Construction of a High-Dynamic Range Image (HDRI) by combining photos of different exposure settings.....	126
Figure 5.4. RGB Channels.....	129
Figure 5.5. Vector vs Raster	131
Figure 5.6. Demonstration of Chroma Subsampling to compress a digital photograph.....	133

Figure 5.7. Simultaneous Contrast	135
Figure 5.8. Audio Recording: Too Quiet.....	140
Figure 5.9. Audio Recording: Too Loud.....	140
Figure 5.10. Audio Recording: Recommended.....	140
Figure 5.11. Insta360 One X & Pro 2 360° Cameras.....	141
Figure 5.12. An early test of 3D scan and real-time exploration in game-engine technology.....	142
Figure 5.13. ChemCert 360° Virtual Training Project	144
Figure 5.14. 3D Scan vs Photogrammetry	145
Figure 5.15. Basic 3D model of a fly with animation rig in Maya .	147
Figure 5.16. A 3D cookie from the Quixel Megascans library.	149
Figure 5.17. Bouncing Ball	151
Figure 5.18. Real-time 2D facial animation for 'STEM2020: Get real with virtual projects'	154
Figure 5.19. Metahuman characters are featured in 'STEM2021: Get real with virtual projects'.....	155
Figure 5.20 The initial release of Unreal Editor with in-game assets	157
Figure 5.21. A linear production pipeline.	159
Figure 5.22. NVIDIA Canvas uses AI to convert the basic shapes in the left panel into a photorealistic image on the right.....	161
Figure 5.23. A basic template to guide content creators into the metaverse.....	163

Figure 5.24. A virtual character can be programmed to perform any activity in a custom city using real-time technology. 167

Figure 6.1. The architecture of metaverse..... 180

Figure 6.2. Types of the metaverse by the simulation-augmentation continuum (Smart, Cascio, and Paffendorf 2007)..... 184

Figure 6.3. The types of the metaverse 186

LIST OF TABLES

Table 3.1. Pearson correlation among design feature scores of sessions.....	60
Table 3.2. Freidman analysis results for design features.....	60
Table 3.3. Pearson correlation among simulation effectiveness scores of sessions	61
Table 3.4. Freidman analysis results for simulation effectiveness ..	62
Table 3.5. Participant status of experiencing IVR before.....	62
Table 3.6. Feeling more confident to use	63
Table 3.7. The reviews of participants about interface, usability and learning components.....	64
Table 3.8. Likes of the participants	66
Table 3.9. Dislikes of the participants	67
Table 3.10. The reviews of participants to use this IVR as a teaching tool in the University.....	69
Table 3.11. The recommendation of participants to design differently	71
Table 3.12. The suggestions to add new features to myVOR	73
Table 3.13. The reviews of participants about the potential usage of VR as educational technology.....	75
Table 4.1. Initial program testing evaluation results (rounded to nearest %)......	100

Table 5.1. Relationship between ISO, F/stop, and Shutter Speed..	119
Table 5.2. The dynamic range of correctly and incorrectly recorded images.	120
Table 5.3. Bit-depth defines the range of colours available in a classic RGB image.	127
Table 5.4. Bitmap table	130
Table 5.5. 16-Bit editing workflow will reduce the significant loss of data in an 8-bit workflow.	136
Table 5.6. Selection of industry-standard image sizes for video...	138
Table 5.6. Twelve basic principles of animation by Walt Disney animators Frank Thomas and Ollie Johnston.	150
Table 5.7. Top 5 Offences in Concept (A. Hagan – Introduction to Animation).....	152
Table 5.8. Elements of the metaverse (KPMG)	164
Table 6.1. Traditional metaverse vs modern metaverse	182

PREFACE

"I touch the future. I teach." - Christa McAuliffe

Thank you for your genuine interest in quality education and supporting technology. We often hear "Enhanced", "Learning Environments", "Technology", and "Innovation" liberally applied in conversations with an assumption their inclusion provides any meaningful significance to the quality of education. This book looks beyond mere buzzwords and seeks the ground truth in how education, technology, and innovation can enhance theory and practice in pedagogy and andragogy.

Technology is a constantly moving target. Any contemporaneous information in these chapters may appear quaint and somewhat obvious when read in retrospect. If hindsight affirms the knowledge shared in these chapters, we will be thrilled to move beyond the status quo challenges at the time of writing. We hope that this book will provoke original thinking, engage critical analysis, and fuel the desire to invest in new technologies in diverse learning environments effectively.

Our curiosity about teaching and technology motivated us to write about the extraordinary capability of new opportunities that can benefit learners. Using the tools for increasing the learning outcomes is essential to providing effective learning so that we may observe the interface and influence of the learner experiences. Web-based learning platforms, eLearning, or MOOCs are only a few terms that entered our lives at the turn of the century and restructured our learning habits. Today, extended reality technologies have been integrated into our lives and expanded by immersive computer vision techniques and semantic web systems like the metaverse. The

increasing global attention to these applications may switch our education systems and learning habits. So what should we do?

This book represents a diverse range of academic perspectives from various disciplines. The styles range from rousing personal opinions to purely factual analysis, all from informed peer-reviewed perspectives. Our goal is to stimulate the intellectual, ethical, practical, and economic discussions motivating technological change in education in the hope we enhance learning environments for the good of humanity.

“One looks back with appreciation to the brilliant teachers, but with gratitude to those who touched our human feelings. The curriculum is so much necessary raw material, but warmth is the vital element for the growing plant and for the soul of the child.” - Carl Jung

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Zeynep Taçgin also thanks Lyn Hay for her support of the ethical approval of the project represented in Chapter III. The authors of Chapter IV would like to thank the University of Newcastle Innovation team, Professor Sally Chan Head of School, Nursing and Midwifery, Faculty of Health and Medicine, and the University of Newcastle for support during this prototype development and beta testing.

SUMMARY OF THE CHAPTERS

The book is structured in a way that starts with a philosophical criticism about education and technology to remind us of our responsibility to teach with purpose. The next chapter discusses entrepreneurial thinking regarding education. Chapter three makes a strong case for how technology can impact life-saving educational training. Chapter four uses an immersive virtual reality learning environment for exploring the essential design components from the perspective of instructional designers and subject experts. Chapter five examines how state-of-the-art Hollywood technology is now accessible to all and what impact this may have on education. The final chapter introduces the metaverse concept and helps us prepare for a pioneering new frontier in future-focused enhanced learning environments.

Chapter I: Back to Basics: An Essential Refresher on The Concepts of Education and Technology - *Can Mihçi*

Abstract: Education and technology are concepts so integrated into modern life that we usually take them for granted and rarely stop to think about their definitions. However, language is ideological, and it is argued that the haphazard use of the word Technology (the “T-word”) by educators reinforces the creation of myths, which, in turn, serve the interests of dominant classes in a society. In the end, our worldview, which is altered by these so-called myths, leads us to redefine what education might mean, ultimately severing it from a progressive philosophy. In this context, education technology is also reduced to its instrumental counterpart, EdTech, which is more of an ideology than discipline and which entails the commodification and marketization of public education. This chapter explores these ideas by providing a retrospective, reintroducing fundamental works

from the 20th century to help educators today establish a healthier dialectic in their relationship with the notions of technology and education technology.

Author's biography: Can Mihci has earned his doctoral degree in Instructional Technology from Marmara University, Turkey. He currently works as faculty at Trakya University School of Education, Department of Computer Education and Instructional Technology, where he offers undergraduate-level courses such as Introduction to Instructional Technology to prospective teachers. Current research interests include critical pedagogy and technology, problem-based pedagogical approaches and the impact of social media on educational processes. He has also occasionally worked in software projects as a Full-Stack Web Developer within the last decade.

Chapter II: Learning Methods and Digital Technology for Tackling Social-Ecological Aspects in Entrepreneurship Education *- Ileana Hamburg*

Abstract: Entrepreneurship usually means creating a new profitable business by ensuring the optimal use of resources. In order to address sustainability issues, it should also take into account social and environmental challenges. Entrepreneurship education (EE) supports the development of the entrepreneurial attitudes and skills of people interested in participating in business creation. EE also has to support innovations in order to assure optimal results. Due to COVID-19, education institutions have had to move to digital solutions to continue their learning and teaching programmes. This chapter first presents skills required in entrepreneurship and discusses how entrepreneurs could learn to develop business models supported by digital technologies taking into consideration social-ecological value creation. Second, a brief description is given of interdisciplinary, experiential and problem based (PBL) approaches supported by digital platforms which can be used in EE. The use of social media, serious games (SGs), and MOOCs presents advantages in EE and facilitates social-ecological value creation in

entrepreneurship. In order to survive and thrive through continual technological change and disruptions such as that due to COVID-19, future entrepreneurs should continuously improve their own knowledge independently or with the help of the enterprises in which they work. In this context, Lifelong learning (LLL) is more important than ever before, helping to improve the knowledge achieved in EE, to achieve practice specific skills and apply them wherever the need arises. An example of a project coordinated by the author is given

Author's biography: Dr Ileana Hamburg worked as a professor for 20 years and studied Mathematics and Computer Science at the University of Craiova in Romania. She worked as a software developer for a company and as a researcher within the Faculty of Informatics at the University of Erlangen in Germany. She is a research fellow at the Institute for Work and Technology (IAT), Westfälische Hochschule Gelsenkirchen and lecturer for Informatics at the Open University (FU) of Hagen. She works and coordinates German and European projects in the field of eLearning, knowledge management, and entrepreneurship, particularly for SMEs and people with special needs.

Chapter III: Evaluation of an Immersive Virtual Reality Learning Environment from Subject Experts and Instructional Designers - *Zeynep Taçgın, Barney Dalgarno*

Abstract: This study investigates the impact of design components of an immersive virtual reality learning environment for increasing simulation effectiveness. myVOR was developed to offer an immersive virtual learning experience for nursing students about operating theatre instruments and procedures. The initial version of myVOR has been revised and adapted to a standalone VR headset to employ design components aiming to decrease levels of stress, disorientation and confusion among the users. During the development of myVOR, six volunteer educational designers and three nursing academics participated in this design-based research,

selected by using convenient sampling. Both qualitative and quantitative data gathering techniques were used for collecting the data regarding opinions, reactions, behaviours, and simulation evaluations of participants. The results of this study confirmed that adapting to the IVRLEs takes at least two or three times practising, and the iteration number is about experiencing immersion through additional hardware rather than HMDs functionalities. Besides, the level of stress or motion sickness through myVOR decreased for the majority of users after adjusting to the system. Depending on the findings of this study, I recommend presenting learning outcomes or additional tasks to the learners in the IVRLEs to increase the implementation time of the users. Despite seeking the ideal instructional design for myVOR, we should not forget that the data from a particular group may not be enough for evaluating the instructional adequacy of the learning environment.

Author's biography: Zeynep Tacgin has worked in the education technologies field for more than ten years. She is an Adjunct Associate researcher at Charles Sturt University and an Assistant Professor at Marmara University. She graduated at the top of one's class from Computer Education and Instruction Technologies program at Marmara University in 2012. She received a master's degree in Education Administration and Supervision program in 2013. She received a PhD degree in Computer Education and Instruction Technologies program in 2017. Her PhD thesis was about immersive virtual reality learning environments. She completed her Post-Doctoral Research regarding VR Technologies at Charles Sturt University between 2019-2020. She has been working on AR/VR/MR technology usage in education for five years. Also, she designs and develops virtual environments for educational purposes. She is interested in merging MR technologies and distance education. Her fields of interest are education, wearable technologies, innovative learning environments, technology integration into education, education management and policies, distance education, augmented reality, virtual reality, simulations, instructional design, and material development.

Chapter IV - The Development of the Compromised Neonate: A Virtual Reality Neonatal Resuscitation Program - *Donovan Jones, Darrell Evans, Michael Hazelton Zi Siang See, Shanna Fealy*

Abstract: Globally, about 2.5 million newborns die annually during the neonatal period and improving and increasing the availability of neonatal resuscitation training is considered a global health priority. Neonatal resuscitation comprises interventions to preserve or initiate breathing and/or circulation. In Australia, health personnel attending births are expected to maintain these skills through regular involvement in neonatal resuscitation training programs. Simulation-based education incorporating deliberate practice, reflection and feedback on practice, has become central to neonatal resuscitation training. Simulation-based education can require considerable material and human resource investments that may limit access to training. Technological advancement has brought changes in neonatal resuscitation training, including the use of immersive and non-immersive virtual reality simulation techniques. It is important that health professionals are involved in the design and development of simulation-based education initiatives in areas such as neonatal resuscitation training. The objective of this paper is to outline the development of an immersive virtual reality neonatal resuscitation program, the “compromised neonate simulation”, and describe the initial implementation and attitudes of the program amongst a small group of final year undergraduate midwifery students in one Australian University. Given the recent COVID-19 pandemic, the use of transformative technology such as virtual reality may afford new and immersive educational opportunities in training health care professionals.

Author’s biography: Donovan has explored applications of transformative technologies such as virtual and augmented reality (AR/VR), and the potential for integration in service provision, education and teaching contexts in health care; international collaborations include the University of Illinois, University of Surry, and Carle Hospital Illinois and has led to expertise in usability and

acceptability of digital technologies across the health care landscape in health education and clinical applications. Currently a Senior Lecturer with the School of Nursing Midwifery and Indigenous Health, Faculty of Science, Charles Sturt University, Australia, and Conjoint Senior lecturer with the School of Medicine and Public Health, College of Health, Medicine and Wellbeing, University of Newcastle, Australia. Donovan is committed to integrating immersive technologies for midwifery, nursing students and registered health professionals to promote maternal and infant health nationally and globally. Internationally, Donovan is a member of SMARTlab, linked with universities around the globe with the aim to create and research social inclusive, sustainable VR/AR projects for use by all.

Chapter V: Hollywood at Home: Democratising High-Quality Content Creation for Enhanced Learning Environments - *Andrew Hagan*

Abstract: How can educators benefit from enhanced learning environments in the Fourth Industrial Revolution, where physical and virtual worlds blend to extend reality? The unlimited potential of emerging technologies conjures a rich catalogue of Science Fiction concepts spanning from dystopic to utopic ideals. Creative foresight requires a daring imagination. Distinguished futurist Sir Arthur C. Clarke challenged us to think beyond the current limits of possibility because; "Any sufficiently advanced technology is indistinguishable from magic". This chapter examines how the state-of-the-art technologies, once considered Hollywood's exclusive domain, are now accessible to all and what impact this may have on creating enhanced learning environments.

Author's biography: Andrew Hagan has over 20-years of experience as an academic and practitioner. He is co-founder and Director of XRC (eXtended Reality Centre) at Charles Sturt University. He is a Visual Effects Producer & Supervisor, co-director of the Australian International Animation Festival, Adobe Certified Expert, Autodesk

Certified Maya Instructor, international judge, and established Australia's first undergraduate university degree dedicated to the art and science of Animation and Visual Effects. He has innovated change within the education sector to enable creative minds to stay ahead of the curve and prepare for future careers. His broad experience in researching creative technology has provided him with professional expertise while also supporting his educational interests in sharing comprehensive artistic theory and practice with others. His latest work is in real-time technologies that can be applied across all industries and develop projects that are smarter, faster, and cheaper.

Chapter VI: Defining the Metaverse for Educational Environments

- Zeynep Taçgın

Abstract: Metaverse is a comprehensive term and a shifting paradigm that brings several disciplines together to structure a universal system for its users based on the developments in the related fields. To understand what the metaverse is, initially, we should examine its definitions and comprehend the meaning of related terms. This chapter deep dives into the metaverse literature to explain its essential features, components and systems for discovering its capability to boost learning outcomes.

Author's biography: As presented above in Chapter III.

CHAPTER I

BACK TO BASICS:
AN ESSENTIAL REFRESHER
ON THE CONCEPTS OF EDUCATION
AND TECHNOLOGY

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“Specialists without spirit, sensualists without heart. This nullity imagines that it has attained a level of civilization never before imagined” – Max Weber (2013)

Both education and technology are concepts so integrated into modern man's daily life that he usually takes them for granted and rarely stops to think about their definitions. After all, education is something we all have *been through*, and technology is something that *surrounds us* today. A combination of these two fundamental words in any language, education technology, therefore, might seem a concept that may easily be defined by any person in any corner of the world. And yet, I would like to begin by reminding the reader that all language is ideological (Hodge and Kress 1993), and such definitions put into words by the common man may reflect conceptions of reality distorted according to class interests (Määttä 2014).

As an instructor in a Turkish university, I have observed this phenomenon personally in several semesters, during which I have

offered undergraduate students in a school of education a course titled *Instructional Technology*. Undergraduate level teacher training programs in Turkey are strictly mandated by the Turkish Council of Higher Education, and this course, the syllabus of which is determined by this national council and may not be altered by the instructor, is compulsory for all undergraduate departments in any school of education in the country. Year after year, I have worked during this course with students who entered the classroom for the first time in the first week of the semester and were surprised, wondering *where the computers were?* I have learned in time that it was the name of the course; specifically, the *T-word* contained within, that is causing the prejudice. Incoming students usually had expectations in them towards learning during this course how to use various software applications and gadgets for developing materials to “enrich” (this is the proper translation of the Turkish word used in this context, as opposed to “enhance”) the *rather ordinary* learning environments they would be working in as teachers. After all, “*Technology Enriched Learning*” has been a highly popular buzzword for a very long time and used in newsreels or advertisements of Turkish mainstream media, most likely shaping the expectations of students from this course.

Therefore, the first challenge in this course for me is to dampen the prejudice of students and establish a common vocabulary. I, therefore, begin the course with the definition of technology by using the rather unpleasant example of manure; explaining how faecal matter may not be considered a manifestation of the T-word on its own and that it is the context, i.e., the entire process of fertilization, reflecting a detailed practical process based on numerous scientific principles in biochemistry, that should be focused on. Still, though, a non-negligible amount of students tend to fall for the distractors of the related multiple-choice questions found in midterm exams. For instance, when asked about the two fundamental characteristics of technology, more than a few students opt to answer “*a potential of high-profit margins when sold / a potential to dominate international markets*” rather than “*being based on scientific principles / involving*

practical applications seeking to overcome human problems and needs". The reader should mind that these are not only undergraduate students but also pre-service teachers. If this anecdote exemplifies the way language is ideological and distorted conceptions of reality serve to further the interests of the dominant classes, then one must ask, what better way to maintain social reproduction than to ensure that public school teachers adopt said ideology?

There exists a broad academic literature asking similar questions and reflecting a critical perspective on the notions of education, technology and educational technology. Unfortunately, in a Brave New World-type post-truth dystopia that is the 21st century, the message is unheard due to the massive amount of noise caused by the echoing of buzzwords such as *Technology Enhanced (Enriched?) Learning* (Hayes 2015) or *21st Century Skills*, or *STEM Education*. So, for a moment, let us go back in time and away from the loudspeakers broadcasting how globalization and the Internet have *revolutionised education*.

Technology According to Educators

Although pedagogy and public schooling may seem to have been around since the dawn of time, it may be claimed that it was only as recent as the previous century that both have become topics that the common man may relate with. So, if a revolution has occurred, it has not occurred all that long ago in the past. In contrast, even though the enthusiasm that is inherent to most of the works one may encounter in educational technology today may convey the feeling that the field is as new and exciting as the next *flagship* a popular smartphone company will announce, this is not the case. The history of educational technology may indeed be traced as far back as the history of public education itself. To understand the validity of this claim, one need only refer to one of the many definitions of the word *technology*, which particularly emphasizes the application of scientific knowledge for the solution of daily life problems. There are also many mainstream definitions of education, but what these all

have in common may be the way they define education as (a series of) interventions for the transition of a conscious subject from state A to a previously intended state B. Educational technology is all about *how* that intervention should be for the transition to succeed. As it deals with this rather old—if not oldest—question in the book, it is not surprising to take a historical trip down the 20th century and encounter forefathers of this field, who may appear as stereotypical military scientists with thick-rimmed glasses illustrated in black and white – in portraits that are highly unlikely to be taken with a high-resolution camera from a flagship smartphone. In short, although educational technology seems to be all about *the Future*TM—just like everything else these days—it does, however, have a long past.

A glance at the yellowed pages of the 1968 special issue of the Educational Technology magazine titled *What is Educational Technology* – published back in the days when educational technology was *actually* a new thing – shows a collection of writings by the field pioneers, who reflect anxiety as they try to do their best in combating misconceptions around educational technology, and technology in general—not unlike the way I begin my Instructional Technology classes 50 years later. A very brief chapter authored by Heinich (1968) begins with the following words:

“‘Technology’ is one of the most misunderstood words in our language - particularly when applied by educators to education. Undoubtedly, the misunderstanding is caused by a failure to view technology as a process at a sufficiently high level of abstraction... Educators tend to define technology simply by its obvious manifestations: machines. It is an easy step from this to the simplistic view that if we have machines, we are using technology, and if we haven’t machines, we are not engaged in a technological process.”

Similar remarks showing how technology is misunderstood by educators may be found in the remaining chapters of this old tome (Bright 1968, Ely 1968, Humphrey 1968). And yet, 50 years later, I still feel compelled to open my lesson to teacher candidates by giving examples of manure to emphasise process rather than a pile of silicone and stacks of code. Because audio-visual technology of the

'60s has now been replaced by infinitely more sophisticated computers and the misconceptions have become much harder to deal with. Nowadays, the T-word does not even need an identifier before it and seems to have lost the need for context. Nowadays, everybody seems to agree that if it is shiny, powered up, and expensive (or highly profitable), it is technology. The way this perspective has become dominant in modern society – and more importantly, among educators – has urged me to write this chapter, in which I will try to explain how distorted conceptions of technology (and education technology) shape our very view of education itself and ultimately *dehumanize it or end up reducing* it to a tool of oppression. Although the title may suggest otherwise, in the end, I do not mean to force a definition of education upon the reader but only intend to make educators today ask themselves the questions “what is technology” and “what is education” more often.

Corpus linguistics is a methodology where massive databases of text (corpora) in a given language are analysed using computers, and collocates (words that are commonly used together) in real-life examples (such as text found in newspapers or books) are determined. This approach lets linguists track the ways languages evolve. Such evolution may manifest as a semantic change occurring as a result of technological advancements. For example, it is possible to observe that the word *click* has become a collocate of the word *mouse* starting from the 1990s, whereas during the 1950s, there was no such association (Andersson 2020). I am leaving it to the linguists to research how the T-word has evolved, but I believe making meaning of its modern collocates will assuredly require more abstract (if not critical) thinking than understanding why the word *click* is a collocate of the *mouse*. A critical discourse analysis of some popular collocations featuring the T-word, such as *tech companies*, *tech stores*, or *tech giants*, may offer interesting results. If nothing else, a semantic change involving how the word “technology” is used to describe only a) computer or electronics technologies or b) goods with high-profit margins in the global market seems to be highly evident. This is the reason why, although the extraction of natural

gas from the earth's crust involves significantly sophisticated technologies, referring to a multinational natural gas company as a tech giant would be considered highly absurd, no matter how large it may be and no matter how important natural gas is for heating our homes during cold winter nights.

Even in the '90s, before the heavy onset of the so-called *digital age*, it has been claimed that the definitions of technology made by teachers were usually inconsistent with one another, with certain teachers explaining it as the application of science and others explaining it as an all-embracing human activity involving the design and making of tangible products (Jarvis and Rennie 1998). And it has been shown in the same study that equating technology to computers or electrical and mechanical devices is a concept that begins to form in children 2 to 6 years old. This tendency of children has been shown to be especially strong if they had parents who were technicians that used such devices for work-related purposes. More importantly, however, this study tells us that children's conception of technology can be based on TV advertisements or programs. Again, this was during the '90s, before broadband Internet and smartphones, Facebook and Google, back when the genie of the T-word had perhaps not yet been released from the bottle (to the extent that it currently is).

Throughout the last decade, a group of researchers in Turkey has been working on the perception of the concept of technology through metaphor analyses. In the first study in this vein, Gök and Erdoğan (2010) have studied pre-service teachers in this regard, asking them to fill in the blanks in the phrase "*Technology is like ... because ...*", defining the T-word using a metaphor and explaining why. Responses have then been broken down into the following categorical themes: "*needed*", "*constantly changing*", "*developing*", "*harmful*", "*beneficial*", "*addictive*", "*both beneficial and harmful*", "*rapidly developing*", and "*facilitating our life*". And although one of the respondents is quoted saying, "*technology is like a human because they both grow up and develop*", the authors have not found multiple categories that liken technology to other sentient beings such as