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Preservice ICT teachers' technology metaphors in the margin of technological determinism

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Abstract

Many factors might influence the current place and the role of information and communication technologies (ICTs) in social quarters, including education. One such factor might become one's conceptions of technology. From this point of view, the purpose of this study is to examine preservice ICT teachers' technology metaphors by linking to concepts of technological determinism. The study was carried out in a qualitative pattern. The data were gathered through metaphor elicitation prompt from 55 preservice ICT teachers, and content analysis was applied over the data. The findings of the study revealed that technology is widely being regarded in a utopian and improved state of affairs way of approach. Revealing preservice ICT teachers technology metaphors might enable scholars to broaden more realistic perspectives regarding how technology might be integrated within educational praxis. Furthermore, such an awareness might enable a realization of what to expect from technology, both for students and teachers.

Keywords Preservice ICT teachers · Technology metaphors · Technological determinism · Metaphor analysis

1 Introduction

Intellectual development of humanity is conceptualized under four anthropological spaces: the earth, territory, commodity, and knowledge (Lévy 1997). According to Poore (2011) the knowledge space is still emerging and it is all about the wealth of the collective mind, rather than the individual one. The evolving nature of the knowledge space is vital during the *'ontological vocation'* of humanity (Freire 2000), particularly in the digital age. One of the most important components of knowledge space in digital

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age is information and communication technology (ICT) which has a potential to transform the way how societies accomplish the wealth of the mind (Poore 2011). At this point, it is important to clarify the term ICT to better understand its role on the ontological vocation of humanity and its importance for the wealth of the mind.

Investigating the term technology within different disciplines clearly reveals the fact that it has distinct elements (Baytun and Özerem 2012; Bimber 1990; Bourdon 2018; Fleck and Howells 2001; Fox 2018; Kerr et al. 2018; Staley 2018). However, when it is challenged in the digital age, ICT is generally remembered as a means of technology. There is little doubt that the technology leads dramatic shifts in sociological quarters; such as, economics, communication, or politics (Baytun and Özerem 2012; Bourdon 2018; Chandler 1995; Fox 2018; Kerr et al. 2018; Poore 2011; Surry and Farquhar 1997). Although there is an agreement that technology transforms organizations and institutions, it is less obvious and there is less evidence regarding how technology transforms the discipline of education (Baytun and Özerem 2012; Bourdon 2018; Fox 2018; Kerr et al. 2018; Selwyn 2012b). One of the central considerations in most debates regarding the current place and the role of technology in daily lives involves a degree of technological determinism which is critical when examined in educational praxis (Coleman 2012). The term technological determinism is believed to be coined by an American sociologist, Thorstein Veblen (1857–1929) and seeks to determine one principal factor for explaining social and historical phenomena (Chandler 1995). The debate over technological determinism has two spectrums and polarized between those asking the role of technology in social lives, and those asking, instead, for which interests technology is being shaped in a particular way (Bourdon 2018; Canpolat 2012; Selwyn 2012a). If this is the current state of the art concerning the spectrum of viewpoints that might be possessed during the adoption of ICT into education; that is, an individual's disposition on the spectrum of technological determinism, it gains importance to examine and reveal how preservice ICT teachers' metaphorical expressions of technology disperse with respect to technological determinism.

When technology is considered within educational context, the hope that the use of ICTs, either at classes or homes, enhances learning is widely accepted across the society and their rapid diffusion and adoption is being performed in developed countries (Livingstone 2012). Researchers generally focus on the possible instances as learners engage with digital technologies, and educational technology researchers concentrate primarily on how learning might become more effective, engaging and efficient with the potential of technology use, whereas broader concerns are paid little or no attention (Selwyn 2012a). However, one way to enable the successful integration of ICTs into educational considerations is through supporting such processes with philosophical and theoretical frameworks (Conole and Dyke 2004; Selwyn 2012a). Taking this consideration into account, Conole and Dyke (2004) argued and proposed numerous affordances, like accessibility, diversity, communication and collaboration, reflection, and so on, for several properties of ICTs that might be grounded on a theoretical basis. However, they stated that those affordances are generally not understood to be carefully exploited into educational settings. In addition to that, one of the most important problems in integrating ICTs into educational praxis is the lack of a clear analysis of the learners, education, and digital technology from the perspective of theoretically sophisticated and considered approach that both links the technological, cultural and the social (Selwyn 2012a). The lack of a sophisticated philosophical and

theoretical framework for the integration of ICTs into education has two spectrums with regard to beliefs that they pose for the process; that is, utopians and dystopians (Baytun and Özerem 2012; Chandler 1995; Fox 2018; Halpin 1999; Kabakçı and Odabaşı 2004; Kerr et al. 2018; Moylan 2018; Russo 2018; Selwyn 2012a). How those two spectrums of viewpoints; that is, utopian and dystopian sides, are dispersed and what accounts they have in their claims, in other words, how technological determinism is placed into a position when considering the integration of ICTs into educational praxis clearly warrants further investigation.

Utopian and dystopian viewpoints basically resembles the philosophical viewpoints on the issue of how science and technology influences and determines the social life of humanity (Hannah 2018; Papastephanou 2008; Russo 2018). The term utopia, on the one hand, was introduced by Thomas More (1516) as a way to conceptualize the social life that was modernized and made worth living through technological developments (Halpin 1999). Hence, technological advancements are seen as a way to facilitate a better and happier societies for the future. The term dystopia, on the other hand, was introduced by John Stuart Mill (1868) as a criticism for the utopian side and generally unfolds the negative effects of technologically determined social lives; such as, detracting people from natural environments, making lives more monotonous, and provoking socio-economic imbalance between societies. Dystopian side focuses primarily on possible negative influences caused by technological advancements (Bourdon 2018; Russo 2018; Vural and Bakır 2007). Both utopian and dystopian sides have distinct characterization of how technology is conceptualized. Utopian side, on the one hand, claims that technology has a role in transcending nature, making life easier and more egalitarian, empowering all the different classes and groups equally, creating new workspaces, and leading shared social values, skills and cultures across the globe (Bourdon 2018; Buras and Apple 2008; Corazza 2008; Czitrom 1982; Nyman and Teten 2018; Vural and Bakır 2007; Williams 2003). Utopians are inherently positive, so much so that even if there is a difficulty or disappointment, there is always a way to be improved no matter here and now, but might be later in the foreseeable future which is considered to have a value in educational context because many of its aspects are frequently experienced and spoken negatively (Halpin 1999). The situation is not different when it comes to integrating ICTs into education; that is, rather than focusing on the advantages and opportunities that technology facilitates, the debate generally rides more on the disadvantages and threats (Coleman 2012). One of the reasons of such debates is that utopians generally focus solely on the positive effects of ICTs by neglecting numerous downsides or boundaries, such as, the possible contextual factors (Bourdon 2018; Buras and Apple 2008; Çelik 2018; Lewis 2007; Papastephanou 2008; Papert 1997), teachers' beliefs concerning teaching and learning with ICT (Ertmer 2005; Mama and Hennessy 2010; Mumtaz 2000) or technical and infrastructural thresholds (Fox 2018; Tanner et al. 2014; Türel 2012) that might lead negative outcomes or problems. On the other hand, dystopian side rides totally on the other direction (Halpin 1999). Although both utopian and dystopian sides have a similar trick in that technology might shape the future occurrences, dystopians argue that such a determination will cause numerous negative effects as well; such as, standardization of life styles (Chandler 1995; Feenberg 1995; Heilbroner 1967; Russo 2018). In addition, they claim that technology causes moral bankrupts, hinders

participating democratically, and conducive to health problems and inequalities (Neuman 1991; Nyman and Teten 2018; Williams 2003). Other than those two extreme sides of the spectrum; that is, utopian and dystopian sides, there are researchers trying to emphasize that a more soft-utopian or techno realistic approaches should be adopted during the integration of ICTs into educational praxis (Kabakçı and Odabaşı 2004; Selwyn 2012a). According to this viewpoint, technology is conceptualized as a subpart of a culture during its own ontological vocation to achieve the wealth of the mind, and the technology might have both positive and negative influences on social quarters. Furthermore, technological innovations should be placed at the heart of a nation's own norms, values, or ideals and they should be viewed as a way to satisfy the needs of the society. However, such needs must be treated in light of critical viewpoints, rather than to support those powers of economically and politically developed.

It is clear that both utopian and dystopian spectrum of viewpoints have distinct characterization for conceptualizing the notion of technology, and it remains somewhat elusive to ground ICTs integration on a philosophical approach. The reason why technological determinism is an elusive notion might be due to its relationship with other aspects of human activities (Bimber 1990), one of which is education. Technological determinism is widely accepted as the philosophical approach in integrating ICTs into education (Oliver 2011; Roper 2018; Thurm 1999). The claim that digital technologies will be an important component of the twenty-first century is quite widespread in educational settings, so much so that it is vitalized as much important as the book in the nineteenth century (Livingstone 2012). Furthermore, there is a widespread acknowledgement that the twenty-first century skills; including digital literacy, problem solving, media literacy, innovation skills or collaboration, must be placed at the heart of educational reforms and policies to enable learners achieve those skills (Wagner et al. 2005). From this point of view, society's main ambition to use digital technologies for educational purposes is based on the expectation that they have potential benefits to transform the current teaching-learning processes (Livingstone 2012). Coleman (2012) stated that ICTs have various inherent characteristics that might influence how they are used, and in turn users might also determine how to approach and use those technologies. However, there are researches arguing that learners and teachers are directed to act in a way that they should respond to technological change by making the *'best use'* of those technologies (Baytun and Özerem 2012; Chandler 1995; Fox 2018; Kerr et al. 2018; Selwyn 2012a). The critical point in integrating ICTs into educational praxis involves variations, since there is no one correct theoretical stance in the degree of determinism included into the process (Coleman 2012). Notwithstanding that, extreme sides of the different spectrum of viewpoints have different perspectives on the issue of integrating ICTs into education.

There is a vast amount of research on the issue of how conceptions of technology might be placed into a position with respect to technological determinism. The crucial point within the literature is that the conceptualization of technology by each and every individual has a role in adopting it, which warrants further examination of how metaphors of technology disperse with respect to technological determinism. The philosophical and theoretical frameworks underpinned during the process of integrating ICTs into education is one of the most critical

considerations for teachers, especially for those majoring in ICTs. When considered particularly within the context of Turkish Educational System, ICT teachers are critical stakeholders for determining the integration process as ICT coordinator teachers and they are also responsible for the diffusion and maintenance of technology in educational discourse (Topu and Göktaş 2012). As noted, there is evidence that the degree of technological determinism possessed by each and every individual has a role in integrating ICTs into educational praxis (Baytun and Özerem 2012; Halpin 1999; Kerr et al. 2018; Selwyn 2012a), especially it is valid when it comes to preservice ICT teachers. The reason why such a degree of determinism is more important for preservice ICT teachers is that they have the responsibility of being one of the most critical stakeholder as learning technologists that exploit ICTs into educational settings (Conole and Dyke 2004). Looking from such a glimpse, the purpose of this study is to investigate preservice ICT teachers' technology metaphors from the perspective of technological determinism. The study aims at improving the currently limited understanding of how preservice ICT teachers' metaphorical expressions of technology are placed into a position with respect to technological determinism that might have an influence on their future decisions during the process of technology integration into school processes. Moreover, revealing how metaphorical expressions of technology disperse with respect to technological determinism might enable teacher educators to widen preservice ICT teachers' conceptions of technology that might have a role during the process of ICTs integration into education.

2 Method

2.1 Participants

The participants of the study were 55 preservice ICT teachers who enrolled in a Faculty of Education, in Turkey. While 33 (60%) of the participants were female, 22 (40%) of them were male. All the participants were from middle socio-economics level. The range of the participants' age is 20–27 ($\overline{x} = 22$, sd. = 1.2). The informants were identified on the basis of their knowledge regarding the research topic; that is technology, and their assigned responsibilities in case they start their profession in schools as ICT teachers or ICT coordinator teachers.

2.2 Data collection and analysis

The data of the study were gathered through a metaphor elicitation prompt. Metaphors enable researchers to describe the phenomenon in which words or phrases are included as figures of speech (Woodson 2017). Metaphors were analyzed in a deductive qualitative content analysis approach. Based on a coding scheme, categories were identified, and the data were reviewed to be able to cluster them in accordance. Figure 1 below illustrates the abovementioned coding scheme generated based on an intense literature review.

Following the coding scheme, categories, and the label of codes, three main considerations that were highlighted by Badham (1986) were clarified. Here are the

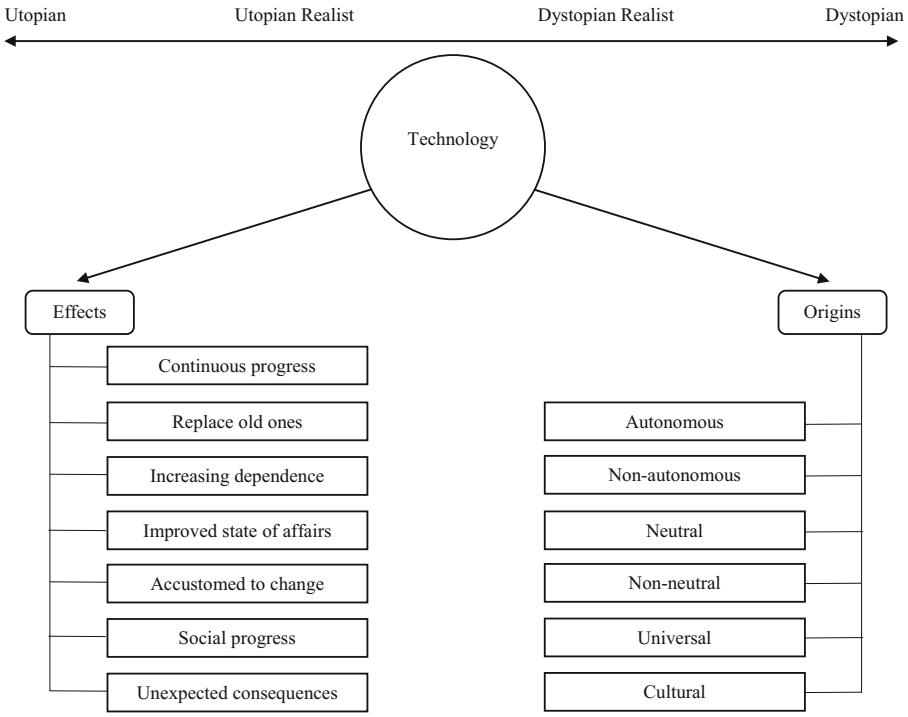


Fig. 1 The coding scheme

questions to be answered posed by Badham (1986) to clarify the organization phase of the qualitative content analysis as proposed by Elo et al. (2014).

2.2.1 When the label 'technological determinism' is employed, what level of determinism is involved?

The study employed a utopian and dystopian level of technological determinism. While the utopian and the dystopian sides resemble the two extreme spectrum of viewpoints, there are also those specifying more utopian realist or dystopian realist viewpoints. Hence, there are four levels of technological determinism. The question of how informants' viewpoints were classified with respect to those categories is a point to be made clearer. To label informants' viewpoints, the definitions of the notions of utopian and dystopian were gathered from the literature (Chandler 1995; Halpin 1999; Russo 2018; Selwyn 2012a). Other than those two extreme spectrum of viewpoints, the conceptualization of utopian realist and dystopian realist were constructed from the definitions of Chandler (1995). In light of those definitions and conceptualizations, the level of determinism was achieved. Table 1 illustrates brief definitions of spectrum of viewpoints.

Table 1 Brief conceptualizations of the spectrum of viewpoints

Utopian	Utopians are inherently positive, so much so that even if there is a difficulty or disappointment, there is always a way to be improved no matter here and now, but might be later in the foreseeable future (Halpin 1999). Hence, utopians adhere technological advancements as a way to facilitate a better and happier societies for the future.
Utopian Realist	Technology or technological change is an *'enabling or facilitating factor'* that might have a role on *'potential opportunities.'* Rather than representing an extreme stance, utopian realists are generally aware of mediating factors, merits, and advantages along with disadvantages.
Dystopian Realist	Technology and technological change has inherently disabling factor. Although technology or technological change might have *'potential opportunities'* negative stances are forefront for dystopian realists.
Dystopian	Dystopians focus primarily on possible negative influences caused by technological advancements (Vural and Bakır 2007). Dystopian spectrum of viewpoints extremely unfolds the negative effects of technologically determined social lives; such as, detracting people from natural environments, making lives more monotonous, and so on.

2.2.2 Does this apply to the origins of technological change or the effects of technological change?

Technological determinism might be encountered both from the origins and effects of technology or technological change. It is important to distinguish both of the specifications. From this point of view, informants' viewpoints were divided into two categories, one of which is the origins and the other one is the effects. After such a categorization, viewpoints were first classified with respect to categories of either origins or the effects. Actually, one informant might specify both of them. In other words, a cluster of statement might both include words or sentences as a meaning units regarding the origins and the effects of technological change. In that case, both specifications were placed into the relevant categories.

2.2.3 What is meant by the 'technology is neutral' thesis? Does this again, apply to the source or effects of technology?

It is somewhat elusive to specify that the origins or the effects of technological changes are neutral. One of the main argument of the neutrality of technology is that it is the product of neutral dynamic. The core assumption of use/abuse model attributed to the neutrality of technology is that to be important is whether, and if so how, a specific technology is being used. There is an argument, though, on the neutrality of technology in that human beings cannot merely 'use' technology without also, to some extent, being influenced or 'used by' it (Chandler 1995). Hence, informants' viewpoints will be classified under the origins label if they are admitted as neutral or non-neutral unless there are specifications on the effects of technology or technological change.

After the above mentioned questions were clarified, concepts for the qualitative content analysis was determined in a way that was offered by Graneheim and Lundman (2004). Table 2 illustrates the concepts guided the analysis, their

Table 2 Concepts underpinned for the qualitative content analysis procedure

Concepts	Definitions	The way used in the study
Manifest or latent content	While obvious or visible components of a text data resembles the manifest content, a degree of interpretation represents latent content.	Manifest content was largely used, yet the latent content was also compiled in case it is decided to be necessary.
Unit of analysis	The representation of the objects of the study, generally containing the raw data.	This study underpinned the metaphor text and the whole segments of it as unit of analysis.
Meaning unit	The constellation of words, segments of a statement or the whole statement.	Words, segments of a statement, the whole statement or the whole paragraph.
Condensation	The idea of shortening the text while at the same time keeping the core.	The whole text, especially in latent content, was condensed for assigning to relevant code, based on the metaphor representation.
Abstraction	Descriptions and interpretations that were used to generate codes, categories, or themes.	The relevant definitions, interpretations and examples were gathered from an intense literature review.
Content area	Parts of a text that guides the focus of the content.	This study focused on the parts of texts, if necessary, on the basis of coding scheme.
Code	Code resembles the label of a meaning unit.	Codes were generated in a deductive approach based on an intense literature review.
Category	Content as a way of expression is represented by categories.	Categories were gathered from the literature and mutually exclusive.
Theme	The underlying meaning behind the constructed categories.	The research question determined the theme of this research; that is technology.

definitions and how they were utilized in this study. After the definitions and rules were determined, theme, categories, codes, names and definitions were gathered in light of an intense literature review. The literature review enabled researchers to generate the coding scheme in a deductive approach. Table 3 illustrates the conceptualizations regarding the origins and the effects of technology, technological change, and technological determinism.

2.3 Trustworthiness

Elo et al. (2014) compiled a checklist to improve the trustworthiness of a qualitative content analysis. Beginning from the data collection to reporting of the results, researchers provided a comprehensive list to cover. This study underpinned the phases and the steps to be checked offered by the aforementioned researchers. However, researchers reported only the reporting phase due to word limit considerations.

Reporting phase of the qualitative content analysis was guided by two main considerations; one of which is the reporting of data and the reporting of analysis process. The reporting of the data is conveyed through figures, tables and explanations.

Table 3 Labels of codes regarding the origins and the effects of technology

Effects	
Routinization	Although there is a change, it is not reflected or seen as a change since the term change is an accustomed way of living that results in a routinization.
Continuous progress	The successive stages of technological development resembles the idea of continuous progress. The notion of accumulation of technology dominates the continuous progress.
Improved state	The affair handled was assumed to be improved in case of the use of a newer technology. Hence, in case of an improvement of teaching-learning process, such as increasing motivation, retention of knowledge or better visualization, it is assumed to improve the education related processes.
Increasing dependence	The assumption of an increasing symbiosis of human beings and machines. As the dependence increases, there will be numerous influences as a result of such an increasing dependence.
Replace old ones	The assumption that the new technology replaces the old ones in a way that it comes with a 'new' way of doing affairs so much so that it is generally attributed a 'good' thing to be replaced with the old one.
Social progress	The idea of as technology progresses, there will be progresses in social quarters as well, such as economics, politics, or daily life. The influence of the progress is mainly on the societal level and societal events, rather than specific to educational praxis.
Unexpected consequences	Technology may be out of control and hence technical developments can lead to unforeseen 'side-effects' which is termed as unexpected consequences. It is a term to clarify the possibilities that the use of technologies might bring out.
Origins	
Autonomous	Technology is external – 'outside' of society. It is presented as an independent without being subject to anything, as it has its own free will.
Non-autonomous	Technology is itself shaped by society in a specific culture and is subject to human control. Rather than having its own will, it is the product of human will.
Neutral	Technology is 'value-free'; that is, neither good nor bad. The important consideration is not the technology of itself, however the way how people choose to use or adopt it.
Non-neutral	The use of a technology involves a degree of being influenced by the use of it. It is the case when the use of technology influences those who use it.
Universal	Technology is outside of any specific socio-cultural context; that is, technology in one culture is expected to be adopted in the same vein in the framework of others, as well.
Local / cultural	Technology itself is a sub-part of a culture and it has its own route in a localized context. Rather than having a universal origin, it is routed within a culture.

To make it clear and understandable, coding scheme is generated, and relevant findings were presented with respect to that specific coding scheme. The participants, data and sampling method were specified with as much detail as possible to satisfy the transferability of the results. The reason why the researchers ensured that the categories covered all the data is because of the coding scheme that was generated after an intense literature review. Furthermore, the low number of the eliminated data ($n = 5$) because of irrelevancy not for the mismatching considerations made researchers to ascertain that the categories are appropriate enough to cover all the data. Finally, the clear specification of how the analysis process was followed enabled researchers to achieve the trustworthiness of the study. Figure 2 illustrates the intercoder agreement process.

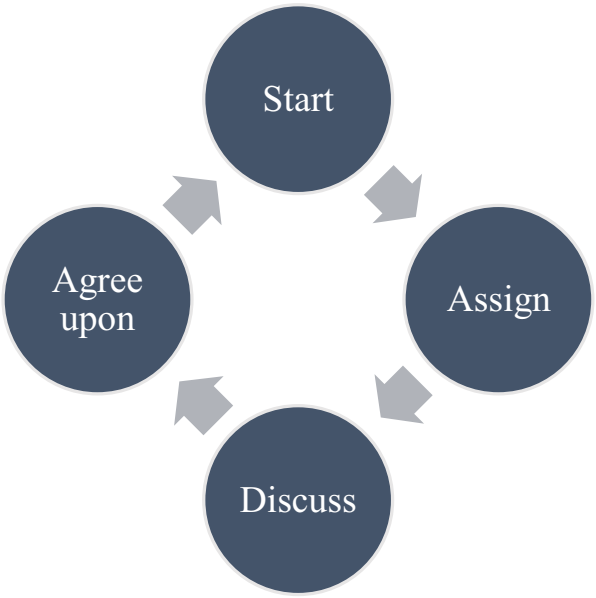


Fig. 2 Intercoder agreement process

As it is illustrated in Fig. 2, the intercoder agreement was established by a circular loop process. In the beginning, researchers developed a coding scheme that included basic labels. Then, the entity to be analyzed (unit of analysis) and the meanings to be extracted from these units (meaning unit) were decided in a four-step process. This process involved the following steps. In the first step, units of analysis including meaning units were determined. Secondly, each of the coder assigned unit of analysis and meaning units to coding scheme by constantly checking the coding scheme and predefined labels. Thirdly, researchers shared their assignments with each other, and discussed over it with reasons and examples from the coding scheme and definitions. Finally, the coding was ended when the coders agreed. However, when there was a non-agreement amongst the coders, that specific unit of analysis and meaning unit was skipped to the final session or the discussion lasted until the coders agreed. The loop enabled researchers to base an iterative process to complete the coding.

3 Findings

Table 4 illustrates how the assigned metaphors were dispersed with respect to categories, codes and relevant spectrum of viewpoints.

As it is illustrated in Table 4, there are both effects and origins routed in the informants' metaphorical expressions regarding technology. The effects with 257 metaphorical expressions is greater than the origins with only 41 metaphorical expressions. There were seven labels under the effects category to be coded with meaning units. The most frequently assigned coding is improved state (103, 40%). Social progress (64, 25%), continuous progress (34, 13.2%), unexpected consequences (28, 10.9%), replace old ones (13, 5.1%) and increasing dependence (10, 3.9%) follows

Table 4 Assigning metaphors

	Utopian	Utopian Realist	Dystopian Realist	Dystopian	General Total	
					f	%
Effects						
Routinization	0	0	1	4	5	1,9
Continuous progress	21	2	2	9	34	13,2
Improved state	42	46	11	4	103	40
Increasing dependence	3	3	2	2	10	3,9
Replace old ones	4	7	1	1	13	5,1
Social progress	30	7	3	24	64	25,0
Unexpected consequences	1	3	5	19	28	10,9
Effects Total	101	68	25	63	257	100,0
Origins						
Autonomous	11	6	0	1	18	43,9
Non-autonomous	3	1	0	1	5	12,2
Neutral	0	4	0	0	5	12,2
Non-neutral	1	6	1	1	8	19,5
Local / Cultural	0	0	0	0	0	0
Universal	0	3	2	0	5	12,2
Origins Total	15	20	3	3	41	100,0
General Total	116	88	28	66	298	

each other respectively. The least frequently assigned coding is routinization (5, 1.9%). The origins with only 41 metaphorical expressions have six main labels to be coded with meaning units. As is it illustrated in Table 4, the most frequently assigned coding is autonomous (18, 43.9%). While the non-neutral (8, 19.5%) is the second most frequently assigned there are three labels assigned equally. Those are non-autonomous (5, 12.2%), neutral (5, 12.2%) and universal (5, 12.2%). There is not any meaning unit assigned to the label of local / cultural. Table 5 illustrates several examples of the informants' own specifications concerning both the effects and the origins of technology.

Table 4 also illustrates how the spectrum of viewpoints were dispersed with respect to utopian, utopian realist, dystopian realist and dystopian. Utopian (116, 38.9%) is the most frequently assigned spectrum of viewpoint. Utopian realist (88, 29.2%) and dystopian (66, 22.5%) spectrum of viewpoints follow the utopian, and the least frequently assigned label as a spectrum of viewpoint is dystopian realist (28, %9.4). Table 6 below illustrates several of the informants' own specifications concerning the spectrum of viewpoints.

After revealing findings regarding informants' specifications both from effects, origins and utopian-dystopian spectrums, Table 7 below represents several of their metaphorical expressions.

Table 5 Examples of participants' metaphorical expressions

Effects	
Routinization	"A World where robots exist. People become insensitive. Our life become so easy that we will do anything and everything without a need or value, like a robot."
	"Technology will make us all mechanical. We will always say the same things at the same places, in a mechanical manner."
Continuous progress	"The effects of technology on educational system are the result of accumulation. The effects of a new technological device on educational system gets stronger through a combination with the effect of the next new technology."
	"Everything can be improved thanks to technology. Previously developed technologies can easily be changed. Of course, it is difficult to prepare, but it is much easier to put things on and produce new things."
Improved state	"There is no need to stand up to turn on the TV, like there is no need to go to school thanks to online learning."
	"All the information necessary for education can be exchanged via internet technologies which makes life easier, like in the case of books in a library."
Increasing dependence	"Like a chocolate, in case of excessive consumption, it causes addiction. You should eat moderately."
	"Technology and education complements each other. The two are inseparable, so much so that it is not enjoyable when one is missing."
Replace old ones	"An old system is replaced with the new on all of a sudden. Of course, the old one has its own effects yet the new one has its dominance and it is already under way..."
	"The tip inside of a tipped pen could not be used forever; it needs replacement. That is, I should replace with the new one like in the case of technology. We cannot use the same technology constantly. We want to replace it with the new one or in case we get bored with the old one."
Social progress	"Thanks to technology that makes life easier, we will be able to live a better life in the future."
	"Thanks to the speed that can catch up with everything, it will continue to make life easier, just like airplanes."
Unexpected consequences	"At the moment, people using smartphones cannot even learn their phone numbers or their own birthdates. In the future, a full of brain slimming will take place. We have to use necessarily."
	"At the moment, instead of talking to each other, individuals do everything on virtual environments. In the future, there will be a complete lack of communication. People will never talk"
Origins	
Autonomous	"Technology is like a hair constantly growing and breaking over time."
	"Like a new born of a day, rain or snow drops falling down, technology renews itself on its own."
Non-autonomous	"Technology is friendly. It will not make sense by itself, but with human beings."
	"When the time for violet arrives to blossom, it comes into flower beautifully and spreads beauty around. However, when we do not give water, first the leaves turn yellow and then they start to dry, which resembles the metaphor of technology."
Neutral	"Technology might be used either in a good or bad way, like the love might lead happiness or sadness."
	"Like a pan, if it is used correctly, one can make very delicious food. However, if it is misused, it might be very dangerous."
Non-neutral	"An individual can use her / his hair in a way that s/he wishes, and so is technology. One uses the developing technology in accordance with her / his own needs."
	"Like a pen, you decide whether to write something good or bad with it."
Universal	"Like a domino effect, many elements of education is being affected by a movement. New technologies are already being diffused in our country, no chance for not accepting. New technologies influence both teachers' instruction and students' performance."

Table 6 Participants' own specifications

Utopian	"When technology was used in education during initial stages, it was like merely an ornament, but later it became inevitable in education."
	"Everything will be clearer and fairer. The technology will enable to be clear."
Utopian Realist	"It not only forced students but also parents to learn how it operates."
	"Like a jack-in-the-box, you cannot always guess what comes out of it."
	"Like a hair clip, if you use it excessively, it burns the hair. It must be used moderately."
Dystopian Realist	"It is like a gruyere cheese. Although it seems as if it is thorough, there are still gaps to fill in. Lack of content, thresholds in rural areas, and so on."
	"It is like a kinder surprise. Sometimes, we cannot foretell. A process that you set out with careful steps can lead to frustration and failure."
Dystopian	"The technological progress will destroy both the world and the humanity. It is a means of power that everyone wants to hold."
	"The further progress in technology, the more selfish people will become. The technology will create an environment for being selfish."

Table 7 Examples of participants' metaphors

	Utopian	Utopian Realist	Dystopian Realist	Dystopian
Effects				
Routinization	–	–	Flaring up the fire	Artificial machine
	–	–	–	Mold
	–	–	–	Mechanic
Continuous progress	Ant	King of the jungle	Alchemy	Immortality
	Robot	–	Chameleon	Doomsday
	Accumulation	–	–	–
Improved state	B12 vitamin	Child's growth	Gruyere cheese	Empty jar
	Zapper	New method	Distributing wallet to the poor	Dearth
	Magic wand	Mood	Kinder surprise	Continuous damage
Increasing dependence	Heart	Chocolate	Dependency	The lord
	Hamburger and potato chips	Cat	–	–
		Hair clip	–	–
Replace old ones	Regeneration	Revolution	Treadmill	Fashion
	Constantly growing hair	Tipped pen	–	–
	Rubber	Oxygen mask	–	–
Social progress	Water	Plane	Ill-communication	Captivity
	Friendly	Brotherhood	–	Exploitation
	Luminescence	Medicine	–	Disease

Table 7 (continued)

	Utopian	Utopian Realist	Dystopian Realist	Dystopian
Unexpected consequences	–	Gift box	Ease	Brain latency
	–	Bomb effect	Already existing	Selfishness
	–	Uncanny valley	Authority	Disloyal
Origins				
Autonomous	Clockwork	Soil	Circle	–
	Maturing of a baby	Modified automobile	–	–
Non-autonomous	Field	Purple violet	–	Guinea pig
	Baby	–	–	–
Neutral	–	Love	–	–
	–	Knife	–	–
Non-neutral	–	Carpenter	–	Evil
	–	Pencil / Pen	–	–
Local / Cultural	–	–	–	–
Universal	–	Domino effect	Exaggeration	–

4 Discussion and conclusions

In seeking to make sense of how metaphorical expressions of technology disperse with respect to technological determinism, this study investigated whether, and if so how, preservice ICT teachers' dispositions on the utopian and dystopian spectrum of viewpoints might have a role on technology integration into school processes. The findings of the study revealed that the participants' metaphorical expressions regarding the effects of technology (86,2%) outweighed the metaphorical expressions of the origins (13,8%). Furthermore, it is realized that a utopian way of approach is the most dominant spectrum of viewpoint. This finding is interesting in that technology is often seen as a means of having an effect on social quarters, including education. In fact individualism / collectivism as a cultural background might have a role in explaining such a narrow or surface approach to the nature of technology. Bagchi et al. (2004) reported that the adoption of ICTs in individualistic cultures is likely to occur more quickly than in collectivistic cultures, and people in collectivistic cultures impose limits on the possibilities of transferring technologies. What is more science and technology in more collectivistic cultures is being treated as magic, and public is uninformed about technological facts (Bagchi et al. 2004). Turkey is classified as one of the collectivistic cultures (Hofstede et al. 2010), and the reason why there is a lack of participants' metaphorical expressions concerning the origin of technology might be up to a certain extent explained by the influence of collectivistic cultural background. Rather than criticizing the nature of technology, it is regarded as something to be imposed and to be affected regardless of up to what extent it fulfills one's own needs. In fact there is evidence for this finding in the report of Nesta (Luckin et al. 2012). In an attempt to search for an evidence on technological innovation, there was only one teacher-led innovation from Turkey that met the researchers' quality inclusion criteria to the report,

despite the researchers admitted a bias up to a certain extent. This finding implies that there is a need for teacher educators to direct the focus of attention more on the origins of technology to better enable teacher candidates handle the process of ICTs integration into education.

A scrutinize investigation of the effects category reveals that technology or technological change is attributed with a 'progress' in a way of an improved state of affairs, social progress or continuous progress. Particularly, improved state of affairs in educational praxis is the dominant stance concerning technological change. In that essence, utopian way of approach is found to be dispersed greater than utopian realist and dystopian realist ones. In fact this finding is consistent with contemporary researches on the underlying assumptions for ICTs integration into teaching-learning processes. ICTs are primarily being adopted to satisfy the hope that they facilitate an improved way of teaching-learning processes (Livingstone 2012). There is a mount of research emphasizing the value and importance of *'constantly utilizing contemporary and cutting-edge technological applications'* (Thornton et al. 2012) for that specific purpose. Take, for example, the case of augmented reality (AR), which is a symbiosis of both real and virtual objects at a real time interactivity with 3D registration (Azuma 1997). According to Horizon Report, AR is expected to become one of the mainstream applications that will take two to three years in higher education and four to five years in K-12 education (Johnson et al. 2015, 2016). The primary concern for adopting such cutting-edge technologies into education might clearly be acquired from the findings of contemporary researches that acceptance and use of those technologies have benefits for both learners and teachers, which resembles a kind of utopian or utopian realist spectrum of viewpoints. They not only increase academic achievement (Civelek et al. 2014; Estapa and Nadolny 2015; Lu and Liu 2015), student engagement (Zarraonandia et al. 2013), and self-directed learning (Garrett et al. 2015), but also facilitate teachers to increase students' interest (Chen and Wang 2015; Pérez-López and Contero 2013), and satisfaction (Chang et al. 2013; Han et al. 2015). While the possibilities of digital technologies in education should not be denied altogether, it is as much important as to be aware of complex all points of that process by keeping in mind the concepts of routinization, increasing dependence, and unexpected consequences. Although the dominance of improved state of affairs, social and continuous progress is obvious, routinization, increasing dependence and unexpected consequences were also revealed from the meaning units of the informants. The assumption that *'if we only implemented strategies supported by decades of research, we'd never try anything new'* (Goodwin and Miller 2013, pp. 78–80) might highlight the value and importance of unexpected consequences exerted from such processes. For instance, although Estapa and Nadolny (2015) found that AR is more effective in getting students' attention, they suggested that the distraction factor should be eliminated, which resembles a stance for unexpected consequences, so much so that several of the students preferred the printed material over the AR-enhanced one. Lu and Liu (2015) suggested that teachers' inability to develop AR-enhanced resources successfully might be seen as a limitation to adopt that technology into educational praxis. In this case, teachers might feel obliged to overcome their limitations, which might lead them to turn over by the

excessive work load or expectations from them. Furthermore, such a finding is contrasting to widely held belief that *'digital technologies lessen the need for hard work and generally improve people's working lives'* (Selwyn 2016b). As it is illustrated, although the dominance of utopian spectrum of viewpoint is clear for the effects of technology, particularly over the concepts of improved state of affairs, social and continuous progress, there is evidence that the effects of technology or technological change might both have advantages along with disadvantages which requires a form of critical thinking during the integration of ICTs into education.

The other category related to technology is about its origin. A scrutinize investigation of the origins of technology or technological change reveals that it is widely seen as autonomous implying that it has its own free will and out of human control. This notion might be seen in the case of X-raying pregnant mothers with a tiny fraction of radiation exposure, for instance, when the conventional wisdom insisted to leave human control out of place by being responsible for the deaths of children. It took *just* twenty five years for Alice Stewart's findings to be accepted by the relevant institutions that pregnant women should not be X-rayed (Hannah 2018; Heffernan 2011, pp. 45–51), which resembles the human control over technology and its possible effects unless if not. In case of educational context, technology should not be outsourced as a way of improving teaching-learning processes, although it may serve opportunities. Furthermore, more utopian realistic approaches should be accepted in case of any intended or unintended consequences. The reason for the need of such a spectrum of viewpoint is that opportunities individuals have on their own through digital education might require a withdrawal of an expert's direction, guidance and support, which is contrary to the widely held belief that learning is a social endeavor with more knowledgeable others (Selwyn 2016a, pp. 73). In that sense, such an endeavor should not be totally outsourced to technology or technological change. On the other hand, there were non-neutral, neutral, non-autonomous and universal meaning units, as well. Although they were not high in magnitude, it is worth to investigate how such spectrum of viewpoints might influence technology integration into school processes. Take the case of interactive whiteboards (IWBs), for instance, as one of the most widely installed educational resources across the globe (Johnson and Kress 2003; Maher 2011). The primary assumption to install IWBs is that they will help teachers generate a more interactive classroom environment which will lead the likelihood of an increase in students' learning. There is no doubt that IWBs have inherent 'technical interactivity', yet acquiring them as neither good nor bad without amplifying how to use them to satisfy a more pedagogical interactivity resembles a form of neutrality of technology. In fact there is a nuance at such a point of view which tends to outsource technical interactivity with pedagogical interactivity. In other words, regardless of how IWBs should and could be used as a means of pedagogical interactivity, the assumption of just installing them will enable teachers to gain required technical competence, hence the pedagogical interactivity, although there is evidence that it is not solely adequate to generate a more interactive classroom environment (Mama and Hennessy 2010; Miller and Glover 2010; Schussler et al. 2007). The fact that *'ultimately, the decision regarding whether and how to use technology for instruction rests on the shoulders*

of classroom teachers' (Ertmer 2005) resembles the importance of how teachers' philosophical perspectives might have a role on teaching and learning by means of ICTs.

One of the most interesting findings of the study is that there is not any meaning unit assigned to the local / cultural aspect of technology or technological change. At this point it is important to state the conventional wisdom that is attributed to teacher-technology symbiosis in educational praxis. As abovementioned, conventional wisdom held that there is a need to constantly try out new strategies with cutting edge technologies, even though there might be numerous downsides, boundaries or unexpected consequences, such as technical thresholds, socio-cultural or socio-economic backgrounds. How such a wisdom might have a role on preservice ICT teachers' degree of technological determinism concerning technology or technological change is one of the prominent concerns of this study. The study revealed the fact that culture is extremely ignored; that is, rather than being directed by one's own culture and needs, it has the same impacts across countries. Introspective, this might be due to the fact that even technology adoption models who were developed by *'rational right-minded people, know that neither faction is correct and that the truth lies in the middle'* (Kirschner 2009) have just started to include social influence and its role across different cultural backgrounds (e.g. Al-Gahtani et al. 2007; Chu and Chen 2016; Göğüş et al. 2012; Nistor et al. 2013; Sun et al. 2014; Venkatesh and Zhang 2010). This finding is important for teacher educators to highlight the value and importance of culture on technology adoption as suggested in contemporary technology adoption researches. When the role of ICT teachers in schools is considered, particularly in Turkey, this implies that there is a need to emphasize the role of cultural dimensions that is offered by Hofstede et al. (2010) which might have profound influences on how ICT teachers should and could handle the process of ICT integration into school processes.

The findings of the study revealed the fact that technology or technological change is widely accepted in a utopian spectrum of viewpoints, particularly in an autonomous and improved state of affairs way of approach. It is obvious that there is a constant endeavor to *'outsource human responsibilities to machines'* (Tufekci 2016) which has a role in altering what to expect from technology for both students and teachers, especially for those responsible for the integration of ICTs into school processes. However, critical reflection to the integration and adoption of ICTs is required to handle such process in a more thorough and successful way. *'To what extent is digital technology really changing education – and is this always in our best interests?'* (Selwyn 2016a, pp. 3) is a question to be critically reflected upon by considering the multi-faceted layer of technology integration into education, especially the culture where it is under way.

Technological determinism as a driving force behind the efforts of generating solely one determining cause for improving students' learning, particularly in a utopian spectrum of viewpoint is evident through the findings of this study. Hence, it gains importance for teacher educators, particularly the educators of ICT teachers, to highlight more than ever that there might be a danger for circling around solely one

determining factor of students' learning. In fact, Robinson (2007) offered a solution to overcome such a technological imperative in a way that placing student learning at the heart of the school process which warrants to investigate learning theories. Theories of learning emphasize the value and importance of a more knowledgeable other, or expert, in guiding learners that could be a peer, but is generally a teacher (Luckin et al. 2012; Selwyn 2016a, p. 73; Vygotsky 1978, p. 90). There might be students benefiting greatly from the support, guidance and mentorship of those more knowledgeable others rather than leaning on their own devices (Selwyn 2016a, p. 144). There is a need to overemphasize the student learning during the integration of ICTs into school processes along with considering the multifaceted complex nature of factors influencing students' learning, rather than the preponderance of technologically determined utopian narratives.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interest.

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