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THE IMPACT OF KNOWLEDGE MANAGEMENT PROCESSES ON TEACHERS' DIGITAL SKILLS

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Abstract:
The impact of IR 4.0 has initiated a new paradigm shift for Greek educational institutions to ensure that all teachers are able to develop new teaching practices related to digital technologies. However, the majority of teachers use traditional teaching methods. Measures are needed to encourage teachers to acquire digital skills and integrate them into the educational process. Knowledge management processes can be used as an alternative strategy by schools to help teachers equip themselves with new skills and to meet the challenges ahead. Therefore, the aim of this study is to investigate whether knowledge management processes can be used as an alternative strategy by schools to equip teachers with the necessary digital skills. Hence, the four knowledge processes-acquisition, storage, distribution, and use-were related to teachers' digital skills. To this end, a quantitative study was conducted with a sample of 668 secondary school teachers from the Epirus region of Greece and analyzed using Partial Least Square Structural Path-Modeling (PLS-PM). The research results showed that knowledge management processes have a positive impact on teachers' digital skills.

Keywords: knowledge management processes, digital skills, educational units

1. Introduction

In recent years, digital technologies have entered most areas of social and economic life. Education is one of these areas where digital technologies are acting as "agents of change", bringing about significant changes in all dimensions of the educational process. The OECD (2016) notes that it is difficult to imagine innovative strategies in education without a strong focus on developing the digital skills of students and teachers. It points out that the introduction of digital technologies does not in itself ensure the improvement of educational quality, but that the key to success lies in teachers being able to make the connection between students, computers, and learning. Teachers need to integrate knowledge and skills in content, pedagogy, and technology in order to pass them on to

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students. However, in Greek schools, the majority of teachers use traditional teaching methods. According to the Cede fop report (2018) and the European Commission survey (2021), Greece ranks last in digital literacy. The introduction of digital technologies and systems to replace traditional methods is often met with skepticism, and a large proportion of teachers are opposed to them. In order to incorporate digital competencies into the educational process, measures are needed to encourage teachers (Rahim et al., 2019). The acquisition of digital competencies is influenced by teachers' personal skills as well as other external factors such as knowledge management processes (Sobandi A. et al., 2021). Therefore, this study aims to investigate whether knowledge management processes can be used as an alternative strategy by schools to equip teachers with the necessary digital competencies to meet the upcoming challenges of the fourth industrial revolution.

2. Literature review and hypothesis

2.1 Knowledge management and knowledge management processes

Knowledge management is a new branch of management science whose main purpose is to integrate internal and external knowledge to deal with environmental changes both inside and outside the organization, solve existing problems, and innovate an organization. Grover & Davenport (2001) argue that effective knowledge management is a critical component for organizations to secure sustainable strategic competitive advantage. To achieve this, the organization must provide a learning environment for its employees so that knowledge is accessible to all who need it (Nonaka & Konno, 1998; Danenport & Prusak, 1998). There are a number of definitions of knowledge management that are applicable to the educational context. Worth mentioning is Dalkir's (2013) explanation in which knowledge management can be defined as "*the deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure to create value through reuse and innovation. This coordination is achieved through the creation, sharing, and application of knowledge, as well as by feeding valuable lessons learned and best practices into organizational memory to promote continuous organizational learning*." In the case of organizations whose strategy is knowledge-driven and which use knowledge to gain a competitive advantage, knowledge management processes must be clearly defined. According to many scholars, these processes should be: acquisition, conversion, application, and protection (Gold et al., 2001) - creation, storage, transfer, and application (Alavi and Leidner, 2001) - acquisition, conversion, and application (Liao and Wu, 2009) - identification, acquisition, storage, sharing, and application (Ali Zwain et al., 2012), and generation, codification, sharing, and use (Muhammad et al., 2011).

For the purpose of this document, the knowledge management practices mentioned by (Gonzalez, R. V. D. et al., 2017) are adopted and defined as follows:

a. Acquisition

Knowledge acquisition means that employees gather and acquire useful knowledge for performing their work activities (Tan & Wong, 2015) and can be seen as a transformation

process in which knowledge passes from its explicit form to its tacit form (Nonaka & Takeuchi, 1995). Knowledge creation begins with the skills of individuals, and appropriate and meaningful training programs or seminars are a means for employees to acquire new knowledge and experiences (Lee and Lan, 2011). Knowledge acquisition involves the organization's ability to absorb knowledge from its primary knowledge base in a learning perspective (Lopez & Esteves, 2012).

b. Storage

The most important process after knowledge acquisition is that of storage, as this is how specific knowledge data repositories or organizational memory are created, which is essentially how they recover knowledge and generally access it anytime, anywhere (Walsh & Ungson, 2009).

c. Distribution

Knowledge distribution is more about the collective nature of knowledge that results from social interaction (Levine & Prietula, 2012). When using the term "knowledge distribution" within an organization, it broadly means that knowledge "flows" within the organization and enhances the ability to know and learn at both the individual and group levels. In addition to knowledge distribution between individuals, there is also knowledge distribution between individuals and knowledge repositories, with tools from IT facilitating this process (Arpaci, 2019).

d. Use

Knowledge use refers to the application of knowledge for decision-making, problem-solving, and coordination by individuals in organizations. Employees accomplish this by applying and adopting best practices in their daily tasks (O'dell & Grayson, 1998). This also means that this process puts knowledge into practice, where employees should apply lessons learned from previous mistakes or experiences (Nonaka & Tacheuchi, 1995). Thus, when preexisting knowledge leads to improvements in the organization's routines and processes, the use of knowledge becomes exploitative or exploratory when the knowledge base is used as primary knowledge to create new knowledge in an innovative proposal (Cohen & Levinthal, 1990; Ganzaroli et al., 2016).

2.2 Teachers' digital skills

Digital literacy is based on basic information technology and communication skills, such as using computers, disseminating information, and also communicating via the Internet. To master these skills, sufficient knowledge of how to use each application in everyday life is required. Such applications can be communication through e-mail, editing and formatting texts, creating presentations and databases, but also the proper use of computers. In addition, necessary pillars of their mastery are the cultivation of understanding, creativity, cooperation, and innovation, as well as the evaluation of available information in terms of validity, but also the ability to use the means wisely (European Council, 2018).

According to the "Dig Comp" 2.0 framework, the digital competencies that 21st-century teachers need to improve educational practice and for continuous professional development have been classified into five categories (INTEF, 2017):

A. Information and Information Literacy. They refer to:

a) information gathering resulting from searching and filtering relevant content in the digital applications of the Internet, but also to the development of personalized search strategies;
b) management of the information gathered through a set of actions that include storage, organization, and retrieval of data;
c) critical evaluation of the digital material through analysis and comparison to verify the validity of the data.

B. Communication and Collaboration, consisting of:

a) communication and interaction through the use of digital platforms;
b) exchange of digital material with other users;
c) participation of the public through digital portals they have created to offer users a wide range of services;
d) development of collaboration through technological methods that promote actions based on collaboration;
e) the correct application of the ethical code of conduct on the Internet, during the use of media and communication through them;
f) the creation of a digital identity, for the purpose of personal protection.

C. Creation of a Digital Context, which includes:

a) the processing and transformation of material into different types;
b) the integration of digital material into an existing material, after improvements, with the aim of creating a new one;
c) understanding the application of intellectual licenses and rights to the content of digital origin;
d) programming, using technical procedures, development and processing of software.

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D. Security, which includes:

a) the protection of technical devices from digital risks in their respective environments;
b) the protection of personal data by understanding their application and processing;
c) the protection of health, which may be exposed to risks in the use of digital media, such as physical and mental stress;
d) the protection of the environment from the effects of the extensive use of new technologies.

E. Problem Solving, a category composed of:

a) solving technical problems that may arise in the operation of digital devices;
b) finding methods and tools to cope with technological demands;
c) introducing innovations by applying digital technologies to solve conceptual issues;
d) uncovering deficiencies in digital capabilities by identifying the weaknesses and finding ways to improve them.

2.3 Knowledge management processes and teachers' digital skills

Knowledge management processes in schools can be viewed as a strategy to help teachers gather information or use organizational knowledge as resources to enhance their professional development (Zhao, 2010), increase their effectiveness in teaching and learning (Leung, 2010; Cheng, 2014), and generally improve intellectual capital (Cheng, 2017). Knowledge management processes can also be used as an alternative strategy by schools to help teachers equip themselves with relevant skills for 21st century challenges (Chu et al., 2011; Alshehri & Cumming, 2020). In particular, they can promote teachers' acquisition of digital literacies (Silamut & Petsangsri, 2020; Sobandi A. et al., 2021). Based on the preceding discussion, Hypothesis 1 was formulated as follows:

H1: Knowledge management processes have a positive impact on teachers' digital skills
H1a: Acquisition process has a positive impact on teachers' digital skills
H1b: Storage process has a positive impact on teachers' digital skills
H1a: Distribution process has a positive impact on teachers' digital skills
H1a: Use process has a positive impact on teachers' digital skills

3. Materials and Methods

3.1 Population sample and data collection

The sample of the study consisted of 668 secondary school teachers who answered the questionnaire, which was issued as part of the study between April and June 2022. In order to ensure the representativeness of the sample, 374 secondary school teachers (Lykeio) and 294 vocational school teachers from the Epirus region, which consists of the four cities of Ioannina, Arta, Preveza and Igoumenitsa, completed the questionnaires.

Table 1: Demographic characteristics

		Frequency	Percent %
Working context	Upper Secondary school	374	56
	Vocational school	294	44
	Total	688	100
Number of teachers in the school	<20	129	19,3
	21 - 40	297	44,5
	41+	242	36,2
Gender	Male	275	41,2
	Female	393	58,8
Age	< 30	21	3,1

	31 - 40	140	21
	41 - 50	273	40,9
	51+	234	35
Higher degree	Bachelor	339	50,7
	2nd Degree	41	6,1
	MSc	256	38,3
	PhD	32	4,8
Working experience	0 - 5	99	14,8
	6-15	184	27,5
	16 - 25	266	39,8
	26 +	119	17,8
	Total	668	100
Job status	Permanent	485	72,6
	Annual	183	27,4
	Total	668	100

Analytically, the sample consisted of 393 women and 275 men, mostly over 40 years old (539 in total). Of the total sample, 485 have permanent jobs and a wide range of professional experience, and it is impressive that 256 educators have a Master's degree. The following details the characteristics:

3.2 Instruments

Our study used a five-point Likert scale ranging from "1 - strongly disagree" to "5 - strongly agree." The constructs were adopted from previous research studies. The knowledge management process measures consisted of 16 items and were modified from Gonzalez & Martins (2017). Knowledge acquisition consisted of four items. Two sample questions worth mentioning are: "*My school encourages teachers to take frequent tests and put newly acquired knowledge into practice*" and "*My school is committed to attending professional development courses for teachers*." Knowledge storage consisted of 4 items. Two sample questions worth mentioning are "*In the school where I work, there is a file of best practices from colleagues*" and "*When faced with a problem, I can easily access the databases to find the relevant information*." The knowledge distribution consisted of four questions. Two sample questions worth noting are "*At the school where I work, the most experienced teachers guide the less experienced ones*" and "*My school has an effective computerized system to support collaboration among teachers*." Knowledge use consisted of four items. Two sample questions worth noting are "*My school applies learning through mistakes and failures to acquire new knowledge*" and "*My school successfully applies new knowledge to help teachers do their jobs better*." To measure teachers' digital skills, the Analysis of Common Digital Competences (ACDC) questionnaire was used, adapted from Sánchez-Cruzado, C. et al. (2021). The questionnaire measures teachers' ability to deal with the areas of information literacy, communication and collaboration, creating a digital context, security, and problem solving, and includes 12 questions to measure this construct. Four sample questions worth noting are: "*I know how to use tools to select and organize information from the Internet*," "*I know tools to create instructional videos*," "*I know the legal and ethical aspects related to ICT*

use, security, and privacy management," and "*I know how to protect digital devices, files, and passwords*."

3.3 Technique

The partial least squares (PLS) procedure was used because it is able to represent the relationship between all latent constructs simultaneously while accounting for measurement error in the structural model (Hair et al., 2017).

4. Results and discussion

In the first phase of the study, external loadings, internal consistency reliability, convergent validity, and discriminant validity were tested with the 28 items of the questionnaire. Some factors were then removed after scoring because their factor loadings were below the threshold of 0.60 (Hair et al., 2019). As shown in Table 2, the final measurement model has 24 items.

Table 2: Outer loadings, internal consistency reliability, convergent validity

Construct	Items	Loadings	Cronbach	CR	AVE	Rho_A
Acquisition (KA)	KA1	0,852	0,837	0,891	0,672	0,841
	KA2	0,805				
	KA3	0,835				
	KA4	0,784				
Storage (KS)	KS2	0,873	0,846	0,907	0,765	0,847
	KS3	0,860				
	KS4	0,891				
Distribution (KD)	KD1	0,865	0,852	0,900	0,692	0.855
	KD2	0,812				
	KD3	0,828				
	KD4	0,823				
Use (KU)	KU1	0,834	0,801	0,871	0,629	0,811
	KU2	0,879				
	KU3	0,727				
	KU4	0,722				
Digital skills (DIG)	DIG1	0,695	0,936	0,947	0,664	0,939
	DIG10	0,878				
	DIG11	0,871				
	DIG2	0,789				
	DIG3	0,812				
	DIG4	0,805				
	DIG7	0,806				
	DIG8	0,813				
	DIG9	0,850				

In Table 3, discriminant validity is demonstrated in accordance with the criterion of Fornell and Larcker (1981).

Table 3: Discriminant validity

	DIG	KA	KD	KS	KU
DIG	0,815				
KA	0,787	0,820			
KD	0,791	0,814	0,832		
KS	0,730	0,760	0,824	0,875	
KU	0,756	0,836	0,833	0,818	0,793

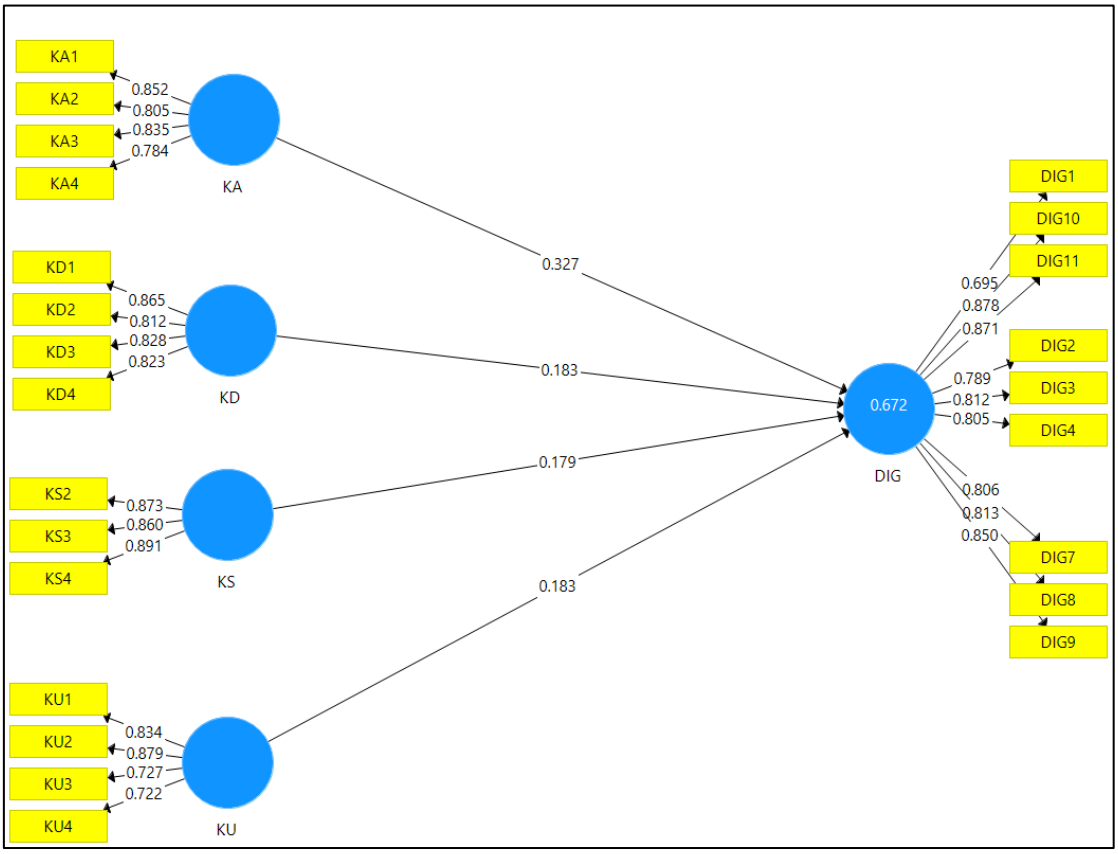

Figure 1: Measurement model result

Table 4: Results of the hypothesis testing

		Original Sample (O)	Sample Mean (M)	Standard Deviation	T Statistics (|O/STDEV|)	P Values	Decision	2.5%	97.5%
H1a	KA -> DIG	0,327	0,326	0,067	4,849	0,000	Supported	0,195	0,459
H1b	KS -> DIG	0,179	0,179	0,049	3,657	0,000	Supported	0,081	0,278
H1c	KD -> DIG	0,183	0,185	0,076	2,395	0,017	Supported	0,034	0,335
H1d	KU -> DIG	0,183	0,183	0,049	3,752	0,000	Supported	0,088	0,278

In H1a, it was hypothesized that the acquisition process would have a positive effect on teachers' digital literacy. The overall effect of the appropriation process on teachers' digital skills is positive and significant (path coefficient=0.327, t=4.849, $p < 0.001$, f2=0.036). Thus, a school that promotes teacher training, learning through trial and error, and the development of a learning-centered culture could help teachers improve their digital skills.

H1b states that the storage process has a positive effect on teachers' digital literacies. The overall effect of the storage process on teachers' digital competencies is positive and significant (path coefficient =0.179, t=3.657, p < 0.001, f2=0.023). Therefore, incorporating knowledge acquired in procedures and rules of school units and retaining knowledge generated by individuals and socialized in groups could help equip individuals with digital skills.

In H1c, it was claimed that the distribution process has a positive effect on teachers' digital skills. The overall effect of the distribution process on teachers' digital skills is positive and significant (path coefficient =0.183, t=0.076, p < 0.05, f2=0.019). Sharing knowledge between individuals through continuous social contact or using information technology as a mediator for sharing could help teachers improve their digital skills.

H1d states that the use process has a positive effect on teachers' digital skills. The overall effect of the use process on teachers' digital skills is positive and significant (path coefficient =0.183, t=3.752, p < 0.001, f2=0.023). Using knowledge to redesign the routines and procedures of educational institutions could increase teachers' digital skills. As for hypothesis H1, the results show that all knowledge management processes can contribute to equipping educators with digital competencies to meet the challenges of the fourth industrial revolution and to transfer these competencies to their students. This study confirms recent research showing that knowledge management processes can promote teachers' acquisition of digital competencies (Silamut & Petsangsri, 2020; Sobandi A. et al., 2021).

From the research findings, it can be inferred that a satisfactory knowledge management environment in schools can contribute to teachers' professional development (Zhao, 2010) and improve intellectual capital (Cheng, 2017). Knowledge management strengthens the culture of knowledge sharing and promotes collegiality in school organizations. Knowledge management improves novice knowledge and supports innovative teaching for more effective learning. (Leung, 2010).

5. Recommendations

The practical significance of this study is that our findings offer guidance and insight to leaders seeking to improve faculty digital literacy. Teachers' digital literacy is an important source of Education 4.0, and knowledge management processes could contribute to individual digital literacy; more specifically, the more successful knowledge management phases are, the more teachers' digital literacy improves.

6. Conclusions

The purpose of this study was to investigate the impact of knowledge management processes on teachers' digital literacies. In times of "liquid modernity", characterized, as social theorist Zygmunt Bauman pointed out, by constant change and the continual replacement of the old with the new, schools and their staff must recognize and respond

to the demanding role they are expected to play in a knowledge-based society. They must continuously and exclusively manage the processes involved in the creation of knowledge and recognize the value of the intellectual capital they offer to society. Since there has been limited research on the impact of knowledge management processes at the individual level, this study focused on improving teachers' digital competencies. However, further research could also analyze the impact of knowledge sharing on teachers' digital competencies.

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Conflict of interest statement
The author declares no conflicts of interest.

About the Author
Zoi Karageorgou has a Bachelor's degree in Educational Technologist and Mechanical Engineer from the School of Pedagogical and Technological Education in Athens. She has supervised public works (mainly electromechanical projects of OTE SA) from tendering to completion. She has also worked as a quality representative. Now she works as a mechanical engineering teacher at the Vocational School of Arta. She obtained her Master of Science degree at the International Hellenic University in the field of management and organization of educational institutions.

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