Knowledge pills in Education and Training: A Literature Review

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Abstract: Object and purpose: Knowledge pills (KPs) are a technique for transferring knowledge through short factual batches of content. In education and vocational training, they can help learners acquire specific pieces of knowledge in a few minutes, through a "microteaching" approach where learners can be involved in active and interactive exercises, quizzes, and games. Thanks to the advancements of multimedia platforms, they can contain a mix of contents, i.e.: lecturer voice, images, videos, or other e-learning applications. This paper explores the state-of-the-art literature on KPs, with a special focus on their actual use as a mechanism to boost effective knowledge transfer and learning processes. The goals are a) to clarify the definition and peculiar characteristics of KPs; b) to classify their main typologies; c) to analyse their implications under a knowledge management perspective, and d) to highlight actual application fields, pros, and possible cons. Methodology: This study is based on a literature review by means of a search in global citation databases and on a snowball effect, with collective participation and sharing among all the authors. The articles found were then selected and carefully analysed. Findings: The advantages of KPs can be related to the division of knowledge into small parts, which also fits today's needs of learners to "study faster" and acquire the specifically required knowledge. In addition, KPs are made of reusable materials and can be more easily updated than traditional supports. Possible limits are that designing a KP can be difficult, and careful consideration of the actual learning process and the mechanism by which a certain type of knowledge is transferred from a "knower" to a "learner" is required. Research limitations: Research is based on a limited literature review. However, this limitation is going to be overcome in future research. Practical implications: Findings provide useful insights not only for academics and researchers but also for teachers and trainers dealing with all types of education.

Keywords: knowledge management, knowledge pills, e-learning, literature review

1. Introduction

Access to knowledge and information is quite easy nowadays, however, this is not enough, because knowledge only becomes powerful through its appropriate application (Durst and Zieba, 2018). At the same time, organizations often face problems related to knowledge, for example, lack of up-to-date knowledge, or knowledge gaps that may hinder their operations (Durst and Zieba, 2020). This brings the need for new solutions that could help organizations in upskilling their employees and updating their knowledge. One such solution is a knowledge pill. Knowledge pills (KPs) are a technique for transferring knowledge through short factual batches of content (Sánchez et al, 2010a). They can help learners acquire specific pieces of knowledge or practical skill in a few minutes, through a "microteaching" approach where they can be involved in active and interactive exercises, quizzes, and games (Cancela et al., 2012). This explains the growing popularity of KPs, especially in areas like vocational training (Gracia-Morán et al., 2013) where people need to learn as fast as possible. Thanks to the advancements of multimedia platforms (Bakala, 2018), KPs can contain a mix of contents, i.e., lecturer voice, images, videos, or other e-learning applications.

This paper explores the state-of-the-art literature on KPs, with a special focus on their actual use as a mechanism to boost effective knowledge transfer and learning processes. More precisely, the goals are a) to clarify the

definition and peculiar characteristics of KPs; b) to classify their main typologies; c) to analyse their implications under a knowledge management perspective; and d) to understand actual application fields, pros, and cons.

The literature analysis was done by means of a free search into the citational database Google Scholar performed individually by each author of the paper during the first months of 2022. A selection of relevant sources was made, and additional material was included by further analysing citations and references in a sort of "snowball" technique. The pertinent articles and books were critically examined to extract and classify the information, presented in this paper in a preliminary and synthetic way.

The paper is organized as follows. In the next section, a mention of the emergence of new active teaching/learning methods and the connection to the knowledge management field is made. Section 3 examines the existing literature on KPs, the current definitions, types, and applications. Also, the connection with the knowledge management field is highlighted. The paper terminates with a conclusion section that summarizes the main findings.

2. Knowledge management processes in active learning and teaching

It is now widely recognized that, in education and vocational training, learning involves many capabilities, requires active participation and contribution by learners, and is also based on the individual and social experience of "what is being learned" (Merriam and Bierema, 2013).

Indeed, the new emerging types of jobs that continuously appear every day, lead to switching the focus on learners from purely passive "receivers" of pieces of knowledge transferred from teachers, to engaged "creators" of their knowledge by means of active learning processes that help them construct and personally assimilate interpretations and applications of knowledge. In addition, very rarely a person owns all the knowledge that is required to face a situation, and collective learning processes are needed, where people work together, share communication languages, and make decisions with others. Finally, learners must be ready to continuously assimilate new updated content and skills, from a lifelong training perspective, to face the challenges of dynamic societal and technological changes.

For specular reasons, the role of the instructor is not that of merely "transferring" the knowledge they possess to learners, but rather to help them process and assimilate knowledge contents, activate autonomous learning processes, and build their own knowledge base for their professional career and life. Active learning/teaching methods, i.e., "any instructional method that engages students in the learning process" so that they "do meaningful learning activities and think about what they are doing" (Prince, 2004), are becoming popular. The literature has already indicated how active teaching and learning can engage both students and learners in new knowledge management processes both at an individual and collective scale (Bolisani, 2019). New forms and methods of teaching become important (Merriam and Bierema, 2013), and technologies and e-learning tools are deemed important to improve this process, by activating new forms of knowledge sharing, construction, and assimilation (Maabreh, 2018). The importance of KPs can be framed in this context.

3. Knowledge pills as an innovative teaching method – literature review

The literature about KPs is still scarce and mainly devoted to the education field. A rapid search for this term on the citational database Scopus carried out on 16th March 2022 yielded less than ten references. On the contrary, this instrument seems to raise more interest among practitioners, as confirmed by the fact that a search on Google carried out on the same day produced more than 10,000 results. In the following sections, some information about definitions, classifications, advantages and problems of KPs applied to organizations are presented.

3.1 Definitions

One can find different definitions of KPs in the literature. For example, Bengochea and Medina (2013) refer to them as "little pieces of didactic material, created with the goal of promoting audio-visual learning, and designed to complement traditional strategies, making comprehension easier for students, either because of its conceptual depth, or its technical complexity" (p. 82). Similarly, Wozniak-Zapor et al. (2020) defined knowledge pills as a way of "transferring knowledge" by means of short but factual batches of material, so that "small fragments of knowledge concerning selected fragments of a wider issue are provided in a condensed form". The 'WeLearning" Team defined a KP as a short, concise piece of content provided to the user quickly and efficiently.

Some other authors (Bakala, 2018) considered KPs as digital instruction materials – short multimedia tips, which are one of the didactic means of innovative and interactive learning process, enhancing modern methods of education, known as smart learning (Ashfaque et al., 2014). The American KM Institute (www.kminstitute.org) used similar terms (knowledge base, or Knowledge Nuggets) to refer to a refined or granular knowledge content on a specific task.

Carrera (2011) considered a KP as a small unit of explicit knowledge in a multimedia format to be used from the "just-in-time" training perspective. Like pills someone takes for the instant relief of some state of illness, KPs enable the user to immediately overcome a situation in which there was a lack of knowledge that needed to be supplied right away (Carrera, 2011). This definition specifically refers to the use of KPs in business, for professional or vocational training. The author affirms that the KP approach allows for efficient education and knowledge sharing in the company, since it uses a set of tools designed to share knowledge and skills easily and effectively among employees. Using KPs in businesses offers several advantages (Mazur et al., 2015; Carrera, 2011):

- It facilitates know-how development
- It transforms each employee into a training agent inside the organization to which she/he belongs.
- It consolidates the existing knowledge in the organization.
- It avoids the permanent repetition of informal training processes.
- It reduces the costs of traditional training.
- It enables the training of employees, customers, and partners.
- It enables training when it is necessary and as many times as it is necessary.
- It enables more involving learning processes than simple reading a text.
- It is particularly effective in environments where there is a rotation of personnel.
- It doesn't require previous knowledge for the learner

3.2 Types and applications

Based on their aim, three main categories of KPs can be singled out (Sánchez et al, 2010b; Carral et al, 2010), as follows.

- *concept learning pills*, pertaining to the knowledge of concepts, classifications, definitions, theories, description of phenomena, etc. For example, they can be used in a course to introduce or summarize some basic conceptual points that are important for the learners to assimilate for further understanding other parts of the course;
- *exercise learning pills*, that can be used to acquire competences or skills that may involve both problem solving and practical activities – of delimited scope – where learners are invited to apply pieces of knowledge acquired elsewhere (or in another part of the course). This can be, for example, the mathematical resolution of an equation, the execution of some manual activity, the solution of a practical problem, etc. They can be provided in a form that includes the presentation (for instance, in a video) of the problem or goal to achieve and, later, a possible solution of the problem. The learner first reflects on the proposed problem, then she/he can learn from the instructor a possible way to deal with or solve it. The pill can end with another version of the problem (for example, an equation with different data) to which learners can try to re-apply the knowledge acquired in the first part to the newly proposed problem.
- *testing knowledge pills*, that can be used to evaluate the level of knowledge of students. These can be proposed as intermediate or final tests in a course. They can be used for learners to self-assess their level of acquired knowledge, or as ways for teachers to assess what (and how) was learnt by students, and can also serve as feedbacks for instructors themselves. KPs can be provided in the form of written or online quizzes (even with animations), and can be followed by explanations of the solution by the instructor. In some cases, students can be allowed to repeat the test pill as many times as they like (so it also serves as a way to consolidate the acquired knowledge). Generally, these tests have a delimited scope so that they can be performed in a short time.

The use of a typology or another can be connected to the aim or expected impact of the educational approach (Franco et al., 2017) and in particular can be aimed:

- to favour *conceptual enrichment*, namely the comprehension and assimilation of specific contents of a subject

- to implement *procedural development*, for instance, to learn the steps to perform a specific action, operation, etc.
- to facilitate *attitudinal changes* and the development of some social or personal skills.

KPs can have different possible formats, and can include audio, video, animations, graphic and multimedia presentations (Carrera, 2011), even combined to one another. The use of an online e-learning platform (or another digital portal) is often recommended. A major advantage of this format is the ability to convey knowledge in a fast and accessible way for almost all devices with just an internet connection.

The most common form is a short video, presented in an attractive form, for example, an instructional presentation showing how to perform various activities within particular jobs. A video format can be effective (Carrera, 2011) because a KP has the purpose to overcome the mere delivery of content (as would be done by a book) and, instead, to simulate an indirect interaction between the instructor and the learner: for example, the learner can see how the instructor performs a specific activity, can hear comments and perceptions directly from the instructor's voice, can contextualise that activity by seeing where the instructor operates, etc.

KPs can find a wide range of applications. For Gracia-Morán et al. (2013), an elective application is vocational training: "Firstly … professionals can only devote a limited amount of time. And secondly, its prior learning can be quite heterogeneous. As a result, units of content should follow the design of knowledge pills, they should remain available 24/7/365 (so they must be online) and, for each unit, precise identification and assessment of prior learning and learning outcomes should be done". The use of KPs, thus, aims to strengthen the professional competence of learners. Once made, KPs can be used many times, only with a slight supplementation or update sometimes. In this case, KPs should be delivered by an online e-learning platform, where they can be easily uploaded and updated.

For some employees, KPs can be a good solution for filling a specific competence gap, while for others, they can help learn by repetition. KPs are also commonly used in personal development for acquiring specific skills for purely private purposes, or for building or strengthening one's position in the labour market (Bakala, 2018), i.e., by improving the personal CV.

A KP can be proposed as a standalone training tool in case of specific purposes, or in combination with other KPs as a series to completely cover a topic, they can also play an introductory role or can consolidate the didactic content presented in traditional or distance classes (Woźniak-Zapór et al., 2020), due to their condensed way of presenting the most important information on a given topic.

3.3 KPs and knowledge management in organizations

KPs can be seen as Web 2.0 tools (specifically video tools) that can be used to enable KM (Mazul et al., 2015). In particular, KPs can support two knowledge processes, that are knowledge identification and knowledge sharing. Therefore, they can be a useful tool for organizations to fill their knowledge gaps or to update their obsolete knowledge. They may also allow better knowledge sharing among employees who need a particular type of knowledge.

The mentioned advantages of KPs (see section 3.1) can also be related to knowledge management processes and activities, for example:

- KPs can facilitate the acquisition or consolidation of professional know-how and can enable the designing of training tailored to the knowledge needs that are specific to a duty. Especially for practical tasks or procedural activities, people often learn and memorize better by seeing than they can do by reading a manual
- They can transform each employee into a training agent inside the organization, because she/he can easily transmit knowledge by creating a KP, for example in a video format showing how a particular activity must be performed
- KPs can consolidate the knowledge already existing in the organization, by creating a sort of organizational memory
- They can avoid the permanent repetition of informal training processes and can reduce the costs of traditional training; training can be performed, even in a self-service mode, whenever it is necessary and as many times as it is needed

- They can easily enable the training not only of internal employees but also customers and partners; they are particularly effective in environments where there is a rotation of personnel.
- No previous knowledge is necessary to be trained through the use of this method because its access is easy and comfortable; the speed of training content creation is also high.

Additional to or outside a formal training system, KPs can support acquiring new skills by effectively organizing knowledge and tasks, and also offering evaluation tools (Arce-Fariña et al., 2013; Ulloa et al., 2011). They are, in themselves, a self-learning tool, nevertheless, they might be incorporated in a learning community of practice, allowing not only knowledge sharing but also the connection to other learning objects integrated into dynamic repositories and e-learning platforms (Álvarez-Bermejo et al., 2017).

KPs are mostly effective for transferring knowledge and building abilities related to simple tasks and topics. However, they can also be useful to understand complex concepts effectively because they can be used to summarize ideas and to provide short tutorials regarding the basics of a complex concept and process (Woźniak-Zapór et al., 2020). Used additionally to classical instruction methods, KPs can increase learners' performance (Vázquez-Rodríguez et al., 2019), in traditional education but also in businesses.

However, the implementation and use of KPs can have some drawbacks and issues. Some studies on the impact of KPs as means to transfer knowledge show that they are evaluated as useful and attractive by students, but they can be less motivating, as well as too slow (Bakala, 2018). Another key problem is that designing and applying KPs are complex processes, which need time and preparation. Ensuring the quality of the products, both considering contents and form, is challenging. Choosing the appropriate ideas, synthesizing complex knowledge contents, adopting the right length and format, and ensuring the communication quality of the product are some of the core issues. Therefore, a significant amount of time is required to collect and select the materials, to record and to edit multimedia content (Mazur et al., 2015). All this can be demanding, especially considering the limited scope of each produced KP. Therefore, creating KPs makes sense if the costs for their production can be spread over a sufficient number of users. This is possible when many individuals need the same piece of knowledge, as in the case of students of a course or members of large organizations who have to study the same topic. The situation changes deeply when smaller companies are involved, or if the needs of students change: in this case, a KP could be of use only for a specific and limited number of users, and for a limited time span.

In terms of pedagogical approach and to ensure an effective knowledge transfer, there are three main dimensions to consider: subject matter content (i.e., focus of the KP, its usefulness and significance), methodology (namely, the proper way to engage students and activate learning), and technology (i.e., choosing and designing the appropriate tool) (Bakala, 2018). The communication format is also critical: KPs should be synthetic, interesting, and dynamic (Woźniak-Zapór et al, 2020).

Learning based on KPs is also an example of collective learning, based on the involvement of many individuals and leading to the accumulation of knowledge through the implementation of specific practices. The sharing and modification of these practices form the basis of learning (Beerepoot, 2008). Collective learning is thus a social process in which knowledge is acquired through interactions with other actors, such as meetings, conversations, etc. (Capello, 1999). Social learning, therefore, goes beyond individual learning and competence acquisition and is based on engaging in collaborative activities (Rozkwitalska and Lis, 2020). Through social learning, participants learn from each other using the demonstration effect. Geographical proximity helps this because the short distance between the actors and the resulting cultural commonality fosters the initiation of interaction and the development of informal relationships (Boschma, 2005). Besides, the shorter the distance between partners, the lower the cost of sharing knowledge and information (Doloreux, 2002).

The above arguments take on a slightly different meaning in the face of the development of technologies which partially remove the physical distance barrier and at the same time contribute to the development of communicative proximity (Lis and Lis, 2021). Communication proximity consists of three other dimensions of proximity: relational proximity, referring to inter-organizational relationships (Eklinder-Frick et al., 2011); virtual (electronic) proximity consisting of indirect distance communication facilitated by digital technologies (Zeller, 2004); and communication proximity, i.e., temporary geographic proximity involving direct face-to-face contact, but for a limited time (Torre, 2008). Thus, in the era of the dynamic development of digital communication technologies, geographical proximity is not indispensable for effective learning based on social processes.

Communication proximity, especially in the virtual dimension, can be treated as an important substitute for geographical proximity, fostering knowledge transfer. For this, KPs can be a particularly appropriate approach.

4. Discussion and conclusion

Nowadays, knowledge, as a fundamental resource of societies, has to be properly delivered or accessed by learners in a fast and convenient way. The consequent shifts in education and training, which can currently be noted, are connected to multimedia. However, though the internet contains millions of didactic materials, selecting those which are really useful can be very difficult and discouraging. To mitigate such problems, the use of KPs might become important. They are purposely designed short multimedia tips, enabling students and company trainees to strengthen their competences. For this reason, as our analysis showed, they have been recently noticed as a promising teaching and training method based on multimedia and e-learning systems. Their use also provides better alignment of educational and training materials, and lead to improved effectiveness of teaching-learning. A significant part of the literature considers KPs in the context of higher education, especially for young and dynamic groups of students, whose main goal is to acquire knowledge as fast as possible, in a standalone modality or as a part of a longer and more complex teaching program. A significant and emerging context is that of vocational training for business purposes and especially in companies for their employees, where the use of KPs tends to be quite specific and activates some special attitudes and processes.

In general, today's learners perceive the internet and interactive tools as common means of information and knowledge development (Crespo and Sánchez-Saus Laserna, 2020), so KPs can meet their favour. As Bakala (2018) showed, most of the surveyed learners consider KPs to be a very good and useful didactic material, and other studies show a willingness to be used, especially by those spending more hours online (Antolin-Lopez and Garcia-de-Frutos, 2015; García-de-Frutos and Antolin-Lopez, 2016). There is an increasing need for easily-found guidelines, which should be logically categorized, short and available, and this explains why there may be a need for increased and better use of KPs in education and training. Indeed, the interest of both the academic and business world in KPs is rising, and they are deemed to be an excellent means of education within blended learning or online learning programs (Bakala, 2018).

The advantages of KPs include the possibility to be used independently from one another or easily connected in a series; their content is easy to remember, and they can easily adapt to the learning level; simpler and faster learning than formal training sessions becomes possible; finally, flexibility in use on various platforms, with various teaching methods, and for different expected outcomes should finally be mentioned (Bakala, 2018; Woźniak-Zapór et al., 2020). Another positive aspect is that when students find it difficult to quickly identify the knowledge they need, KPs can contribute to addressing this difficulty because their content can be easily grasped at a first glance with no waste of time (Barcena and Sanfilippo, 2015).

In contrast, the adoption of KPs implies some potential problems and risks. Not only proper methods and technologies must be adopted to easily define and implement KPs, but also teachers and learners must be aware of how to get the most out of them. A careful selection of content to be provided is necessary, because KPs are, by definition, a fast-learning technique. KPs, if not properly designed, may simply be intended as a presentation of a set of pre-defined knowledge elements that the learners must accept with no critical examination. In other words, a proper methodology has to be used in the design and creation of KPs, to allow the activation of personal learning processes by learners and their increased interest and motivation. Special expertise by teachers and instructors that are willing to use this method must be developed, which can raise the cost of their adoption. The literature also showed that there are different categories or versions of KPs, therefore there is a need for instructors to choose the proper format in accordance with the specific pedagogical needs and, also to the KM processes which the KP is aimed to activate and facilitate. Finally, KPs may require some sort of maintenance for keeping them updated.

This study proposed a summary of the extant literature on KPs, but it does have some limitations. First of all, it is based on the analysis of a subjective selection of scientific and business publications. However, it must be remembered that there is still scarce literature on this topic and not many empirical studies that examine this training method. So, this paper must be intended as a preliminary study on KPs, and more research is required on how this method can be used for effective management of knowledge and learning processes. This also represents a future research agenda.

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