Editorial

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1   Introduction

Knowledge management (KM) emerged as a discipline in early 1990. Since then a lot of efforts have been made to identify and study the strategic impact of KM in business management. In this prospect a number of conceptual frameworks have been proposed with the scope of defining the features, contents, role and relevance of KM (Poynder, 1998; Wiig et al., 1997; Sveiby, 2001; Heisig, 2009; Liebowitz and Wilcox, 1997; Nonaka et al., 2000; Schiuma, 2009). These frameworks have significantly contributed to identify and understand the position and application of KM within organisations and to disentangle the complex relationships linking the assessment and management of knowledge resources with the organisational value creation capacity.

After more than two decades of research it is important to clarify how this research stream can be further developed. Some authors point out that most of the attention has been paid on KM in terms of enablers, processes, people, technologies or performance but mainly in isolation. For example, Meso and Smith (2000) consider that under a socio-technical perspective, KM activities are seen as being complex combinations of technology and organisational infrastructure, corporate culture, knowledge and people. Korac-Kakabadse et al. (2002) argue that alternative views to KM for innovation that are more contingent and contextualised need to be explored. Phipps and Prieto (2012) develop a model showing the relationship between knowledge management and creativity, and stressing the moderating effect of entrepreneurial mindset to seek, identify, pursue, and exploit opportunities.

There is no doubt that KM is now at the crossroads and needs to look to new research and practice-oriented horizons and, then, advance new thinking in relation to the complex and multifaceted essence of knowledge as a driver of performance and growth. A 'quantum leap' is needed to avoid that KM becomes just a fad (Ruggles, 1998) and to solve the questioning of whether KM can survive into the future (Liebowitz, 2011). As in the quantum physics, the energy to allow KM moving from the current 'state' of research to the next one (future directions) can be provided adopting breakthroughs approaches or providing to the system sudden energy from multi-disciplinary and holistic contributions deriving from other disciplines.

In our view, a potential way to move forward the research on KM would be to consider how existing research in other disciplines can impact and most importantly can be integrated with KM theory and practice. Besides strategic management, economics, accounting, and information technology, more attention should be paid to psychology, sociology, anthropology, political science, arts, science, architecture and neurosciences (Moustaghfir and Schiuma, 2013). Some scholars also recognise the importance of such a multi-disciplinary approach and some others already made attempts to apply such principles while conducting their research studies (Corallo et al., 2015).

This special issue reflects on the future challenges of KM as a discipline and it suggests insights and directions for future research (Heisig, 2015; Scholl et al., 2004). The purpose is to identify the possible future contributions of KM to the literature and to the management processes and practices in order to point out the conceptual pillars as well as to contribute to the evolving debate investigating new theoretical and empirical implications.

In this introduction to the special issue we will first discuss an epistemological view of knowledge and the KM perspectives that have been analysed so far. Next, we will draw some perspectives on how to move the field of knowledge management forward.

Finally, we will present the genesis of this special issue and outline the paper selection process summarising the key elements of each of the included papers.

2 An epistemological view of knowledge in management studies

Information and knowledge have been also at the centre of scholarly research in different disciplines. Since then, the recognition of the importance of information and knowledge have crossed over to the firm and knowledge itself, besides traditional factors of production, such as labour, capital, and land, has been heralded as the most important resource of all (Drucker, 1993). Knowledge has been recognised as the most crucial factor for sustainable competitive advantage (Davenport and Prusak, 1998), and particularly as an intangible resource that is used for the attainment of sustainable competitive advantage (Lee and Kim, 2001; Sher and Lee, 2004; Hooff and Huysman, 2009). Companies must now reach higher levels of knowledge productivity to achieve enduring success (Drucker, 1993), and its management represents a critical issue in an organisation's performance (Lee and Kim, 2001).

However, knowledge itself is a very multifaceted concept with many different variations and definitions. Von Krogh et al. (2001) or Kakabadse et al.'s (2003) understanding of knowledge as 'justified true belief' corresponds to the one also used by Sveiby (1997), and goes back to Michael Polanyi's original work (we know more than we can express) (Polanyi, 1966), an epistemological position which is acknowledged to have grown out of Plato's (1953) discourses (Meno, Phaedo and Theaetetus). Based on the fact that the nature of knowledge is widely acknowledged on differing epistemological positions taken from the individual contributors, the following definition of 'knowledge', which is based on Davenport and Prusak's (2000) suggestion, shall provide a possible description:

> "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organisations it often becomes embedded, not only in documents or repositories but also in organisational routines, processes, practices and norms." (Davenport and Prusak 2000, p.5)

Using and managing knowledge for developing innovation products and services is one of the most relevant interpretations of knowledge management (KM) in the literature (Nonaka and Takeuchi, 1995). Knowledge represents core elements in human and organisational activities. Knowledge is the combination of data and information to which is added the experience of people, their interpretations, skills and experiences so resulting in a more valuable asset to be used in decision making (Rowley, 2007; Kebede, 2010). In their sequential order data and information are used as input for knowledge and knowledge is inclusive of data and information (Zins, 2007). This conceptualisation finds also confirmation in the perspective of Cole (2011) related to the theory of information need that connects information to knowledge. The interrelationships among data, information and knowledge are hierarchical where data represents the elementary form of information; information are defined as data interpreted to achieve meaning, and knowledge represents information with experience, insight, and expertise of people (Zins, 2007).

This strictly links the concept of information to the concept of knowledge interpreted as "the capacity for effective action" (Senge, 1997) or as "information in action" (Elliott and O'Dell, 1999, p.34). Knowledge is information that has been given meaning and taken to a higher level (Kebede, 2010). Information is converted to knowledge once it is processed in the minds of individuals and knowledge becomes information once it is articulated (Wiig et al., 1997). The concepts of information and knowledge are strictly related and need to be considered as having some overlapping. From these definitions, the progressing of IS toward KM evolves in a natural way and identify some overlapping when analysing the conceptualisations, tools and management practices of the three elements (data–information–knowledge) since the understanding and the management practices of the higher stages are built on the foundations of the earlier stages (Kebede, 2010).

Knowledge can refer to an object or a capability and it may reside in individuals, groups, documents, processes or repositories (Alavi and Leidner, 2001). Knowledge can be analysed through many interpretative 'lenses': codified/tacit, observable/non-observable in use, positive/negative knowledge (i.e., knowledge of failures and successes), autonomous/systematic knowledge (knowledge that yields value without major modifications of systems or requires modification to other sub-systems), intellectual property (Teece, 1998). Other taxonomies suggest three main types, namely declarative knowledge (asset perspective), procedural knowledge (process perspective) and causal knowledge (why something occurs) (Kogut and Zander, 1992).

Nevertheless Spender and Grant (1996), and Nonaka and Takeuchi (1995) point out that tacit knowledge is the most useful form of knowledge. However, some authors like Coff et al. (2006) affirm that tacit knowledge has great strategic value when it is codified; codification allows to exploit that value and explicit knowledge has been found to be the most reported form of knowledge (Spender and Grant, 1996). Organisational knowledge within companies can be classified in the following main strategic knowledge sources (Skyrme, 2000).

- *Customer knowledge* – This is the organisation's most vital knowledge: organisations typically possess more customer knowledge than they realise. Much of it exists as tacit or implicit knowledge in the workers' mind or in documents and proposals; the rest can be obtained with additional external searches, adopting the potentiality of the blogosphere (Del Vecchio et al., 2011).

- *Knowledge in people* – The organisation's employees and contacts with the external environment provide a rich source both of explicit and, most importantly, of tacit knowledge that can be cultivated and shared. The challenge is less technical and more organisational.

- *Knowledge in products and services* – This is the knowledge embedded in products, services and in the documentation that accompanies products and services.

- *Knowledge in processes* – It is the knowledge embedded in organisational processes and in management decisions. Organisations must uncover the knowledge hidden in business processes so that it can be fully shared.

- *Organisational memory* – It helps identify "knowing what the organisation knows". This is the knowledge embedded in best practices, databases, skills directory, online forums, manuals and other materials.

- *Knowledge in relationships* – This knowledge flows between suppliers, employees, shareholders, community, etc. and it can be both tacit and explicit.

- *Knowledge in the business environment* – This knowledge represents a rich source coming from the business environment: letters, seminars, conferences, websites and trade shows provide a good opportunity to capture this knowledge. All these knowledge sources represent the firm's knowledge assets that must be identified and used internally to create value (Teece, 2000).

Each knowledge source contributes to develop the firm's knowledge asset (Spender and Grant, 1996; Schiuma, 2009).

3 Knowledge management perspectives: three generations

Organisations can develop individual knowledge through knowledge management initiatives. However, there is not yet a universally accepted definition for knowledge management (Chen and Chen, 2006). KM has been defined as "the collection of processes that govern the creation, dissemination, and leveraging of knowledge to fulfil organisational objectives" (Lee and Yang, 2000, p.784). KM is a process of identifying, capturing, and leveraging the collective knowledge in an organisation to help the organisation to compete (Von Krogh, 1998). By Kanter (1999) KM is concerned with the way an organisation gains a competitive advantage and builds an innovative and successful organisation. Tiwana (2002) understands knowledge management as the management of organisational knowledge for creating business value and generating competitive advantage. Klasson (1999) defines knowledge management as the ability to create and retain greater value from core business competencies (Al-Ghassani et al., 2006). According to the knowledge based perspective of the firm, the firm can be seen as a knowledge system engaged in knowledge creation, storage, transfer, sharing and application. However the right implementation of KM initiatives require challenges for organisations (Oliveira et al., 2012).

However, the scope and definition of KM has evolved over the years. In the management literature three major schools of thought can be identified on what knowledge management is (Poynder, 1998):

- one school suggests that knowledge management is primarily an information technology issue

- a second school suggests that knowledge management is more a human resource issue

- the third school promotes the development processes to measure and capture the organisation's know-how.

A further school of thought interprets knowledge management as knowledge engineering and it is focused on how to build intelligent systems that can replicate human cognitive capabilities. At present, there are at least three accounts of generations of KM (Firestone and McElroy, 2003).

The first stage of KM is proposed by Koenig (2002). He argues that the *first stage* of KM evolution focuses on IT-driven KM or knowledge sharing. The use of IT,

in particular internet/intranet, and tools for knowledge sharing and transfer can create value-added to the enterprise. Moreover, this stage emphasises 'best practices' and 'lessons learned'. A definition of Knowledge suitable for this stage of research is the definition provided by Zander and Kogut (1995). They propose the following five dimensions of knowledge that can affect the ability to efficiently share knowledge outside the bounds of an organisational Knowledge Management System: codifiability, procedural complexity, teach-ability, system dependence, and observability. Codifiability is the degree to which knowledge can be encoded and stored. Procedural complexity refers to the variety of procedural resources that must be combined to create knowledge. Teach-ability captures the degree to which the knowledge can be shared via training, either in school or on the job. Observability refers to the degree to which knowledge can be imitated or copied by observing others in the performance of a task. System dependence refers to the degree to which knowledge is dependent on and derived from many different people. Knowledge that is less complex, more codifiable, more teachable, and more observable should be easier to share (Zander and Kogut, 1995).

The second stage of KM is proposed by Snowden (2002) and it is focused socialisation issues, including human and cultural factors. This stage stresses the importance of organisation learning applied from the work of Senge (1990), knowledge creation adapted from the SECI model (Nonaka and Takeuchi, 1995), and Communities of Practice (Wenger et al., 2002). Snowden (2002) envisions the next age of KM as: knowledge viewed as a thing and a view; centralisation of context, narrative and content management; an understanding of organisations as engaged in sense making; and scientific management and mechanistic models.

The third stage of KM is proposed by McElroy (1999) who identifies two generations of KM. The first generation focuses on 'supply-side KM' or knowledge sharing: "It's all about capturing, codifying, and sharing valuable knowledge, and getting the right information to the right people at the right time" (McElroy, 1999); while his second generation emphasises 'demand-side KM' or knowledge creation. Firestone and McElroy (2003) argue that the first and second accounts have many weaknesses and are not clear enough to theorise the proposed generations of KM. Despite the difficulties in the first and second accounts, all three accounts provide a level of similarity: the first generation tends to focus on knowledge sharing, the second generation on knowledge creation. However, the third generation remains unclear (Firestone and McElroy, 2003). An evolution of this stage is proposed by Vorakulpipat and Rezgui (2008), extending McElroy's (1999) generations of KM: KM Value Creation (Vorakulpipat and Rezgui, 2008). Human networks, social capital, intellectual capital, technology assets, and change processes emerge as essential conditions to enable KM value creation (Vorakulpipat and Rezgui, 2008). At the basis of this stage, is the idea that firm's knowledge asset are based on experiences and expertise of their employees (Spender and Grant, 1996), and they represent the most valuable asset for the competitiveness of the companies. Continuing Boisot's (1998) work, Nonaka et al. (2000) define knowledge assets as firm-specific resources that are indispensable to creating value for the firm. Arguably one of the main challenges with knowledge assets is their dynamic nature because they represent at the same time inputs and outputs of the organisation's knowledge-creating activities and they are constantly changing (Nonaka et al., 2000). They categorised them as four types: experiential knowledge assets, conceptual knowledge assets, systemic knowledge assets and routine knowledge assets (Nonaka et al., 2000). In the first category, experiential knowledge assets, the authors introduced tacit knowledge, skills, know-how acquired by

individuals at work. Also emotional knowledge, care, trust, love, are categorised as experiential knowledge assets. Conceptual knowledge assets have tangible forms, and include explicit knowledge articulated via language and symbols. The systemic knowledge assets consist of systematised explicit knowledge, including for example product manuals and specifications, and processes technologies. The fourth category of knowledge assets, routine knowledge assets, includes organisational routines and culture embedded in the daily business. Regardless of knowledge asset category, the utilisation and transfer of existing knowledge in firms often occurs in an ad hoc manner (Becker and Gassmann, 2006).

4 Knowledge management: challenges and future trends

There is no doubt that KM is now at the crossroads and needs to look to new research and practice horizons and, then, advance new thinking in relation to the complex and multifaced essence of knowledge as drivers of performance and growth.

4.1 An interdisciplinary approach to KM

However, KM is currently in a state of pre-science (Sagsan, 2007). In contrast to Hazlett et al. (Chris and Lee, 2005) describe knowledge management as an interdisciplinary area that includes processes and techniques for the creation, collection, classification, distribution, evaluation and reuse of instructional knowledge. Jennex and Croasdell (2007) have investigated the KM by considering Kuhn's criteria in terms of being a discipline. According to them, knowledge management is completely supported by these criteria. For example, knowledge management has its own specialised journals, professional societies, and academic curricula, accepted body of knowledge for group members as well as promulgation of scholarly papers. In the attempt to provide an advance of the discipline of KM (Schwartz, 2007) identifies four layers: the central core layer (1st) includes the philosophers that must inform our choice of practical knowledge management processes. It presents one view of the different stages activities and cycles that comprise knowledge management (2nd). These processes must be implemented and adapted in order to address organisational, social and managerial needs (3rd). Finally, the implementation of knowledge management process to meet organisational needs must be supported by and implemented through a set of relevant information technologies (4th). The Schwartz's (2007) argument or layers shows us that there are four fundamental sciences that comprise the discipline of knowledge management: technology science, organisation and management science, social science and philosophy. Moreover, Sagsan (2007) and Dalkir (2005) argues that knowledge management discipline should be evaluated from an interdisciplinary perspective. Stankosky (2005) details these disciplines in terms of communication theories, system theory, database technologies, collaborative technologies, organisational psychology, strategic planning, decision support systems, data mining, system analysis, total quality management, web technologies, database design and management and theories of management and organisation, artificial intelligence and cognitive science.

4.2   A systemic and collective intelligence approach to KM

Future trends of knowledge management emerge from the adoption of a systemic perspective of the organisations. Organisation can be defined as a group of people with underlying sense and mission or a social unit of people that is structured and managed to meet a need or to pursue collective goals (Daft and Lewin, 1993). All organisations have a management structure that determines relationships between different activities and the members, and subdivides and assigns roles, responsibilities, and authority to carry out different tasks. Organisations are open systems: they affect and are affected by their environment. Two concepts of organisation are characteristic of the classical theory of organisation, above all, namely the organic and the mechanistic conception of organisation (Burns and Stalker, 2000). Traditional mechanistic concept of organisation see organisation as a machine. Instead, modern organic (biologist) concept of organisation compare the organisation with a living organism or 'living organism' (Schiuma, 2011), in which each part or sub system is performing a special function, mutually linked and coordinated so that the purposeful performing of a joint task is ensured (Burns and Stalker, 2000). Organisations based on organic principles depend more on right environment, and conditions. Organisations interpreted as living system operate in dynamic learning environment where the strategic entrepreneurship dimension is dynamically supported and where the old rules of manufacturing-based business need to be reconsidered. Organic approach to organisation requires organisational management that simulates behaviour of living organism. Synergy of individual parts of organisation understood as a system is very important. Synergy brings the factor of interdependence.

These requirements calls for the necessity to introduce the concept of 'Collective Intelligence' defined as the ability of a community to carry out a task or solve a problem more effective and efficient than they could individuals, through collaboration and knowledge sharing (Leimeister, 2010). The concept of collective intelligence (CI) is not new; the core idea emerged at the end of 70s, and it had a strong evolution and formalisation in the 1990s (Lévy, 1994; Pór, 1995; Malone et al., 2008). In its broad sense, Collective Intelligence is a shared or group intelligence that emerges from the collaboration and competition of many individuals. In all cases, Collective Intelligence appears where local and distributed assets and expertise are coordinated to achieve a collective (although not necessarily consensual) goal (Mulgan et al., 2011). It signals groups of individuals doing things collectively that seem intelligent (Malone et al., 2010). At this purpose, four basic elements have been identified (Boder, 2006):

- a group of competent actors in specific knowledge domains

- a set of resources (physical resources, information, knowledge, relationships) and interaction mechanisms (mind mapping, database navigator, visual discussion, etc.) available to the actors

- the objectives and results the actors should reach

- a way of evaluating the results really reached.

It is clear that an organisation can be interpreted as a 'collective intelligence systems' in which Knowledge and Intellectual assets are coordinate toward the achievement of Business value creation. The collective intelligence approach combined with the KM can support organisations in their transformation to improve value creation and business

performance. The application of collective intelligence is aimed at leveraging on collaboration and Knowledge assets sharing to create more favourable conditions to align business and knowledge management. The conceptual model of Collective intelligence systems harnesses the power of knowledge assets collectively created by the engagement of multiple stakeholders inside the organisation value network. Taking the metaphor from the biology, the model is broken down in four main blocks or genes harnessing the knowledge assets collectively created. The genes are particular answer to the four questions: what is being done? Who is doing it? How is done? Why is done? These questions provide the conceptual pillars to describe, respectively, an overall approach to KM for business value creation, the "collective human capital" to achieve the goal, the processes activated inside the organisations, and finally the motivations behind the achievement of the goal. The creation and management of knowledge assets is thus an operational priority to evaluate the alignment between the strategic orientation and the business performance.

When understanding organisation as a collective intelligence system, KM is part of such system and cannot be managed separately from its other parts. Together, economic, technological, and social events have changed the knowledge required to manage organisations effectively. In this rapid changing environment, the knowledge that is most useful to organisations is knowledge that helps them to change, to adapt and to perform effectively. All organisations need research-based knowledge about organisational change, management, and effectiveness (Lawler and O'Toole, 2006). Furthermore, Mohrman and Lawler (2012) have advocated the importance of "future-oriented knowledge generation", whereby researchers should focus less on what is effective today and more on what organisations need for tomorrow (p.42). Typically, researchers study what is effective 'today'. To produce knowledge that can create new organisation designs, we need to study organisations that are outliers – those that are experimenting with new approaches or achieving unique and superior outcomes (Richard et al., 2009). Schiuma (2011) explains how art-based initiatives can drive behaviours, engagement and passion and enhance the business value creation capacity. Finally, Marr et al. (2003) suggest an epistemological view to better understand different value creation pathways and knowledge transformations.

5 The genesis of the special issue

The special issue is an outcome of the international leading IFKAD conference on the theme of 'Knowledge and management models for sustainable growth', held in Matera – Italy from 11th to 13th June 2014. The organisation of this conference stems from IFKAD's mission to create an ideal social cognitive platform catalysing and facilitating the sharing of ideas and practices and promoting a scientific debate on the role of knowledge assets as value drivers for business performance and economic growth.

The rationale of this special issue is grounded in the relationship between knowledge management, innovation processes and intellectual capital management. The selection process took into consideration our interest in publishing papers that examine, conceptually and empirically, knowledge-based innovation and performance outcomes. The topics of interest included, but were not limited to:

- How knowledge management processes and frameworks significantly affect value creation mechanisms for firms and organisational development;

- How to shape the relationship between intellectual capital, intangible assets and knowledge management for sustaining innovation in organisations and firms;

- How to conceptualise and empirically test knowledge-based frameworks for innovation management.

The papers published in this special issue fall into two groups. The first four papers provide conceptual models and empirical evidence on knowledge management practices and their relationship with innovation in business environments. The other two papers focus on environments for managing codified knowledge to support organisational learning. They contribute to shed light on the future perspectives of knowledge management.

In their paper, *Susanne Durst, Ingi Runar Edvardsson and Guido Bruns* highlight the conditions for linking successfully the Sustainable Organisations and Knowledge Process Outsourcing. They discuss the link between knowledge process outsourcing (KPO) and sustainable organisations that pursue not only economic issues but also social and environmental ones. The purpose of their paper is to review extant research on KPO together with the concept of sustainable organisations. To do so the paper relied on a combination of recent reviews of scholarly papers on KPO. Three main conditions to be fulfilled in order to increase the success of the integration of the two terms have been identified in: governance, partnership and organisation members. The recommendations derived from the findings can assist researchers and other actors in better understanding the requirements of KPO for sustainable organisations.

In the paper by *Neena Sinha, N.K. Kakkar and Vikas Gupta*, the authors demonstrate how knowledge management has thus become a critical factor in promotion of innovation. The value of knowledge management lies in its link to organisational performance outcomes. In this paper, the authors have tried to identify the KM practices that are critical for innovation leading to competitive advantage by taking up the case of the Indian IT/ITeS sector. The paper tries to identify KM policies (then redefined practices) critical for innovation in the Indian IT/ITeS Sector, investigating the relationships between different KM practices and innovation, using a survey of 435 respondents from 46 companies. The findings reveal that five out of nine KM practices surveyed are relevant (using discriminant analysis), i.e., culture and leader's support, KM processes, networking and alliances, KM strategy and training and development of employees for KM.

In their paper, *Yasmina Khadir-Poggi and Mary Keating* suggest a link between Intellectual capital, knowledge management innovation through the case of small asset management firms in Ireland. The authors introduce initial insights on the ways small Ireland-based asset managers relied on knowledge-based practices and assets in order to innovate in a knowledge economy. The results show different experiences between three polar cases selected for the study. The contributions of this qualitative study are triple. First, this research provides empirical insights on knowledge assets stocks and dynamics in an industry seldom studied empirically. Second, it investigates the different interactions between knowledge management, intellectual capital and innovation. Finally, the present study concludes on theoretical and managerial implications.

The paper by *Mila Galeitzke, Erik Steinhöfel, Ronald Orth and Holger Kohl* offers new insights on Strategic Intellectual Capital Management as a Driver of Organisational Innovation. The authors start from the assumption that the impact of some intellectual capital factors on the intra- and inter-organisational innovation ecosystems has not been analysed thoroughly. Their contribution seeks to close this gap and draw conclusions with regard to drivers of innovation and related differences between manufacturing and service enterprises. The analysis of the correlation between intellectual capital and innovation capabilities allows statements regarding those intellectual capital factors, onto which enterprises should be focused in order to foster innovation. The qualitative content-related analysis of the 38 intellectual capital statements of German enterprises with regard to new and different types of innovation management methodologies allows the identification of existing gaps in intellectual capital management.

The paper by *Tatiana Gavrilova and Irina Leshcheva* seeks to provide a theoretically grounded, practical methodology for initial knowledge structuring using cognitive psychology bias. Ontology was chosen as the most popular and comprehensive knowledge representation model. The authors used a participatory action research project in which some hypotheses about the relations between the cognitive style and ontology development were suggested. It was found that, some personal peculiarities of cognitive style affect the topology and quality of knowledge structures. These findings provide some implications for collaborative ontology design and development. The knowledge structuring issues derived in this paper can be used by managers and practitioners to address knowledge work and organisational learning. The methodology is original and is based on interplay between knowledge engineering and cognitive psychology. It uses cheap accessible tools, integrates the results of psychological tests into an ongoing practical work of knowledge analysts.

The paper by *Felipe Becker Nunes, Fabricio Herpich, Gleizer Bierhalz Voss, Jose Valdeni De Lima and Roseclea Duarte Medina* highlights the role of U-learning environments to collect context information relative to user's preferences and needs. The paper presents an ubiquitous virtual environment, in which three modules (U-SEA, SEDECA and QoC) were developed and integrated with Moodle, and describes the use of a Bootstrap theme to automatically adapt the interface on mobile devices. The results about the integrated modules showed that the UVLEQoC environment operated satisfactorily, based on the assessments made by the group of users who tested the modules and their operation.

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