

AN ONTOLOGICAL REPRESENTATION OF TEACHERS' ROLES AND COMPETENCIES REQUIRED FOR DEVELOPING STUDENTS' PERSONAL LEARNING ENVIRONMENTS

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ABSTRACT

This paper discusses the theoretically created ontological representation of teachers' roles and competencies required to develop students' Personal Learning Environments (PLEs) in an efficient and effective way. An ontology model is developed that shows the relationship of teachers' roles with various stakeholders such as teachers' required competencies, students, educational institutes, learning spaces, constructivist learning model, and PLE. This is based on an in-depth review of the literature on teachers' socially situated competencies and roles with regard to the tasks and guidance they provide to students shape their PLEs. The review process provides an insight of PLE research studies, constructivist learning theories, and teacher changing roles. The results of this study outline the roles that portray the importance of teacher competencies as role in Planning and Design, Instruction and Learning, Communication and Interaction, Management and Administration, and Use of Technology.

KEYWORDS

Personal learning environment, PLE ontology, Teacher roles, Teacher competencies, Collaborative learning

INTRODUCTION

Competencies of teacher are challenged [1-6]. There is a growing realization [1-3] that traditional teaching competencies will not work in PLE settings. Emphasis on delivery of content in a lecture-based format is not as effective when communication is mediated through technology. Teachers involved in teaching using face to face, distance, or online methods need assistance in identifying the new roles they assume to be successful [4]. Besides this, it is also expected from 21st century teacher to collaborate with all sectors of the educational community in planning, managing, implementing, and evaluating programs [5, 6].

Minocha [2] found that by choice and demand, technology is restructuring education, and changing teaching and learning in ways that impact on everyone. Teacher roles are changing, new competencies are required, and new skills must be learned all at a faster pace than ever before. Selvi [6] and Drexler [7] suggest that free and easy availability of emerging learning technologies and social software have resulted complex and multifaceted challenges for teachers, including the provision of personalized learning experiences using suitable technologies that cultivate student independent learning skills while also scaffolding learner reflection and the development of generic competencies. Våljataga & Laanpere [8] found that the required pedagogical change involves not only the adoption of appropriate teaching approaches, awareness of the learner experience, importance of acknowledging learner's existing skills and capitalizing on them, as well as exploring and integrating social media in ways that pave the way for participation, community connections,

social interaction and global networking. Although, a teacher may not be the only expert in one's learning process, yet he plays key role to help students navigate the breadth of content, apply the tools properly, and offer support in the form of digital literacy skills and subject matter expertise [7-9].

Many research studies have established teachers' critical role in PLE design and implementation, but only some of them have focused on investigating teacher roles and competencies. Hence, we argue that future PLE research should place greater emphasis on this dimension.

CURRENT REVIEW OF TEACHERS' ROLE IN PERSONAL LEARNING ENVIRONMENT

Our review of research studies and online resources with regard to teacher roles and competencies in PLE viewpoint is divided into three areas, which are:

- (a) A review of PLE studies;
- (b) Ontologies overview; and
- (c) An examination of teachers' changing roles.

Personal Learning Environments

PLE represents a paradigm change [10]. It is based on the idea that learning is a continuous process and hence, seeks to provide tools to support that learning which takes place in different contexts and situations and is not provided by a single learning provider [9]. A PLE is seen as either a single technological application (iGoogle, Flock, etc.) hosted and partially controlled by institutions, or a collection of them chosen by each individual student (Facebook, etc.) rather than an institution [8]. It is a place where learner constructs knowledge socially with the help of knowledgeable peers, mentors, or teachers [7]. Hence, the role of teacher in this changing scenario is to assist this learner in taking control of his learning and help him realize his goals [5]. A clear focus, shared goals, support, and mediation seem crucial to the success of PLE [11]. A number of researchers, viz. Väljataga & Laanpere [8], Attwell [9], and Wilson [11] argue that an effective PLE must address deeper educational issues, provide ways of controlling the technological infrastructure, recognize teachers and learners inhabit the same system, and maintain the technological shift in the locus of control from institutional centralized delivery to learner-driven inquiry.

Promise of a Personal Learning Environment

PLE is an environment where people, communities, tools, and resources interact in a very loose kind of way. It promises students' an important learning outcome and an independent pursuit of learning that incorporates a greater range of tools largely under the control of an individual [11, 12]. Elliott [10] found that PLE promises new pedagogical possibilities for successful learning to occur; where teachers need to rethink their approaches, realign their methodologies, and move beyond restrictive, teacher-controlled environments to learner-controlled spaces.

What should be in a Personal Learning Environment?

A PLE should contain a) content; b) context; c) connections; d) collection; e) communications; f) community; g) collaboration; and h) création [13]. Peña-López [12] argued that an effective PLE may contain accessing and searching knowledge, aggregating and scaffolding, manipulating, analyzing, and reading; or in other words, a PLE should provide the facilities of reading, noting, thinking, and writing. Wilson [11] found that in order to facilitate learning processes, a PLE should provide analysis, synthesis, abstraction, and critique components.

Ontologies Overview

The term ontology in the field of computer science is defined as a model for describing the world that consists of a set of classes, properties, and relationship types [14]. Another definition given in [15] represents ontology as an explicit specification of a conceptualization, where a conceptualization is an abstract and simplified view of the concepts and their relationships. Such conceptualization gives a possibility for concrete domain understanding, concepts clearing, as well as flexible method for sharing and reusing the included knowledge. Ontologies may vary in their content, structure and implementation. They include a terminological component (XML document) that defines the terms and structure of the ontology's area of interest and an assertion component, populating the ontology with instances that manifest that terminological definition. Ontologies can be realized in a number of languages such as DAML+OIL (DARPA Agent Markup Language) and OWL (Web Ontology Language) that support the instances' representation. Such instantiation allows converting ontologies into knowledge bases.

The Teacher Roles PLE ontology has been developed using the software platform of Protégé. It allows designing of RDF Schema and OWL ontologies using a graphical design view, check the syntax of any RDF Schema or OWL ontology and the semantics of OWL Lite and OWL DL ontologies, and export ontologies in the RDF/XML and N-Triples format. Protégé supports creation of OWL DL, OWL Lite and OWL full ontologies. OWL Lite language is used for building the ontologies in hierarchies and relationships that exist between different concepts within the PLE domain [16].

Teachers' Changing Roles and Competencies

Teacher is responsible for operating educational system; hence he needs strong and efficient professional competencies [4]. According to Shaikh [15], it is necessary to redefine teacher competencies. Since teacher's main role is transferring changes into educational system, hence, teacher needs new competencies that must deal with all these new changes effectively [15]. Selvi [6] suggested that teacher competencies should be reviewed consistently in parallel with the changes and reform studies through scientific methods. This study considers teachers' socially situated competencies and roles with regard to the tasks and guidance they provide to students shape their PLE. According to Drexler [7] and Williams [17], socially situated competencies pay attention to the nature of the tasks and the particularities of the learning environments where teaching takes place. Hence, in socially situated learning, teachers' competencies must always be made in relation to the context and, consequently, any such statements will be relative to these particular circumstances [18].

METHODOLOGY

In order to perceive teacher competencies and roles, we consider putting forward this preliminary study of theoretical nature reviewing bibliographical references, centering on teacher roles and competencies in PLE context.

We reviewed a number of research papers that discussed the concept of teacher roles and competencies in PLE. The scientific output from the past 10 years was of particular interest, given that the term PLE was first used in the literature by Olivier & Liber [18] in the year 2001, and that was the time when seminal work started in this research area. Besides, the literature on teacher competencies and roles in face to face, distance education, online learning environments, and virtual learning environments was also comprehended. Special attention was paid to looking into specialist journals, books, and online resources of great scientific prestige (e.g., *Interactive Learning Environments*, *British Journal of Educational Technology*, *Turkish Online Journal of Educational Technology*, *Australasian Journal of Educational Technology*, Cambridge University Press, Harvard University Press, *American Journal of Distance Education*, *Workplace Learning in Context*, *Pontydysgu*, *Wikipedia*, *Educause*, *iCALT*, *eLearning Papers*, etc.). The main purpose of this research is to identify different roles of a teacher in such environment. This is very important as this study will help identifying different qualities and abilities to be developed by a teacher to work under this environment.

Teacher competencies are categorized as suggested by Alvarez et al. [3], Williams [17], and Trilling [19] proposals. Categorizing the functions to bring them in line with their respective competencies also respected Alvarez et al. [3] and Williams [17] classifications, noting that these classifications are not essentially different from the rest of the authors reviewed, as they all agree on grouping teacher competencies around the five work areas proposed by Alvarez et al. [3], and Williams [17].

RESULTS

A PLE invite teachers to consider a role change and extend their craft to prepare students for the challenges of life beyond university through developing lifelong learning skills which are paramount to self-direction and self-regulation, e.g., see [7-9].

Despite the numerous studies on design, pedagogies, and structure of PLE, no competency study on role of teacher in PLE has been conducted to date. However, recent studies in the field of face to face learning, online learning, distance education, and network literacy have shed some light on critical components of teacher roles to include in a list of teacher competencies in PLE perspectives [1-6]. Hence, a review of these specific findings and concepts is useful to provide a framework and focus for this study.

The results of this study focus on the model suggested by us in [Figure 1]. The figure shows an ontological representation of different roles of a teacher categorically grouped as different competencies.

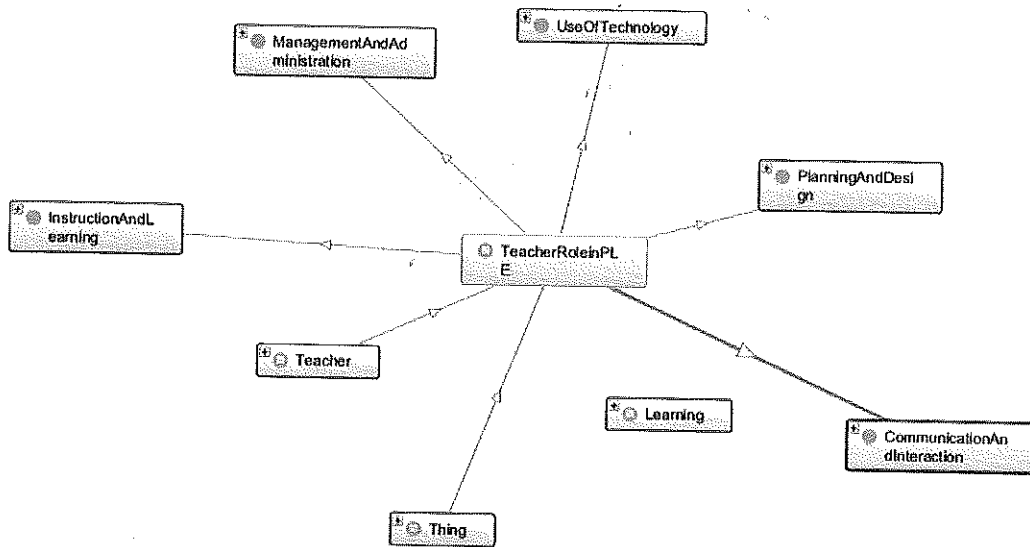


Figure 1. Ontological representation of teachers' roles as per performing tasks.

Teacher Changing Roles

Setting up a PLE requires considerable planning; teachers need to be innovative and knowledgeable regarding where and how to locate the resources they need. They not only have to understand clearly why the need of PLEs should be introduced to students but also how these emerging learning technologies can be integrated into the existing curriculum to facilitate collaborative learning [13].

In PLE, a teacher should be an expert instructional designer [1, 20]. According to Jonassen *et al.* [16], instructional designs play vital role in designing the learning activities within a PLE. An instructional designer is one who creates, browses, views, and edits learning designs used for the automatic creation of personalized learning activities for students, makes instructional decisions based on his or her judgment about what students should learn, how they should learn, what their learning contexts should be, what learning strategies they should employ, and how they should be assessed [21]. Computer programming skills have also been rated highly as teacher competencies in digital network literacy phenomenon. As Downes [1] reflected in his study "a programmer builds sequences into machines, manipulates symbols to produce meaning, calculates, orders, assembles, and manages social networks, set ups wikis".

In teacher competency studies, lecturing and learning are two components that surface repeatedly. Several researchers, viz. Downes [1], Minocha *et al.* [2], Alvarez *et al.* [3], and Thach & Murphy [4] found that a lecturer has the responsibility of organizing larger bodies of work or thought into a comprehensible whole, and employing the skills of rhetoric and exposition to make the complex clear for students. Siemens & Tittenberger [20] observed that a lecturer or instructor is an expert learner. Instead of dispensing knowledge, a lecturer creates spaces in which knowledge can be created, explored, and connected [5, 21].

Related to lecturing and instructing is the very critical competency of theorizing and demonstrating. A demonstrator can use actual equipment, simulations, or video to tell stories; while a theorizer is the person who leads students develop world views, find the underlying cause or meaning of things, create order out of what appears to be chaos, or help them remember things by giving a single structure [1, 5].

In PLE, teacher motivates learners to take ownership of process, assist him take control of his learning, and mentor him realize his goals [21-23]. Kuo [21] and Mullen [22] advocate that the role of a mentor is multi-faceted; ranging from sharp critic to enthusiastic coach. Not everyone can be a mentor, not every mentor can take on too many prodigies, and of all the roles described here, that of the mentor is most likely to be honorary or voluntary [23]. The need of agitator and master artist is also critical in PLE. The former creates the seed of doubt, the sense of wonder, the feeling of urgency, and the cry of outrage [1, 24], while the latter observes the activities of all students and can draw attention to innovative approaches [20].

Instructive and cognitive services raise new requirements to teacher competencies in knowledge and skill level. According to Mullen [22], teachers need to get accustomed to and trained on their new role as partners and facilitators in learning processes, rather than lecturers. Minocha *et al.* [2] add that one of the changing roles that this new learning phenomenon has created for teachers is that of a facilitator who help learners adapt their PLE, scaffold learning, and manage the content before it become more complex [24]. Attwell [9] stress that coordination, collaboration, cooperation, communication, connection, and integration of teacher and students in PLE process is important. Peña-López [12] suggested that the role of the teacher is more that of a coordinator who supplies a framework in which participants collaborate, connect, and integrate more or less freely. Alvarez [3] and Elliott [10] argue that communicator or connector is the person who draws associations and makes inferences. Downes [1] noted "the connector is the person who links or bridges distinct communities with one another, allowing ideas to flow from art to engineering, from database design to flower arranging".

Many studies outline how teachers should facilitate the process of learning within PLE and act as moderator, convener, collector, and salesperson [1-4, 22-24]. Drexler [7] assert that teachers have always been collectors, from the days when they bring stacks of old magazines into class to the modern era as they share links, resources, new faces, and new names. In many studies [1-4, 22-24], teacher is seen as a role model, leader, manager, and change agent. Selvi [6] observed that teachers are the administrative managers who manage classroom computing resources and finances, organize accountability procedures, and maintain systemic coherence. Trilling [19] found teacher a curator and advocate that he should balance the freedom of individual learners with the thoughtful interpretation of the subject being explored, and create spaces in which knowledge can be created, explored, and connected.

As discussed in [24] and as Mullen [22] suggested that PLE demands teacher to act as a) a coach who these days is no longer the sage on the stage, but instead provide learners with access to a variety of independent learning experiences; b) a concierge who direct learners to learning opportunities that they mean to be aware of, serve to provide a form of soft guidance, and permit them to explore on their own; c) an evaluator who assess not merely declarative knowledge or compositional ability, but instinct and reactions, sociability, habits and attitudes; and d) a goal setter who assist learners in taking control of their learning and education, and scaffold them realize their goals.

Related to managerial is the very critical role of technologist. This relates to a) sharer who share cultures, concepts, ideas, material, mailing lists, links, create and manage e-portfolios, [1, 23]; b) technologist who provide ample technical assistance, and encourage students to voice technical problems [1-4]; c) technician who make students knowledgeable about learning resources [22-24]; d) network administrator who help students gain the skills required to construct networks for learning, evaluation of their effectiveness, and working within a fluid structure [1]; e) editor or media publisher who edits for style, clarity, grammar, and structure [1, 19, 20]; and f) alchemist who mixes the ordinary and unexciting into something new and unexpected, sees rhythms and symmetries in distinct materials and brings them together to bring them out [1, 19].

DISCUSSION

Following the same order as the teacher competencies and roles discussed in the Results section, we now present our findings. Considering the significant role of teacher in PLE; we have grouped teacher competencies around five main roles according to the nature of tasks with which they are associated as shown in Figure 1.

Planning and Design (Designing/Planning Role)

The planning and design aspect of teacher as shown in Figure 2 is related with setting up student PLE, designing learning activities, creating learning spaces, making instructional decisions, and solving programming problems. Tasks include: plan and prepare course design; promote teamwork in design process; defining the procedures of instructional design; conduct needs assessment of students; presenting content and questions; in line existing courses with PLE requirements; creation of online interactive content; ensure course design works with technology; etc. Perceived Roles: planner, designer, instructional/learning designer, programmer, etc.

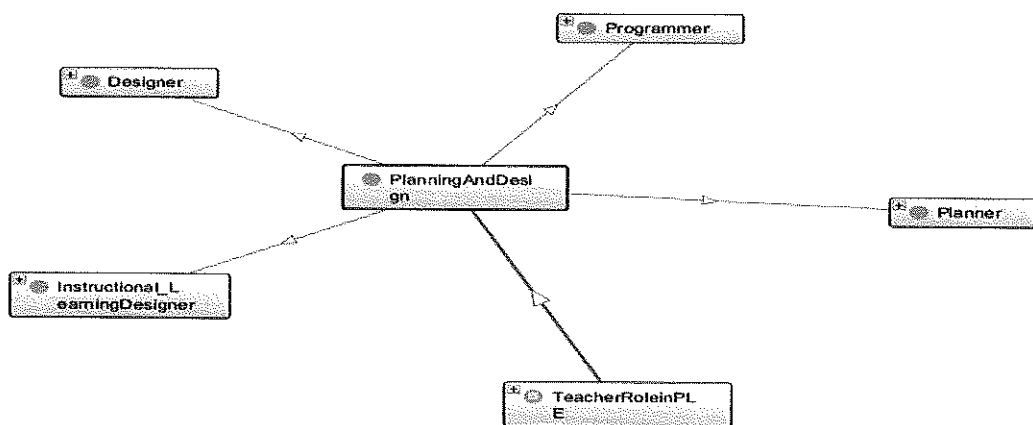


Figure 2. Ontological representation of teachers' designing/planning role in developing students' PLEs.

Instruction and Learning (Instructive/Cognitive Role)

This role as shown in Figure 3 relates to instructive and cognitive aspects of instruction in PLE. It relates with mental processes of teaching and learning, abstraction and generalization, information storage, motivation, and mentoring. Tasks include: tutoring; learning guidance and evaluation; be competent in the subject matter; provide students with timely feedback; encourage peer learning; validation of knowledge acquired by collaborative learning; initiate and maintain interactive discussions; monitor and evaluate student performance; be enthusiastic about teaching; know aspects of collaborative, active, constructive, reflective, and authentic learning; facilitate information presentation; monitor and evaluate student performance; establish learning outcomes; advice and counsel students, etc. Perceived Roles: lecturer/instructor, demonstrator, theorizer, master artist, learner, critic, agitator, motivator, mentor, etc.

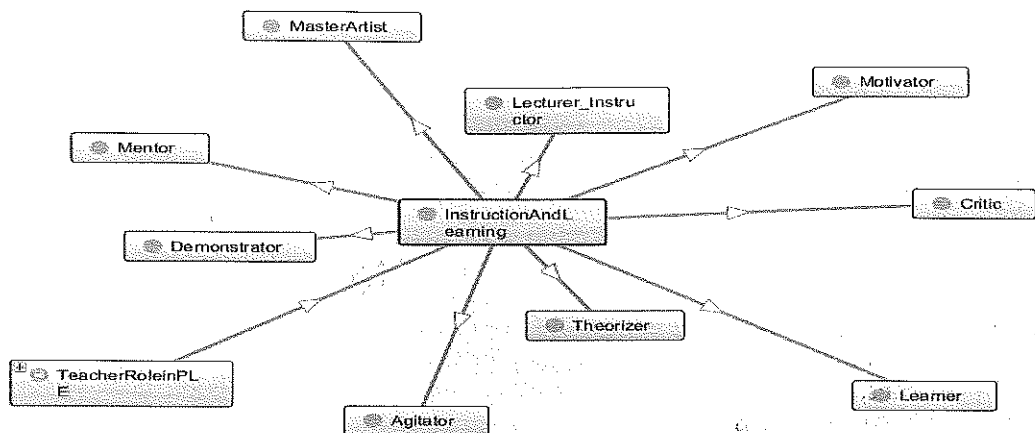


Figure 3. Ontological representation of teachers' instructive/cognitive role in developing students' PLEs.

Communication and Interaction (Social Role)

The communication and interaction aspect of teacher roles as shown in Figure 4 is related with students' relationships with the teacher and with other students. Tasks include: managing cooperative interactions among students; identifying areas of agreement/disagreement; diagnosing misconceptions; seeking consensus, understanding, encouraging, acknowledging or reinforcing student contributions; setting climate for learning; drawing in participants; prompting discussion; assessing the efficacy of the process. Perceived Roles: coordinator, facilitator/partner, connector/communicator, moderator, convener, salesperson, collaborator, participant, collector, etc.

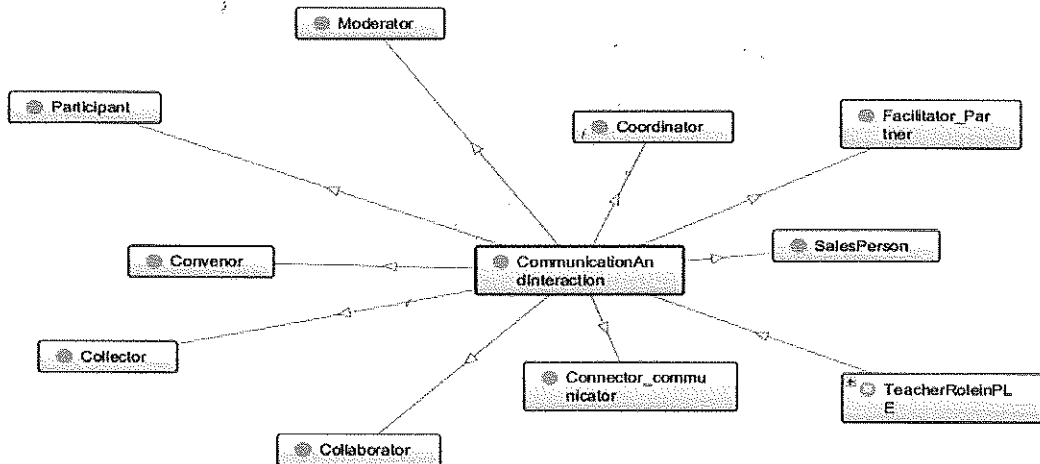


Figure 4. Ontological representation of teachers' social role in developing students' PLEs.

Management and Administration (Managerial Role)

Teachers' management role as shown in Figure 5 is related with a group of competencies that allow him to develop and adapt the planned actions such as: responding to expectations, motivation and learning needs, administering the classroom, and managing spaces and channels of communication. Tasks include: driving the classroom; sharing online file area; managing synchronous/asynchronous places; managing the shared mailboxes. Perceived Roles: leader/change agent, administrative manager/bureaucrat, curator, coach, guide, concierge, goal setter, evaluator/evaluation specialist, etc.

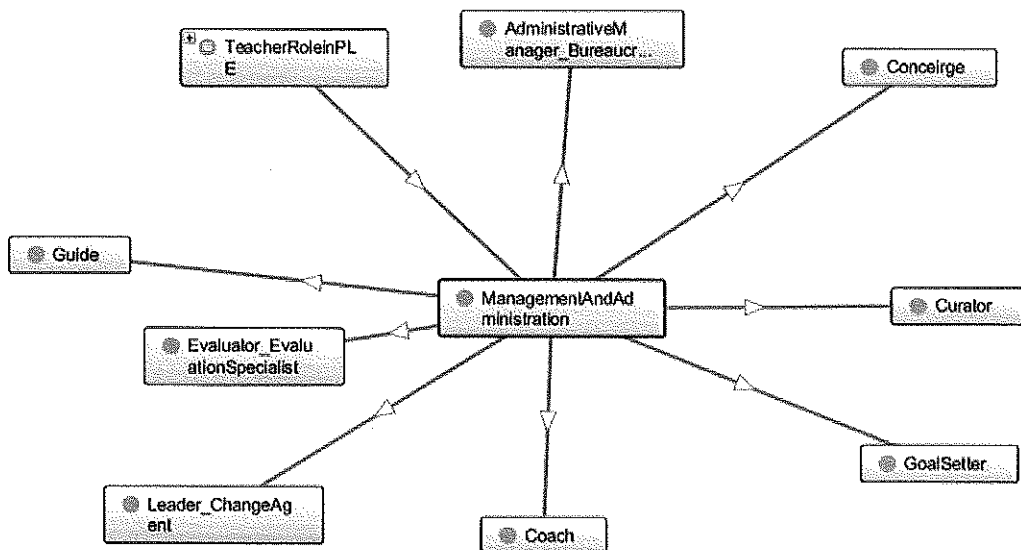


Figure 5. Ontological representation of teachers' managerial role in developing students' PLEs.

Use of Technology (Technologist Role)

Technological role as shown in Figure 6 relates to technical knowledge of support services, applications, software, and data analysis skills. Tasks include: functionalities in the lecture; learning platform tools usable for tutoring; styles of face to face, virtual, and online communication; traditional and virtual environment uses of applications for web-based teaching; knowledge of learning management systems, PLEs, etc. Perceived Roles: alchemist, sharer, network administrator, technician, technologist, media publisher/editor, etc.

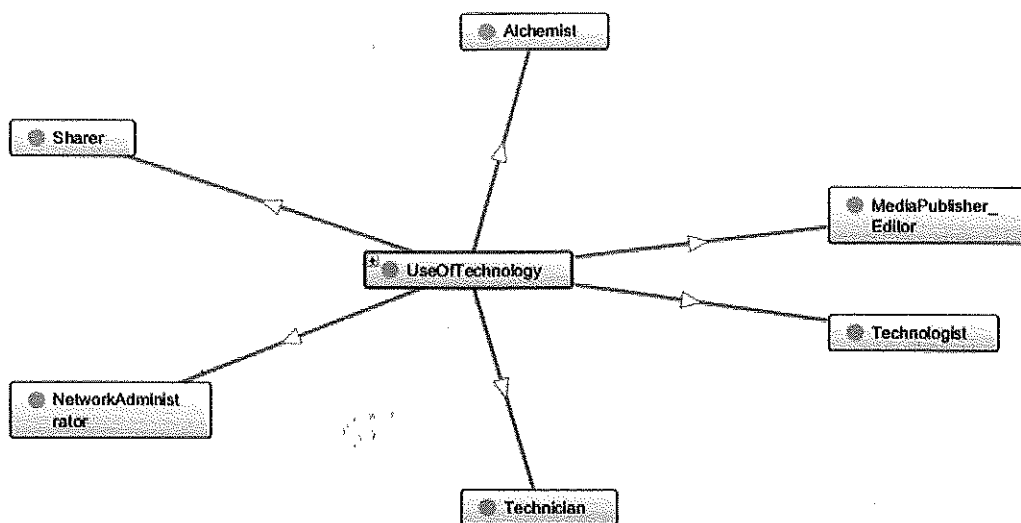


Figure 6. Ontological representation of teachers' technologist role in developing students' PLEs.

CONCLUSION

This paper discusses the theoretically created ontological representation of teachers' roles and competencies required to develop students' Personal Learning Environments (PLEs) in an efficient and effective way. An ontology model is developed that shows the relationship of teachers' roles with various stakeholders such as teachers' required competencies, students, educational institutes, learning spaces, constructivist learning model, and PLE. This study contributes and clarifies to the growing body of research on teacher competencies and roles in PLE while linking them with the notion of situated learning. The decision of adopting applications, the development of matching learning activities, the moderation and facilitation provided, and teachers' confidence level in integrating these technologies in instruction are all roles and activities that directly contribute to the successful implementation of PLE.

In developing PLE, teacher tasks are carried out by both students and the teacher, hence a teacher does not necessarily perform all the roles but rather interact with his students in general. But, in any case, the competencies required by a teacher will depend not only on the role being performed but also on the nature and complexity of the task being carried out. Consequently, this notion implies that there is an overlap of teacher competencies in PLE.

Recommendations for Future Research

Recommendations for future research include further validation of the results of this study by teachers, practitioners, and the people involved in PLE research within academia, business, and industry, with survey methodology for developing consensus over teacher competencies and roles. In addition, comparisons could be made between these different groups to determine if there is a difference in perception. Since this study does not explore the criticality of the competencies for different types of learning technologies, approaches, and contexts; further research is needed in these dimensions. And due to the rapid changes in information communication technology, the growth of PLE, and the fact that this was the first literature review of its kind; similar studies should be repeated periodically to ensure the relevancy of teacher roles and competencies in PLE.

Finally, it is also very important for future research on PLE to consider the importance of teacher as part of PLE implementation and to recognize the diversity of roles teacher perform in this context. Although we have focused on higher education in this study, the issues that we have raised are also applicable for teacher roles in further and school education where student PLEs are being developed, social software is being integrated in teaching and learning, and research to investigate the potential benefits of these new learning technologies has been commissioned.

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