




# Lurking Reduction at School Through Virtual Communities of Practice: The Binario 9 ¾ Project

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**Abstract.** The recent COVID-19 emergency has pointed out the importance of distance learning in modern Education. Indeed, although it cannot be considered a substitute of traditional didactic methodologies based on frontal lectures, it can be a valid integration, especially when addressed to those students characterized by learning disturbs and/or cultural barriers. In this paper we present a recent project, namely Binario 9 ¾, where distance learning has been implemented through virtual communities and storytelling adoption, to support impaired students of middle school to bridge the gap with others.

**Keywords:** Virtual communities of practice · Distance learning · Storytelling · Legitimate peripheral participation

## 1 Introduction

COVID-19 pandemic has caused the total closure of schools in about 192 world countries; it has been calculated the 91.4% of the total number of students in these countries stayed out of the school<sup>1</sup>. Consequently, distance learning has suddenly become the unique way for them to continue attendance of courses, despite problems in its implementation due to several reasons, from teachers' difficulties to revise their teaching styles to students' and their families' problems in acquiring necessary technological equipment. In Italy, the *educational emergency* originated from the pandemic has seen the arising of spontaneous *communities of practice*, composed of teachers, students and parents involved in the complex task of terminating the current school year.

Brown and Duguid (2001) defined *communities of practice* groups of people sharing knowledge and competencies about a given theme. This notion has been adopted to indicate the spontaneous arising of knowledge centers in organizations with respect to the classical business units clustering. According to Pan and Leidner (2003), CoPs facilitate the development of an environment characterized by *structured informality*. Finally,

<sup>1</sup> United Nations Education Scientific and Cultural Organization (2020). COVID-19 Educational Disruption and Response. Available at: <https://en.unesco.org/covid19/educationresponse>.

the importance of CoP emerges from the fact that knowledge cannot be considered apart from the context where it develops. Every type of knowledge activity implies that *knowledge contributors* as well as *seekers* require a *community* to share general conversation, experimentation and experiences with other people carrying out the same kind of activities. Following these guidelines, two distinct roles emerge in the process of knowledge generation within CoPs: contributors and seekers. The former must be willing to part with their knowledge and share it via a *knowledge management system* (KMS); the latter typically log into the system, type keywords to search, retrieve and examine the results (Sutanto and Jiang 2013).

Indeed, knowledge contributors are *active* entities and knowledge seekers are *passive* entities in the KMS development: the way knowledge is modeled within the system is transparent to the knowledge seeker; he/she is not interested in its modification or maintenance. Indeed, this is a big limitation to the CoP potentialities in developing knowledge models, especially when the CoP is *virtual*, since the principle of *legitimate peripheral participation* (Lave and Wenger 2002) is not satisfied. Legitimate peripheral participation is the key aspect when developing technological solutions for CoPs promotion, aiming at transforming newcomers into contributors rather than passive *lurkers*. Yeow et al. (2006) highlight that lurkers are participants *who persistently refrain from engaging in the core activities that sustain a virtual community*. Arguably, as the perception of both periphery and participation are context-specific, the identification of a behavior as lurking is dependent upon technology constraints and group-specific norms.

In this paper we reflect about the relationship among the three entities above, i.e. knowledge contributors, knowledge seekers and lurkers, in the distance learning scenario. We'll present the methodological issues behind Binario 9  $\frac{3}{4}$ , a project aiming at the support of middle school students characterized by difficulties in learning contents proposed by teachers, mainly due to poor level of inclusion into society. The intervention has allowed to develop a virtual community of practice, made of teachers, tutors and students, where the latter can exploit collections of exercises thought to enable them overcoming their difficulties in understanding concepts. Each lesson has been designed as a story, through which the student ideally moves from her/his initial lurking condition to the knowledge contributor one. The story contents have been validated by teachers involved in the community and, although their use with students has been postponed due to COVID-19 emergency, initial results are encouraging. The rest of the paper is organized as follows: Sect. 2 briefly reviews the literature about virtual communities of practice and storytelling, focusing on Education. Section 3 reflects about legitimate peripheral participation. Section 4 introduces our case study to show in practice how Binario 9  $\frac{3}{4}$  works. Finally, the paper concludes with some considerations about future works.

## 2 Motivation and Background

Virtual communities of practices can be meant as replacement of company web sites for information and commerce (Sutanto et al. 2011). Indeed, despite the existence of many tools for promoting such communities, how keeping the community alive is still an important research trend, from both the theoretical and practical points of view. Preece

and Shneiderman (2009) highlighted that few of billions of people involved in on-line social activities take active part in generating contents, by writing reviews of products or services, uploading photos and/experiences of their travels, or expressing opinions about politics or social life.

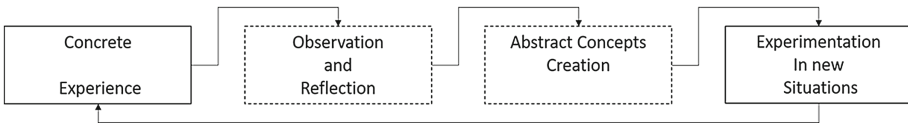
The debate on how to improve the capability of participants to contribute is still important, although many results have been reached in the recent past, see e.g. (Ma and Agarwal 2007) and (Zhang and Zhang 2005). Blanchard and Markus (2004) introduced the term *Sense of Virtual Community* (SOVC) to measure the degree of involvement of people in a community. This means that the feeling of belonging to a community is not innate, but it must be developed within the community structure goals and rules. Indeed, technology plays a crucial role in improving SOVC. A person starting the collaboration within a community as a lurker could become a knowledge contributor in the future, if and only if he/she will be guided to understand the community structure, to share its goals, boundaries and rules. For instance, *rating-based ranking* positively affects knowledge seekers' attitude to extract and comment about the knowledge modeled in a KMS (Sutanto and Jiang 2013), as well as *algorithm-based approaches* to evaluate the quality of knowledge shared by contributors positively guide them to continue feeding the system.

Successful implementation of CoPs depend on three crucial factors, as proposed by Wang et al. (2008): *remove barriers* to participation of individuals; *support and enrich* the development of participants' uniqueness within the context of the community; *link that uniqueness* with the goal of the community. Moreover, technological supports for CoPs traditionally based on centralized architectures do not meet knowledge contributors' and seekers' behavior, although they facilitate easy control and management of knowledge. This aspect is highly relevant when we think on how cultivating virtual communities of practice for the Education domain: which features should be considered to develop *virtual community systems* (VCSs) suitable allowing the emerging of positive SOVC among participants?

Educational processes aim to the promotion integral health of persons; thus, it should be a right rather than a privilege during the whole life span development (Alberici 1998).

Contemporary socio-cultural context supports the idea of knowledge acquisition and management, not only as development of organizations, policies, methods of knowledge diffusion, but also as a community benefit. Starting from these considerations, we reflect about the concept of continuous learning within organizations and how to support it. In this methodological framework, we focus on *learning by doing paradigm* at school. Learning by doing methodology states that the learning process is the result of a continuous interaction between theory and practice, between experimental periods and theoretical elaboration moments. Learning by doing is articulated into four distinct steps (see Fig. 1), where practical phases, i.e. *concrete experience* and *experimentation*, are alternated with theoretical ones, i.e. *observation* and *reflection and creation* of abstract concepts: The result is a *lesson learned* that is applicable in the future. In our framework, a concrete experience can be represented by a *story*, which is a description of decision-making process about a problem to be solved. As reported in Denning (2006), *storytelling build trust, unlock passion, overcomes hierarchies due to its intrinsically collaborative nature and its capability to flatten the communication among people (or*

*communities*). A story is a narrative account of real or imagined event(s). Stories explain how things are, why they are, and the different roles and purposes involved. Stories are the building blocks of knowledge, the foundation of memory and learning. In the Knowledge Management literature (Bhardwaj and Monin 2006), stories are often considered as very profitable tools to make explicit tacit knowledge, with the possibility to exploit them in the process of generating collective creativity from individual creativity. Starting from these considerations, we have reflected on how promoting the creation of virtual communities capable to improve integration of students with special needs at school, focusing on those courses traditionally characterized by higher level of lurking conditions, like Math (Di Poccio 2018).

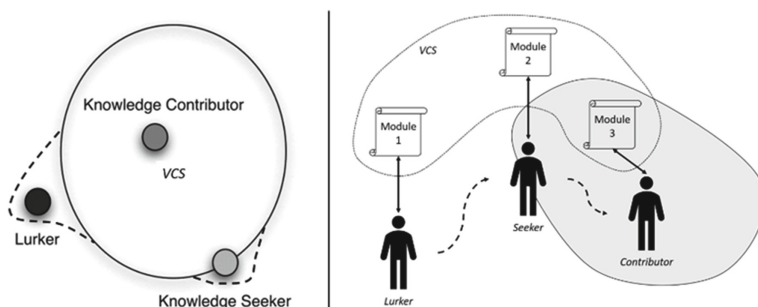


**Fig. 1.** The four steps of learning by doing

### 3 Legitimate Peripheral Participation

Legitimate Peripheral Participation (LPP) is the most crucial aspect of communities of practice: basically, it concerns the possibility for each member of the community to increase the global knowledge of it. Moving towards virtual communities this principle is hard to satisfy, being clear the distinction among, at least, three distinct roles, that are knowledge contributor, knowledge seeker and lurker. Indeed, the former has greater influence than the latter, being responsible for the maintenance of knowledge within the community. An interesting point is understanding how people can move from a role to another one: indeed, this possibility must be provided by the virtual community backend, from both the organizational and technical points of view. Most of the times, a person can acquire credits based on his/her activity on the system (that is very often designed and implemented as a blog). This way, a user can enter the community at the lurker level improving it till the contributor one. Figure 2 shows a sketch of a virtual community from the LPP perspective: Knowledge contributors are fully integrated in the community; they participate to its definition and evolution. They can be the designer and/or developers of virtual community systems (VCS), that are the set of organizational and technical tools that enables people to interact with the community; knowledge seekers are partially integrated in the community, they can be defined borderline participants. They will occasionally act as contributors as well as lurkers, on the basis of topics discussed by the community; lurkers are outside the community, they will occasionally enter it to find solutions to their problems rather than to support it.

Virtual community systems are crucial to encourage the community growth: as highlighted by dashed lines in the figure, lurkers and knowledge seekers will be interested in the community activities if and only if the underlying tools will be able to capture them. Their nature and characteristics depend on the nature and characteristics of the



**Fig. 2.** On the left, Legitimate peripheral participation in Virtual Communities; on the right, the role of VCSs in the maintenance/growth of virtual communities.

community they serve and the problem to solve; anyway, their scope should be the maintenance and, possibly, growth of the virtual community by means of opportune modules dedicated to each role, as shown in right part of Fig. 2.

#### 4 Case Study: The Binario 9 $\frac{3}{4}$ Project

Project Binario 9  $\frac{3}{4}$ , funded in the frame of Italy-Switzerland V-A Interreg Programme 2014–2020, aims at promoting success at school and better learning opportunities for impaired students, focusing on immigrants. Indeed, there are still many differences between their conditions at school with respect to Italian or Swiss students: in Italy, the 2018 report<sup>2</sup> about “Invalsi test” results pointed out how foreign students obtain lower scores than Italian ones at the last year of middle school. Similar claim states for Swiss situation. The project has allowed to design and implement a comprehensive approach to reduce this impairment situation: in this paper we focus on the development of tools for reducing the gap between Italian students and their foreign colleagues in math, to improve the inclusion of the latter as well as their capability to access secondary schools programs.

As stated above, a virtual community of practice is characterized by three kinds of roles: knowledge contributors, knowledge seekers and lurkers. In the project, knowledge contributors are both domain experts and knowledge engineers: while domain experts provide the knowledge necessary to develop the virtual community system, knowledge engineers are responsible for modeling this knowledge into a suitable system. Domain experts are middle school teachers; they are responsible to indicate the topics the system should focus on; knowledge engineers are technicians. Knowledge seekers are tutors, i.e. people who have knowledge about the domain and how to use the developed VCS. Their task is supporting students with special learning needs in filling the gap with their peers. Students are lurkers in the project scenario; they are excluded from the community at the beginning, due to their difficulties in solving problems. We have based our choices on students with difficulties in understanding mathematics and Italian language. Thus, the

<sup>2</sup> See [https://www.invalsi.it/invalsi/doc\\_evidenza/2018/Rapporto\\_prove\\_INVALSI\\_2018.pdf](https://www.invalsi.it/invalsi/doc_evidenza/2018/Rapporto_prove_INVALSI_2018.pdf).

crucial aspect in the design and implementation of successful VCS was the definition of iterative paths to enable students to evolve from the initial status towards the others.

As introduced in Sect. 2, storytelling has been adopted to deal with virtual communities in the project. A story has been designed as a collection of learning modules at different levels of granularity. According to Fig. 2 a story is divided into three levels: at the first level (i.e. the lurker one), the student is supposed to be at the beginning. Here, the proposed activity is thought as a simple game, where concepts the students should learn at the end of the story are not explicitly presented. The rationale is enabling the student to reason about the content of the lessons exploiting samples from the concrete life. At the second level (i.e. the seeker one), the student who has passed the first step is invited to increase his/her level of competence about the lesson subject by means of a lecture, supported by a tutor. Here, he/she should be able to learn theoretical aspect of the concrete problem solved when staying at lurker level, by means of comparison between the usual training program at school and the reality. Tutor presence is crucial to this aim, to guide the student with special needs to develop the conceptual capability to build up virtuous connection between the two positions.

Last, but not least, the contributor level presents another game to the student, maybe the same as the first level one, but asking him/her to exploit theory to solve the problems. Doing so, the VCS tests the student about his/her capability to evolve from the initial condition, characterized by difficulties in understanding a problem due to the absence of necessary conceptual references, to the final one, where the student should be potentially able to design and implement similar stories for supporting his/her peers. Of course, a story could be partially followed according to the level of initial skills of the students, as well as the subject covered by it. Till now, fifteen stories have been completely developed, for a total of 45 learning modules on topics from arithmetic operations to solid geometry. All the stories are thought as chapters of a meta-story, that tells us about the summer holidays of a group of friends. In this way, we hope the students understand that Math is composed of different theoretical questions whose answers can generate new questions rather than isolated concepts. Such modules have been implemented into Scratch 3.0TM; this environment<sup>3</sup> has been chosen for two main reasons: the metaphor of program as a theatrical performance in terms of actors, scripts and stages is ideal for reproducing the narration of a story; most of students know Scratch since they studied basic notions at school, so we hope to promote the evolution towards the knowledge contributor role allowing them to explore how a story has been realized, in order to enable them to produce other stories on their own.

Figure 3 shows a sketch of a narration in the project: the sample concerns the surfaces area and perimeter topic. In Chapter 1, the story presents the friends at the end of holidays, asking the user to draw the most beautiful monument in the pictures. Monuments proposed have been chosen thanks to their aspect, characterized by the presence of figures studied at school, like triangles, rectangles, squares, and circles. Figures are drawn by the student exploiting a grid on the touchscreen and their areas and perimeters are calculated in terms of it too. Then, Chapter 2 proposes definitions, descriptions, and formulas of different kinds of figures, providing the tutor with guidelines to increase the understanding of the topic by his/her student. Finally, Chapter 3 revises the sample

<sup>3</sup> <https://scratch.mit.edu/discuss/topic/326861/>.

of Chapter 1, asking the student to play tangram, recognize the figures composing the pictures and calculating the areas and perimeters of total surfaces by composition of single elements. Formulas learned following Chapter 2 must be applied and grid can be used to validate results.



Fig. 3. A story in the Binario 9  $\frac{3}{4}$  project

## 5 Conclusion and Future Works

In this paper we have introduced a conceptual and computational framework for the development of virtual communities in the Education domain. The Binario 9  $\frac{3}{4}$  project has been presented as a case study. The implementation phase of the project has finished on January 2020, as well as the definition of the Binario 9  $\frac{3}{4}$  virtual community members. Selected students are 30, only one of them is Italian. Eight students are at first grade, six at second grade and sixteen at third grade of middle school. Fourteen students are male, the rest are female. The community is completed by 13 tutors and two teachers; ten tutors are attending University, two the last two years at Secondary schools and one is working as teacher's aide. Teachers have developed a questionnaire to evaluate the initial level of students. Unfortunately, the COVID-19 emergency has stopped the project just at the beginning of the testing phase. Although the initial results are encouraging, an intense validation campaign will be implemented when restarting next September. This validation will be conducted from two perspectives at least: first, the effectiveness of the proposed VCS will be evaluated in terms of better understanding of topics by students. This step will be based on questionnaires prepared by virtual community teachers; second, the effectiveness of the proposed VCS in improving the maintenance and growth of the community will be measured too. This point will address our future research, being necessary to build up a bridge between the application of correct SOVC measures. Abfalter et al. (2012) proposed recently to adopt a revised version of SCI (Chavis et al. 1986), namely SCI<sup>2</sup> (Chavis et al. 2008): this index consists of 24 closed-ended items measured on Likert-like scale. The items are grouped into four dimensions: reinforcement of needs (RON), membership (MEM), influence (INF) and



shared emotional connection (SEC). The total sense of community index (TSOC<sup>1</sup>) is the summary of the  $Q_i$ , where  $Q_i$  is the value in the range [0...3] given by the user to the  $i$ -th question. In our study, we are interested in evaluating if virtual community systems can support communities of practice to evolve. To this aim, we will apply the notions of lurking, seeking, or contributing communities on the basis of their TSOC<sup>1</sup> value (Sartori et al. 2018).

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