

Revisiting and Rethinking the Structural Elements of Communities of Practice

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Abstract. Communities of Practice have existed for as long as people have been learning and sharing their experiences. However, it was not until the early 1990’s before the study of these communities gained attention from the research community. Since then, these communities have been studied in many research domains, yet, the core structural elements, which are critical to these communities remain constant - *Domain, Community* and *Practice*. In this paper we re-examine the structural elements of Communities of Practice and argue for the extension of these to include aspects on *Participation, Learning* and *Knowledge*. We also take a first step in validating these new structural elements by presenting a study that explores how they appear in a known Communities of Practice (the CoderDojo movement). Our research informs the future study of COP from both a theoretical and organizational perspective.

Introduction

Communities of Practice (COP) have existed for as long as people have been learning and sharing their experiences through storytelling (Lave and Wenger, 1991). However the study of COP, and in particular their impact on how groups of people work and learn together only gained attention from research communities in the early-1990s. Today, COP are widely studied in many domains, such as Healthcare (cf. (Falkman, et al., 2008)), Software Engineering (cf. (Ranmuthugala, et al., 2011)) and Business and Management (cf. (Wenger and Snyder, 2000)) to name but a few. Over this period, much research has validated and confirmed Lave and Wenger’s claim (1991) that the three main structural elements of a COP are:

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Domain, Community and Practice (Corso and Giacobbe, 2005; Sánchez-Cardona, et al., 2012; Snyder, et al., 2003; Wenger, 1998; Wenger, 1998b; Wenger, 2006; Wenger, et al., 2002; Wenger and Snyder, 2000). Research also supports the assertion that these three elements are vital to the formulization and development of a COP (Wenger, 1998) and the combination of these three elements is what differentiates a COP from a normal community (Eckert, 2006).

The aim of our research is to revisit the structural elements of COP (Domain, Community and Practice) and in doing so also pose the questions: *What defines a Community of Practice? What are the key characteristics of a Community of Practice? And how do the key characteristics materialize in an existing Community of Practice?* Our objective is to explore previous research on COP to seek whether other structural elements have been discussed and could possibly be given as much prominence as the three that Lave and Wenger (1991) first established. In doing so, the approach we took involved a two-step process, whereby we first conducted an extensive review of literature related to COP, the results of which lead us to propose amending the three current structural elements (*Domain, Community and Practice*) with *Participation, Learning and Knowledge* to form a more holistic understanding of the structural elements of current COP. As a first step in validating this claim we conducted a follow-on study that involved embedding ourselves in a commonly known COP (the CoderDojo movement) whereby we conducted a series of semi-structured interviews with CoderDojo mentors to identify how and where these elements (*Participation, Learning and Knowledge*) appear in the day-to-day running of this community. The main contribution of this paper is twofold, first we present a review of research on COP, conducted in many domains over the last twenty-five years. Secondly, based on our review we propose an extension of the current structural elements of COP and take a first step in validating these new elements.

Communities of Practice

Communities of Practice (COP), as a term and research area, was first introduced by Lave and Wenger (1991) when they discussed it in regards to apprenticeship as a learning model. Wenger then extended this concept, and applied it to other domains, such as, for instance: organisations (Wenger, 1998b). As part of this work Wenger defined COP as a “group of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly” (1991, pp 72-73). Many others have developed different definitions of COP in relation to their use in various types of organisations and sectors (Brown and Duguid, 1991; Hildreth & Kimble, 2002; Fisher, 2001; Hoadley, 2012; Lindkvist, 2005; Gherardi, 2006).

While there are many different definitions of COP in the literature, there is more consensus on the key structural elements that help to form and develop a COP. Lave

and Wenger (1991) first discussed the three structural elements of domain, community and practice in their early work and they were further elaborated by Wenger (1998). They first introduced them to describe the way in which a COP can evolve naturally because of the members' common interest and commitment to a particular domain or area. The early work of Lave and Wenger, which identified these elements, has subsequently been developed further throughout the years. If we look at each element individually, *Domain* refers to the shared domain of interest the community members are engaged in (Corso and Giacobbe, 2005; Probst and Stefano, 2008; Ranmuthugala, et al., 2011; Wiggberg and Daniels, 2011) and commitment to this domain is implied by membership and a shared competence that distinguishes members from other people (Lave and Wenger, 1991; Wenger, 1998, 1998b, 2006). *Community* refers to the joint activities the community members engage in (Lave and Wenger, 1991; Wenger, 1998, 1998b, 2006), i.e. they share information, help each other, engage in group discussions, build relationships etc. Finally, *Practice* refers to the shared repertoire of resources the community members build up, (Lave and Wenger, 1991; Wenger, 1998, 1998b, 2006), i.e. stories, tools, experiences, ways of dealing with recurring problems, etc. These elements have been validated by many researchers in the current COP literature (see for instance, Ranmuthugala, et al., 2011; Nistor and Fischer, 2012; Sánchez-Cardona, et al., 2012; Corso and Giacobbe, 2005; Snyder and Briggs, 2003; Lindkvist, 2005; Wiggberg and Daniels, 2011).

Our research leverages on these works, as well as those that sought to explore structural elements beyond those first established by Lave and Wenger (1991). Couros and Kesten (2003) explored COP by conducting a considerable literature review to elicit the different definitions of a COP that exist, along with what they call the “general characteristics” of a COP (Lave and Wenger, 1991, pp. 10). Under this term they discuss characteristics such as social learning theory, participation, knowledge sharing, and more. However, they don't go so far as to describe or define these as key characteristics or structural elements of a COP. Also, the literature they used to identify these characteristics may be considered as being quite narrow as they mainly relied on the work of Wenger (1998; 1998b). Since then, the body of literature on COP has greatly expanded.

As part of a review of literature on COP, Roberts (2006) explored the role of a COP for interpersonal knowledge transfer. In this she summarised the key characteristics of a COP compiled by Wenger (1998b), however, she overlooked the three aspects we focus on in this paper: *Participation*, *Learning* and *Knowledge*. The characteristics she did focus on can easily be identified with *Domain*, *Community* and *Practice*. Although Roberts does mention participation with regards to negotiating meaning (Roberts, 2006, pp. 4) and forming an identity within the COP (pp. 8) she does not explain how one participates in a COP and fails to highlight the importance of participation as a key characteristic.

In this section we provided a brief overview of research that has sought to define and elaborate on the study of COP. In the next section we continue our review of related literature but we focus on work that has explored the structural elements of COP with the aim of identifying key elements that may have been somewhat overlooked in previous work.

Reviewing and Extending the Structural Elements of COP

This phase of the study followed on from the initial review of literature on COP. We decided to conduct a Meta Review of the literature in order to extract the most prominent structural elements of a COP. In doing so, our aim was to explore whether or not there are structural elements discussed in the literature that may have emerged since Lave and Wenger (1991) first established the three known elements of Domain, Community and Practice - and if so, why they have not been considered as structural elements before. This phase involved reviewing literature that investigated different aspects of COP. We extracted the definitions and characteristics from the literature and stored them in an online digital archive, keeping a detailed record of each. Next, we categorised these based on keywords and phrases related to the structural elements of Domain, Community and Practice. During this process, we found many characteristics could not easily be categorised under these elements, including the way in which a member of a COP moves from the periphery to the centre through participation, the way in which knowledge is transferred from one member to another, and the type of learning that takes place in a COP. Therefore we went through a process of coding, categorising and describing the characteristics that did not relate to Domain, Community and Practice and we ended up with a set of three new structural elements: Participation, Learning and Knowledge. In Table 1 we present a list of characteristics under these elements that were prominent in the literature. We categorised all of the similar characteristics in the literature together based on similarities in key phrases and meaning. In the following we discuss these structural elements in more detail.

Participation

According to the literature, participation in a COP refers to the accumulation of expertise, the development of expertise and the stimulation of the social construction of knowledge (Nistor and Fischer, 2012). Members in a COP go through a process of legitimate peripheral participation (Couros and Kesten, 2003; Lave and Wenger, 1991; Wenger, 1998b). People initially join the community and learn on the periphery, and as they become more competent, and the activities of the community become more relevant, they move closer to the core of the

community (Hoadley, 2012; Lave and Wenger, 1991; Wenger, 1998b). Through this process of legitimate peripheral participation the COP members gain expertise with the COP and they construct knowledge. One's identity in a COP can be described in terms of various levels of expertise. Members start as a novice on the periphery moving towards an expert at the centre of the community. This expert status comes as a result of participation (Nistor and Fischer, 2012).

Table 1 – COP Characteristics - extracted from existing literature under the structural elements Participation, Learning and Knowledge.

Participation	Learning	Knowledge
Legitimate Peripheral Participation (Eckert, 2006; Lindkvist, 2005; Wenger, 2006)	Informal Learning (Boud, Middleton, 2003; Wenger, 1998b)	Tacit and Explicit Knowledge (Avasti, et al., 2015; Bradshaw et al., 2004; Sauve, 2007; Wenger, 2006)
Members join and learn on the periphery of the community before moving towards the center (Hoadley, Kilner, 2005; Lindkvist, 2005; Wenger, 2006)	Learning is an active process (Lindkvist, 2005)	Members develop advanced and reproducible knowledge in the community domain (Probst, Borzillo, 2008)
Members gain experience with the practice of the community (Probst, Borzillo, 2008)	Social Participation (Lindkvist, 2005; Wenger, 1998; Wenger, Snyder, 2000)	Knowledge is categorized by narratives, collaboration and constructivism (Blankenship, Ruona, 2007)
Member construct knowledge through participation (Probst, Borzillo, 2008)	Participation fosters learning in a COP (Lindkvist, 2005)	Knowledge is transferred through informal methods (Sheridan, Goggin, O'Sullivan, 2016)
Members build up and develop their expertise within the COP (Avasti, et al., 2015, Eckert, 2006; Probst, Borzillo, 2008; Wenger, 2006)	The person is actively involved in their learning process (Lindkvist, 2005; Wenger, 1998; Wenger, Snyder, 2000)	Knowledge in a COP is created and disseminated through the C4P model (Jakovljevic, et al., 2013)
Participation leads to various levels of expertise & expert status in a COP (Probst, Borzillo, 2008; Wenger, 2006)	Situated Learning Theory (Clancey, 1995; Lindkvist, 2005; Wenger, 1998)	Narratives or stories are used to identify problems and represent existing knowledge (Jakovljevic, et al., 2013)
Members start as a novice and through participation become an expert (Probst, Borzillo, 2008; Wenger, 2006)	Learning takes place in the same situation it is applied (Wenger, 1998; Wenger, Snyder, 2000)	Collaboration involves members engaging in and sharing common practice (Jakovljevic, et al., 2013)
Expertise can determine the level of participation a member engages in (Probst, Borzillo, 2008)	Members learn through content, context, community and participation (Clancey, 1995; Lindkvist, 2005; Wenger, 1998)	Constructivism allows members to develop an understanding of the practice and how to solve problems (Jakovljevic, et al., 2013)
Different levels of participation – (i) Core group,	Formal learning can sometimes take place	Collaboration and interaction increases and improves

(ii) those who engage in discussions & activities and (iii) periphery group (Wiggberg, Daniels, 2011)	through training sessions, workshops and courses (Sauve, 2007)	knowledge in a COP (Jakovljevic, et al., 2013)
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Learning

The process of legitimate peripheral participation is a social process and fosters learning in a COP (Lave and Wenger, 1991). Lave and Wenger describe it as follows: ‘learning occurs if the person is actively involved in the learning processes’. This process of learning is grounded in the situated learning theory (Clancey, 1995; Lave and Wenger, 1991; Stein 1998) and Lave and Wenger relate this to the learning within a COP. Members of the COP acquire professional skills and the process of legitimate peripheral participation leads to full memberships in a COP (Lave and Wenger, 1991). Situated learning is the relationship between learning and the social context in which it occurs, i.e. learning takes place in the same situation in which it is applied (Stein 1998; Wenger, et al., 2002). The major elements in situated learning are: content (facts and processes of a task); context (situations, values, environment, and cues); community (the group where the learner will create and negotiate) and participation (where a learner works together with others in order to solve the problem) (Clancey, 1995; Lave and Wenger, 1991; Stein 1998). This form of learning is a social process and comes as a result of social participation, i.e. the individual is an active member of the COP and in the construction of their identity within the community (Stein 1998; Wenger, et al., 2002). According to Wenger (1998), social participation leads to the informal learning which takes place in a COP. This form of learning takes place within the informal meetings, conversations and relationships the community members engage in (Boud and Middleton, 2003).

Knowledge

Communities of practice are very important sources of knowledge (Avasthi, et al., 2005), and it has been argued that they have become the most natural way in which tacit knowledge is transferred within organisations (Bradshaw, et al., 2004). The types of knowledge created and disseminated in a COP can be described as tacit and explicit knowledge (Avasthi, et al., 2005; Sánchez-Cardona, et al., 2012; Wenger, 1998b). COP can be used to facilitate the informal knowledge transfer that drives leadership development, productivity, and innovation because the amount of work driven by tacit knowledge continues to rise (Sauve, 2007). The creation of knowledge in a COP can be categorised by the following three elements – Narratives, Collaborations and Social Constructivism (Blankenship and Ruona, 2007; Brown and Duguid, 1991; Couros and Kesten, 2003; Hoadley, 2012). Narratives are used for identifying problems and representing existing knowledge.

Collaboration refers to participants engaging in and sharing common practice. Social Constructivism describes how participants develop a common understanding of their practice and how to solve problems. The C4P Framework (Content, Conversations, Connections, Context and Purpose) established by Hoadley and Kilner (2005) describes how knowledge is created and disseminated in a COP.

We argue that our proposed structural elements - *Participation, Learning and Knowledge* - alongside *Domain, Community and Practice*, provide us with a more comprehensive way of describing and understanding how COP form and develop. These extra elements may not have been considered as key elements before, as the existing literature has arguably sought to confirm Lave and Wenger's (1991) postulation of three key elements. Lave and Wenger (1991) identified Domain, Community and Practice as structural elements of a COP and these elements have a number of links between them. For example, the domain is what brings the community together and if the community doesn't interact on a regular basis, they cannot develop their practice. Lave and Wenger (1991) discussed characteristics of participation, learning and knowledge within the context of a COP and highlighted their importance but did not consider them as structural elements. This may be because they chose to discuss them within the context of the Domain, Community and Practice and within the context of how a COP operates.

In the following, we present a study aimed at validating the extension of the structural elements. We focused on how and where aspects of Participation, Learning and Knowledge appear in a recognised COP - the CoderDojo Movement.

The CoderDojo Study

Before we describe the study, we will describe the CoderDojo movement, its structure, as well as the rationale for us selecting it as an exemplar COP to study. The CoderDojo movement is a global network of public, volunteer-led, community-based programming clubs for young people aged 7-17 years old. Through participation in these clubs, young people learn how to code, build a website, create an app or a game and explore technology in an informal, creative and social environment. This community is relatively new, starting first in Cork, Ireland in July 2011. It soon became a global phenomenon, with over 10,000 registered coding clubs in 125 countries worldwide¹ and the growth of several new Dojos each week.

¹ <https://www.codeclubworld.org/>

The CoderDojo Structure

The CoderDojo is a global community of coding experts, parents and children who all come together for one purpose - to teach and learn how to code in an informal learning environment. The core group of a CoderDojo includes the mentor - typically the person who set up the CoderDojo (i.e. CoderDojo Champion) - and the children who attend the CoderDojo. Each child is initially on the periphery of the community where they learn how to code, but as they become more proficient at coding and familiar with the activities of the community, they move towards the core of the community by helping newcomers and becoming junior mentors. The parents are generally on the periphery (unless they set up the dojo), although they also have an opportunity to learn how to code with their child. Each individual Coderdojo can be viewed as a COP – however, each dojo has little or no interaction with each other. Instead they could be viewed as a network of COP which fall under the umbrella of the Coderdojo Foundation.

We selected the CoderDojo movement as an exemplar COP to study, not only because it is a commonly recognised COP, but also because we have access to over 20 local CoderDojos, which helped us to gather a number of different opinions and insights on the day-to-day running of the community. Access to the CoderDojos allowed us to understand how the CoderDojo mentors and participants communicate and collaborate with each other both inside and outside of their weekly clubs. Moreover, we anticipated that interviewing members of the CoderDojo would help us to understand what kind of learning outcomes are expected or anticipated from participation in the CoderDojo.

The Study

The aim of this part of the study was to investigate whether or not the new structural elements established as part of phase one, i.e. *Participation, Learning and Knowledge*, appear as key elements in the day-to-day running of a CoderDojo. With this in mind we collected in-depth insights into the everyday running of the Coderdojo from those at the core of the community. We conducted ten semi-structured interviews with ten CoderDojo mentors (P1-10) from eight different Coderdojo groups (C1-8) (See Table 2.) The interviews were conducted with 6 female and 4 male mentors and the age group varied between 17 and 60. Two participants are CoderDojo Champions, i.e. they are responsible for setting up the dojo but do not mentor the participants. Five participants are CoderDojo Champions and Mentors, i.e. they were responsible for setting up the dojo and they also mentor the students. Another participant is a CoderDojo Mentor only – i.e. she attends the dojo each week and mentors the students with her background in coding. Finally, two participants are CoderDojo Champions and parents to some of the participants, i.e. they set up the dojo because they thought it would be a good activity for their children. These participants are also involved in the logistics of

the CoderDojo, i.e. organising the venue, trips, guest speakers, etc. Each interview lasted between 25 and 40 minutes. The questions asked were open-ended and focused around aspects that relate to Participation, Learning and Knowledge to determine if they were prominent characteristics in the day-to-day running of their CoderDojo. The questions asked included: How did you get involved in the CoderDojo and why? What have you learnt during your time in this CoderDojo? Tell me about the activities of this CoderDojo – can you describe a typical CoderDojo class? All interviews were video and audio recorded, and the same researcher who conducted the interviews transcribed them (lead author).

Table 2 – Interview Participant Information

Interview Participant/ Coderdojo	Coderdojo Venue	Mentors & Participants in the Coderdojo	Champion	Mentor	Parent
P1/C1 (male)	Community Library	20 participants; 2-4 mentors	✓	✓	×
P2/C2 (male)	Large Multinational Company	30 participants, 2-4 mentors	✓	✓	×
P3/C3 (male)	Large Multinational Company	30 participants, 2-4 mentors	✓	✓	×
P4/C4 (male)	Large Multinational Company	30 participants, 2-4 mentors	✓	✓	×
P5/C5 (female)	Community Centre	20 participants; 2-4 mentors	✓	×	✓
P6/C5 (female)	Community Centre	20 participants; 2-4 mentors	✓	×	✓
P7/C1 (female)	Community Library	20 participants; 2-4 mentors	×	✓	×
P8/C6 (female)	Community Hall	20 participants; 2-4 mentors	✓	×	×
P9/C7 (female)	Large Multinational Company	30 participants, 2-4 mentors	✓	✓	×
P10/C8 (female)	Third Level College	60 participants, 2-4 participants	✓	×	×

Data Analysis

As part of our analysis we coded the interview transcripts against the three new structural elements of a COP – Participation, Learning and Knowledge. We chose a directed content analysis approach (Bengtsson, 2016; Elo & Kyngäs, 2008;

Graneheim & Lundman, 2004, Helgevold & Moen, 2015) and close-coding approach as we sought to focus the analysis on aspects of the three new structural elements. The interview transcripts were read through several times to obtain a clear understanding of the data before the transcripts were divided into high level categories of Participation, Learning and Knowledge. Each of these transcript sections was then coded, which resulted in 45 unique codes (13 Participation, 20 Learning and 12 Knowledge). These codes were then sorted semantically whereby two themes emerged for each structural element (see Table 3.). These themes are discussed in the following section.

Table 3 – Data Analysis – Structural Elements, Themes and Codes.

Structural Element	Theme (Unique Codes)	Exemplar Code
Participation	<ul style="list-style-type: none"> • Legitimate Peripheral Participation (8) • Active Participation accumulates Expertise (5) 	<ul style="list-style-type: none"> • Children helping their fellow participants • Collaborative participation
Learning	<ul style="list-style-type: none"> • Participation fosters learning (11) • Participants formulate their own learning (9) 	<ul style="list-style-type: none"> • Children learning from the mentors • Children can personalise projects
Knowledge	<ul style="list-style-type: none"> • Participation leads to increased knowledge (6) • Knowledge is disseminated through collaboration & communication (6) 	<ul style="list-style-type: none"> • Children increasing their knowledge of coding through participation • Face-to-face communicate & collaborate

Findings

Through our analysis of the interview transcripts, we identified numerous occasions where our participants referred to aspects of Participation, Learning and Knowledge when talking about their everyday experience of the CoderDojo. In the following we outline where these structural elements are evident in the day-to-day activities of the CoderDojo.

Aspects of Participation

Legitimate Peripheral Participation

Evidence from the interviews indicates that the participants of the CoderDojo (parents, children and mentors) go through a process of legitimate peripheral participation (Lave & Wenger, 1991). The parents bring their children to the

individual CoderDojo clubs, sitting on the periphery of the community but they often learn with their child as P2/C2 explains, *“Parents have an opportunity to have a good learning experience as well. They can learn the challenge and watch their child learn too. They engage in a joint exercise.”* Parents can also move through the layers of the community as they become mentors to the new members. They gain experience with the community practice through learning and teaching coding. P6/C5 highlights this point, *“Parents end up being mentors because they pick up things along the way.”* The children also join the community at the periphery, attending their first class and learning the basics of coding. They start with simple coding, moving towards more advanced coding as their coding expertise increases. In this way, they move through the layers of the community. As they become more proficient at coding, they move towards the centre of the community and act as a mentor to the new CoderDojo members: *“Kids do the mentoring of the blue belt. To get the blue belt, the idea is that they do three consecutive stints of teaching a class or group of students. The kids do an entire run of a class”* (P5/C4); *“We have one junior mentor and she is in the teenage room. She started here as a participant. Now she has started her own dojo in her own school”* (P9/C7). Mentors in the CoderDojo are immediately part of the central activities of the community. Some join at the centre from the beginning (e.g. those with a prior knowledge of coding) while others, through legitimate peripheral participation, move towards the centre and become mentors over time: *“I was going to CoderDojo as a participant for about six years since it started. Bill Lau who set up the original CoderDojo spoke to me and had been very encouraging about setting up my own one...I set up this CoderDojo when I was in Transition Year. My role is Mentor.”*(P1/C1)

Active Participation accumulates Expertise

The children accumulate expertise of coding and problem solving as they actively participate in the classes - listening to their mentor, collaborating with fellow participants, asking questions, etc. This is how they construct their knowledge within the community: *“The motto is if you have a problem, ask three other kids first before you ask the mentor and this encourages group work and collaboration”* (P10/C8) and *“We (the mentors) tackle lots of questions asked by the kids. We tackle things line by line.....We do gentle quizzes to make sure the kids understand what is happening because the point is to learn how to code.”* (P7/C1) It can be said in the CoderDojo that one’s identity can be described as various levels of expertise, and that this expertise comes as a result of participation in the community. The parents and children typically join the community as novices, and some parents remain a novice on the periphery. Meanwhile, children move from being a novice to an expert at the centre of the community as they increase their knowledge of coding. Some children and parents become mentors to the younger children, and mentors are seen as experts in the community. The organiser of the

CoderDojo may not always be a mentor, although they are still central to the activities of the dojo. They are responsible for recruiting mentors and participants and organising events or activities for the dojo if necessary: *“I started bringing my son to this CoderDojo when it started. After about two weeks, I became secretary on the committee. We make sure the kids work on their projects... We try to organise day trips and guest speakers to come in when mentors are unable to attend.”* (P3/C3).

Aspects of Learning

Participation fosters Learning

The transcripts reveal that legitimate peripheral participation also fosters the learning that occurs in a CoderDojo community. The participants learn by being actively involved in the activities of the dojo and by actively moving through their community. The participants are engaged in an informal learning environment, which is somewhat different from what they are familiar with at school, *“The dojo has a relaxed learning environment. If it’s too like school, they won’t want to come back again....They (the kids) might have their own thing that they would like to add, something they’ve seen on YouTube. The kids will do their own thing, changing variables in the code, etc.”* (P7/C1) The CoderDojo facilitates a learning environment where the children can have fun and enjoy themselves while learning to code: *“We facilitate a learning environment. I want children to have fun and enjoy themselves. I want them to learn how to solve problems, something they can’t learn in schools.”* (P2/C2) The activities of the CoderDojo lead to informal learning activities that in turn facilitate collaborations and an exchange of knowledge between its participants. Children work on their own as well as in groups: *“Generally kids work on their own projects. Although they are working on their own games, they still work together. A lot of the kids teach themselves. They generally come up with their own ideas”* (P8/C6). They are also encouraged to help each other: *“The mentors go around and help the children and we also encourage the children to help each other....I love when the children are inquisitive and cheeky. I like a lively session! I love when kids ask questions”* (P9/C7).

Participants formulate their own Learning

The children are often the determinants of their own learning, and can influence the topics that are covered in the classroom, *“...we were doing tables but the kids didn’t want to do it so we skipped past it. The kids can come up with ideas. For example, one kid wanted to add a video to his website so we dedicated a class to that.”*(P1/C1) The mentors and the children acquire new skills as they participate in the CoderDojo, both technical and soft skills: *“The mentors learn communication skills, presenting skills and organisation skills”* (P5/C4). Meanwhile, along with coding, the children learn *“social, soft skills,*

communication, teamwork and people skills” (P9/C7). Some children will chose to work on their own projects, “The children downstairs work on their own projects. They’ve been invited to take part in classes but they like working on their own stuff. They help each other” (P4/C4). Mentors learn what’s involved in running a dojo and what it means to be a mentor: “I had to grasp the difference between teaching students at University College Cork (UCC) and kids who may be as young as 10. The students in UCC would pick things up a lot quicker...Adapting to the young age of the children was a challenge” (P4/C4). Younger and older children learn different coding concepts: “We introduce them (young children) to Scratch. That is used to introduce the children to coding, but the older kids think this is very juvenile. We try to give them the opportunity to work with Internet devices such as Raspberry Pi and others. Some kids learn Python and Java...” (P2/C2).

Aspects of Knowledge

Participation leads to increased Knowledge

The content and approach to learning in a CoderDojo varies from one dojo to another. Some CoderDojo use PowerPoint slides and the CoderDojo book as sources of content for each class: *“It is my responsibility to prepare the material, know the code beforehand, prepare slides, PowerPoints, PDFs, teach the kids, explain the code to them and explain what it is used for” (P1/C1).* While other dojos will introduce the children to different software programmes and allow the children to work on their own projects: *“We shifted towards an overview of the environment (e.g. Scratch) for fifteen minutes and then a challenge from the first opportunity. We offer new challenges, rewards, demos but a lot of the projects in the class can be similar.” (P2/C2)* The mentors and children engage in face-to-face conversations on a regular basis as they meet for classes each week.

Knowledge is disseminated through collaboration & communication

The mentors help the children with any problems they are facing, and in doing so disseminate knowledge to the community members. Two mentors we interviewed also use an online platform where mentors can discuss what they are delivering each week, and the children can ask questions of the mentors if they are working on a project outside of the class: *“We use a Slack Channel which is a team chat channel. There are different channels for different classes. On the mentors channel we discuss what we are going to cover each week. Students can ask questions about something they are stuck on.” (P5/C4),* and *“We also have the Discord Channel where the kids can ask questions about anything to do with CoderDojo coding or separate coding.” (P7/C1).* The children form friendships with each other and they also form a relationship with their mentors as they meet on a weekly basis and this forms trust between the community members, *“I wanted continuity. That way I knew what the child was working on each week and I could attempt to help the child*

the following weeks. We needed to build a relationship with the children” (P2/C2) and “The friendships they make is nice to see as well. They help each other with the code, if one is finished they go around and help each other” (P7/C1).

CONCLUSION & FUTURE WORK

It is evident in the literature that COP are widely studied across different sectors, yet only three structural elements of COP – *Domain, Community* and *Practice* – are used when identifying the key characteristics of a COP. We argue that these structural elements overlook how and why people participate in a COP. They also overlook aspects of learning that takes place within a COP and they don’t represent how knowledge is created, managed and disseminated in a COP. During our review of COP literature we found that these characteristics were not listed under the main identifying features of a COP, yet our study of the CoderDojo movement seems to indicate that they are crucial to the formation, development and day-to-day running of this COP.

In summarising our work, we firstly presented a comprehensive review of research on COP, conducted in many domains over the last twenty-five years. Secondly, based on our review we proposed an extension of the current structural elements of COP and we took a first step in validating these new elements by investigating how these new structural elements appear in the day-to-day running of the CoderDojo movement. We did so by embedding ourselves in this community and conducting semi-structured interviews. Our analysis of these interviews not only allowed us to shed light on each structural element, it also illustrated several connections between them. It is through active participation in the COP that the participant increases their learning. They learn by doing and being actively involved in the activities of the community. Participation also leads to increased knowledge within the community. Participation in the community activities leads to the dissemination of knowledge as participants communicate, collaborate and share their knowledge with each other. As knowledge is exchanged, learning also takes place. Participation, Learning and Knowledge are interlinked elements of a COP and one cannot take place without the presence of the other two.

As part of our future work, we will plan to carry out further analysis of the interview transcripts to explore whether there is any evidence of other structural elements that have not been established to date. We would also like to expand on the contrasts made between the old and new concepts discussed in this paper, especially in relation to participation and practice. Following this we will focus on developing an approach that will support the creation and development of a successful COP. The aim of this particular COP will be to enhance the learning of STEM subjects

for second level students across Europe. We hope that our new view on how COP are formed and develop will help us and other researchers better understand the wider range of complexities that are involved in the creation, development and study of Communities of Practice.

Acknowledgments

This work is funded by the H2020 project Umi-Sci-Ed² [71083]: Exploiting Ubiquitous Computing, Mobile Technology and the Internet of Things to promote Science Education.

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² See <http://umi-sci-ed.eu/>

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