Online learning communities in context

Rosemary Luckin* and Kristen Weatherby

The London Knowledge Lab,
The Institute of Education,
London, England, WC1N 3QS, UK
E-mail: r.luckin@ioe.ac.uk
E-mail: kriwea73@yahoo.com
*Corresponding author

Abstract: Online learning communities could be seen as tools or resources that enable people to perform actions together online. One could conceptualise the multiplicity of resources both within and outwith the online community as the set of circumstances that support learning. These circumstances might more commonly be referred to as the learning (or the learner's) context. But what do we understand about the ways a participant's context impacts upon their participation in a community, and how might knowing more about this help us to develop better tools for online learning communities? We address this question through a case study, in which an online learning community is viewed through the lense of the ecology of resources model of context. We illustrate how this approach can increase our understanding of an online community and its participants and support the further study and development of online learning communities and tools.

Keywords: classroom ICT practice; context; ecology of resources; online learning communities; zone of proximal development; ZPD.

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Biographical notes: Rosemary Luckin is Professor of Learner-Centred Design at the London Knowledge Lab and EPSRC advanced research fellow. Her research explores how to most effectively scaffold learning across multiple technologies, locations, subjects and times. This work is interdisciplinary and encompasses education, psychology, artificial intelligence and HCI. It investigates the relationship between people, the concepts they are trying to learn and teach, the contexts within which they operate and the resources at their disposal. She is also a non-executive director of the UK government agency leading the national drive to ensure the effective and innovative use of technology for learning.

Kristen Weatherby is Partners in Learning Manager Microsoft, Ltd, working with government, schools and partners to develop programmes and resources that help teachers integrate technology into learning. She is also studying for a PhD at the University of London's Institute of Education, researching teacher participation in online communities. Before coming to the UK in 2008, she spent ten years at Microsoft headquarters in worldwide education, where she developed the global Innovative Schools Programme. Prior to joining Microsoft, she was a teacher. She holds a Master in Education from the University of Michigan.

1 Introduction

The growth in online learning communities supported by the continuing evolution of the technologies and tools that support these communities can be seen in many walks of life. In this paper, we concentrate attention upon the ways in which online communities can be used to support educational practitioners in their pursuit of improvements to their classroom ICT practice. The question at the heart of this paper concerns the context of online learning community members. We investigate what we mean when we use the word context and we explore how an increased understanding of participants' context might enable us to develop better means and resources to support online communities. We present the ecology of resources concept as a way to talk about context, and the ecology of resources design framework as a tool to analyse people's context in a manner that supports the development of the technologies and practices that enable online communities. In particular, we study use of the Microsoft's Partners in Learning Network (PiLN) (http://partnersinlearningnetwork.com) as an example online community: a community of teachers around the world designed to support their innovative use of technology in teaching and learning.

In this paper, the learners we focus upon are classroom teachers who are learning about using ICT in the classroom. Previous research has confirmed the importance of looking at the context of a learner's interactions (Figueiredo, 2005; White, 1985; Wood et al., 1999). However, this research has been largely limited to specific environmental locations, such as university lecture halls, school classrooms or 'the workplace'; and it has rarely focused upon teachers as learners. Such an approach limits consideration to just one of the many settings with which and in which a learner interacts (Catling, 2005). It can also encourage a view of context that conceptualises it as a container (Cole, 1996), rather than as something that connects our learning experiences together and helps us to make sense of them.

1.1 Context

Context is a concept that is discussed across many disciplines and from a variety of perspectives: geography, architecture, anthropology, psychology, education and computer science, for example. It is however possible to identify common themes that transcend these disciplinary boundaries and to arrive at a *learner-specific definition of context*, which can be used as the basis for exploring learning contexts and developing technology-rich learning opportunities that take advantage of the potential afforded by the wide range of evolving ICTs, including those that enable online communities. The provision of such a definition is not an easy task, context is a complex concept (Nardi, 1996) and very difficult to 'pin-down' in a way that enables it to be used as the basis for informing design. Such a definition is offered by Luckin (2010):

> "Context is dynamic and associated with connections between people, things, locations and events in a narrative that is driven by people's intentionality and motivations. Technology can help to make these connections in an operational sense. People can help to make these connections have meaning for a learner.
>
> A learner is not exposed to multiple contexts, but rather has a single context that is their lived experience of the world; a 'phenomenological gestalt' (Manovich, 2006) that reflects their interactions with multiple people, artefacts and environment. The partial descriptions of the world that are offered to a

> learner through these resources act as the hooks for interactions in which action and meaning are built. In this sense, meaning is distributed amongst these resources. However, it is the manner in which the learner at the centre of their context internalizes their interactions that is the core activity of importance. These interactions are not predictable but are created by the people who interact, each of whom will have intentions about how these interactions should be." [Luckin, (2010), p.18]

This definition recognises the complexity of the concept of context, but there are key messages to take forward for our purpose: context is about the way a learner is connected to the world, including other people; context is personal to the learner and not something to which they are serially exposed. This definition offers a starting point for developing a clearer way of talking about context, but it needs further integration with learning theory if we are to use it to develop something really useful to support the development of learning communities. If one considers Vygotsky's zone of proximal development (ZPD) (Vygotsky, 1986) as the crystallisation of the internalisation process that is at the heart of learning, then the ZPD can be thought of as a context of productive interactivity, i.e., the interactions between people that lead to learning. This conceptualisation emphasises the important role played by the society within which the learner exists and in particular by the more knowledgeable, or more able, members of that society; members who are lecturers, teachers, trainers and parents, for example. The ZPD is useful, but it requires further clarification and specification (Wertsch, 1984; Wood et al., 1976). A way towards such a clarification and specification is offered by the zone of collaboration (Luckin, 2010), which is an interpretation of the ZPD concept that involves two constructs called: the zone of available assistance (ZAA); and the zone of proximal adjustment (ZPA). The ZAA describes the variety of resources within a learner's world that could provide different qualities and quantities of assistance and that may be available to the learner at a particular point in time. The ZPA represents a sub-set of the ZAA that is appropriate for a learner's needs. The important point about the constructs of the ZAA and the ZPA is that they offer a way to describe learning in terms of the assistance that a learner's context can afford to them.

The zone of collaboration concept is integrated with the definition of context outlined above in the formulation of the ecology of resources model of context. This model offers a tool for the study and development of online learning communities and the tools that support them.

1.2 Online learning communities

This article is concerned with online communities and a learner's activity as part of an online learning community is related to their personal learning context. We therefore briefly consider what can be learnt from existing research into online communities. A number of recent research studies that explore participation in online learning communities (Chapman et al., 2005; Hew and Noriko, 2007; Sheehy, 2008) consider such participation from a communities of practice (COP) perspective, inspired by the work of Lave and Wenger (Lave, 1988; Lave and Wenger, 1991; Wenger et al., 2002), who studied communities in which newcomers become fully participating members of a community through a process of participation, reification and negotiation of meaning known as legitimate peripheral participation. The concept of legitimate peripheral participation, as we noted earlier, has its origins in the work of Vygotsky. Of particular

note is the idea that a more able other enables a learner to be able to participate in activities that they themselves may not be capable of.

In this article, we explore a particular online learning community as a case study for the ecology of resources approach and we therefore limit discussion here to online communities that have a similar participant base: communities for teachers' learning and professional development. We are particularly interested in communities that involve interaction between people and that offer the possibility of longevity. This is in contrast to communities that may act as content repositories or online spaces to provide teachers with a new idea in the short term, but do not serve to transform them from novice to expert as prolonged relationships and participation in a community of practice might (Lave and Wenger, 1991).

Professional learning communities are "whole-school approaches wherein teacher-teams work on improving student outcomes by analyzing teaching practices, assessment, and student achievement data with the view to bringing about improvement in student outcomes" (Scott, 2009). Studies, such as that conducted by Duncan-Howell (2007) looking at online COP in the UK and Australia suggest that membership in these communities can change teaching practice.

Two large-scale online COP for educators that have been widely researched are: the inquiry learning forum (ILF) and the 'tapped in' community. The ILF was designed to help support teachers who wanted to employ inquiry-based learning approaches in their teaching. It is important to note that teachers came to this community looking to change their teaching practice. Researchers studying this community found that not only did participation in the community change a teacher's practice, but the act of participation changed the community as well (Scheckler, 2009).

The 'tapped in' community was started by SRI International and is still in existence. It was created with the goal of trying to convince teachers that they could have the same relationships, conversations and professional development experience online as they could offline (Schlager et al., 2002).

2 The ecology of resources model of context

The ecology of resources model is illustrated in Figure 1. It develops the ZAA and ZPA concepts into a characterisation of a learner along with the resources and relationships that form that learner's context, its full detail can be found in Luckin (2010). The contribution of this paper as compared to other writings about the ecology of resources is its application of the ecology of resources approach to online practitioner learning communities for the first time. Here we briefly describe the ecology of resources model in order to situate our investigation of an online learning community case study.

The resources that comprise a learner's ZAA embrace a wide range of categories, including people, technologies, buildings, books and knowledge. It is useful to consider the different types or categories of resource that might be available in order to identify them and the relationship they bear to the learner and to each other. One of the types of resource that a learner encounters is the 'stuff that is to be learnt': the knowledge and skills that are the subject of their learning. A second category of resource is that described as 'tools and people' in Figure 1. This category includes books, pens and paper, technology and other people who know more about the knowledge or skill to be learnt than the learner does. The last category of resource is that represented by the

'environment' label in Figure 1. This category includes the location and surrounding environment of the learner: for example, a school classroom, a park, a virtual world, or a place of work.

In many instances, there is an existing relationship between the resources within these three categories: knowledge and skills, tools and people, and environment. For example, within a formal school situation, the book resources appropriate for learning science are located in the science section of the library and formal lessons probably take place in a particular location in school. This type of organisation is often re-created in online communities, with science learning lesson plans linked to appropriate software and human resources through the online learning community interface. Hence, in Figure 1 the categories of resource surrounding the learner, and with which they communicate and relate, are joined together. In order to support learning, the relationships between the different types of resource need to be identified and understood. They may need to be made explicit to the learner in order to build coherence into their learning. For example, if we wish to teach the concept of food chains, then we might decide to make a visit to a pond, or a garden in order to observe the animals and plants that live there and to talk about the feeding relationships that are required to support the particular ecosystem. In online communities the virtual may be adapted to suit particular requirements: such as discussion forums and presentation 'spaces'; these online resources might also be connected to physical elements of the environment. For example, a community of science experts exploring and learning about how the thickness of polar ice might best be measured could communicate through a networked tablet computer with a scientist on location in the arctic; or teachers brought together through a discussion forum could compare their classroom practice and discuss how they might help each other to develop and improve.

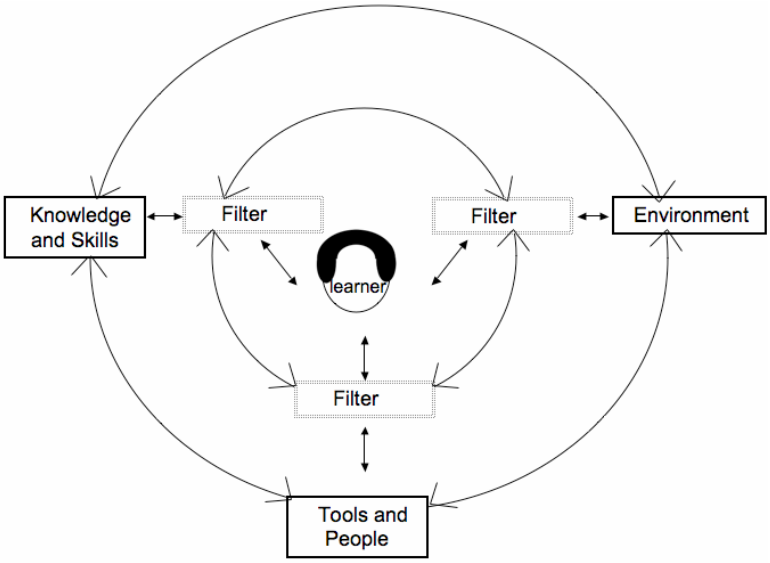
Another factor that needs to be taken into consideration is the way in which a learner's relationship with the resources they encounter is often filtered by the actions of others rather than experienced directly and unimpeded by the learner. The online mentor might collect together particular resources that he or she considers to be particularly appropriate for a colleague and encourage, or even restrict, access to these resources. Filters can be positive or negative. For example, the subject matter to be learnt is usually filtered through some kind of organisation, such as a curriculum, that has been the subject of a process of validation by other members of the learner's society. This resource filter is stronger for subjects such as formal educational disciplines than for more grounded skills. However, even with skills-based subjects there is, to some extent at least, still some formalisation of what is recognised as the accepted view about the nature and components of the skills that need to be mastered. The tools and people that may be available to learners are also organised or filtered in some way. For example, classroom and online technologies are not always available to learners whenever they want: there are school rules and protocols that restrict the learner's access to these resources and network constraints that can restrict connectivity to an online community. Finally, a learner's access to the resources categorised within the environment label in Figure 1 is mediated by the manner in which these resources are organised. This is more obvious in formal settings such as schools, where timetables and regulations have a strong influence on the ways in which learners relate to their environment. However, even in online communities there are rules and protocols that influence the manner in which that community operates.

In the same way that there may already exist a relationship between the different resource elements in the outer circle of Figure 1, there may also exist a relationship between the filter elements of the inner circle. The coherence of the learner's experience can be enhanced through careful consideration of the existing relationships between the filter elements and between the individual resource elements and their associated filters. All of the elements in any ecology of resources bring with them a history that defines them, as well as the part they play in the learner's wider cultural and political system. Likewise, the individual at the centre of the ecology of resources has their own history of experience that impacts upon their relationship with each of the elements in the ecology.

3 The ecology of resources design framework

The ecology of resources model offers a way of characterising a learner in terms of the resources and relationships that form that learner's context. The ecology of resources model could be viewed statically as merely a snapshot of the set of resource elements and relationships that describe a learner's ZAA and that could be 'optimised' by design and/or by practice. The model can also be seen as the basis for a dynamic process of instigating and maintaining learning. In order to further investigate this dynamic process we have developed a design framework based upon the ecology of resources model. The framework can be used to analyse existing situations, to design fresh learning activities, to design the way in which technology might best be used to support learning activities, or to design the technology itself. In the case study, we present here the framework is used to analyse an existing situation and to develop an approach to the further investigation of that situation, and potentially to develop tools to support the online community learning process.

Figure 1 The ecology of resources model (see online version for colours)



Source: Luckin (2010)

The ecology of resources design framework is iterative and has three phases, each of which has several steps. A full account of the framework can be found in Luckin (2010); here we explain it in outline in order to situate discussion of the Microsoft PiLN case study that follows.

- *Phase 1:* create an ecology of resources model to identify and organise the potential forms of assistance that can act as resources for learning. This phase has six steps:
  a Step 1 – brainstorming potential resources to identify learners' ZAA
  b Step 2 – specifying the focus of attention
  c Step 3 – categorising resource elements
  d Step 4 – identify potential resource filters
  e Step 5 – identify the learner's resources
  f Step 6 – identify potential more able partners (MAPs).
- *Phase 2:* Identify the relationships within and between the resources produced in Phase 1. Identify the extent to which these relationships meet a learner's needs and how they might be optimised with respect to that learner.
- *Phase 3:* develop the scaffolds and adjustments to support learning and enable the negotiation of a ZPA for a learner. Phase 3 of the framework is about identifying the possible ways in which the relationships identified in Phase 2 might best be supported or scaffolded. This support might for example be offered through the manner in which technology is introduced, used or designed.

To date the framework has been used for a variety of purposes, including studying how teenagers might use simple technologies to support learning on a trip to a science exhibition and studying how the resources available to adults trying to learn a second language might be effectively co-ordinated and integrated through technology. In the case study that follows we concentrate on Phase 1 of the design process and deal with Phases 2 and 3 more briefly.

4 Using the ecology of resources to build better-connected online learning communities: a case study

This paper proposes that the ecology of resources offers a methodology for exploring how best a learner's activity as part of an online learning community might be connected to their relationships and collaborations both within and beyond that online community. Our aim is to explore the ways in which an online learning community might be studied using the ecology of resources approach (the model plus the associated design framework), and as a result to ascertain how our understanding of that community might be increased and the tools developed to improve support for that community improved. We have already outlined the ecology of resources design framework, we now discuss a particular online community: Microsoft's PiLN, in terms of the ecology of resources as an exploratory case study.

Microsoft's PiLN (http://partnersinlearningnetwork.com), from here on referred to as the PiLN, was originally set up in 2004 as the innovative teachers network, an online community for teachers worldwide based on Microsoft's SharePoint technology. The site

has undergone several iterations over the years since its inception, but the overarching objective remains the same: to connect teachers around the world with resources, continuing professional development (CPD) and a community of like-minded teachers to support the innovative use of technology in teaching and learning.

Partners in learning is Microsoft's corporate social responsibility initiative for global education, and as such the PiLN is free of charge for educators. There are localised versions of the online community in over 75 countries around the world, comprising more than 2.9 million members. Each local site may have slightly different branding and content based on local partners and the needs of the teacher community. For the purposes of this article, we will try to describe the PiLN in general terms and when referring to a specific country's community we will look at the PiLN for the UK.

We will describe the features of the site first and then explore the resources it offers to learners. Then we will look at the site through the lense of the ecology of resources framework, identifying potential resources and filters, which might frame the learner's ZAA and the MAPs that exist on the site.

There are a variety of resources available to the learner on the PiLN, including communities, people, lesson plans and ready-to-use classroom plans, professional development materials and software. To access most country PiLN sites, users must register and log on using a free Windows Live ID. When users are logged into the site, they are brought to a home page, the content of which varies by country. On the UK PiLN site, the home page links learners to the newest and most popular content for teachers (see Figure 2). This includes links to free software downloads, top-rated teacher-created resources on the site, information about upcoming professional development events for teachers, and links to the latest UK teachers blog posts, written by Microsoft.

When a learner moves past the first page of the site, she chooses from the tabs at the top of the page to go to any of four other sections: My Notebook, Connect, Community and Resources. In the My Notebook section, teachers are able to personalise their PiLN experience by completing a personal profile that allows other users to find them based on school, educational background, interest or the subject and age they teach. They also see one picture of their actions on the site, including a list of the communities they belong to, the resources they have uploaded, and the public and private documents they have posted to the site.

In the connect section, a learner can find another teacher on the site who has similar interests, experience or subject expertise. The teacher can contact that other teacher with questions or 'connect' to them to become contacts. This feature is reliant on how well other users have completed their individual user profiles. A teacher could use the site without ever completing a user profile, and another teacher might never find them.

The community section of the UK PiLN is one of the most used sections of the site. In this section, learners can create private or public communities dedicated to a specific content area or interest (teaching science or using a specific piece of software, for example), a professional development offering or to collaborate on a project or piece of work. The communities look like typical SharePoint document-sharing spaces, with places to post documents, have discussions, make announcements and view the community members. If a learner has a particular interest or learning need, he can search for a particular community or look at the list of all communities on the site and can join the community (if it is public), or send a request to the community member to join (if it is private).

Figure 2 The PiLN welcome screen (see online version for colours)

Last, the resources section contains professional development, free software, lesson plans and other learning resources for the teachers to download and explore. The common resource on the PiLN is called a virtual classroom tour (VCT). A VCT is unique to the PiLN and is essentially a Microsoft PowerPoint template with embedded documents that together contain all of the resources another teacher needs to replicate a lesson in her classroom.

4.1 Ecology of resources design framework – Phase 1: creating an ecology of resources model

In this section we analyse the PiLN using the ecology of resources approach. In particular we complete a first iteration of Phases 1 and 2 of the design process and discuss how

Phase 3 might be approached. The analysis is based upon the experience of the Microsoft professional whose role has been to support the PiLN and to be a participant in it. The ecology of resources process requires participation with those whom the outputs of the process are intended to benefit. The key output from the initial iteration of the process reported here, will therefore be a clarification about the empirical methodology that could be used for further study of the PiLN and a clearer view about how to engage further participants in the process.

The first two steps in Phase 1 of the design process are to brainstorm and identify potential learner resources and to specify a focus of attention for the design process. In this case study the learners at the centre of the ecology of resources are the teachers who are members of the PiLN. The resources available to these teachers include those mentioned in our description of the PiLN above and also those available at the teachers' school, at home and throughout the rest of their life. In order to make the construction of the ecology of resources model tractable one must adopt a focus on the specific aspect of the learners' context that relates to the purpose for modelling. In this instance we choose to focus our attention upon the resources that are available online to teacher participants to connect them with other teachers around the world, and the resources available outside the online learning community that can help them to connect with their colleagues. The purpose of the PiLN is the professional development of its members with respect to their use of technology to support learning. The data that is used to identify and brainstorm the resources are drawn from the PiLN sessions of the Microsoft professional.

The third step in Phase 1 is to categorise the resources that have been identified so far, remembering that the process is intended to be iterative and that therefore each step in each Phase will be conducted more than one time. Table 1 identifies some of the resources that could be identified after an iteration as far as step 3 of Phase 1.

Table 1 Some of the resources that make up the ZAA of the Microsoft's PiLN.

Knowledge and skills	*Tools and people*	*Environment*
Professional development of classroom technology practice and its integration into teaching and learning	PiLN: *VCT*; lesson plans; user interface; notebook; software downloads; community members; documents; events; e-mail application; school technology: school's learning platform; computer; personal technology: computer. school staff members; pupils, parents, colleagues at other schools	PiLN site (post log-in); *VCT*; community member's school building with classrooms; furniture; staff room; community member's home with home workspace, living space, furniture

Step 4 requires that one asks: how, what, or who, might constrain a learner's access to the resources identified so far and therefore act as a filter element in the ecology of resources?

Step 5 involves the identification of the sorts of resource that the participants in the PiLN bring to their community participation and therefore their learning. The range of potential learner resources is vast, and could, for example, include existing subject knowledge, confidence, and comfort with the tools.

The penultimate and sixth step involves the identification of people who can offer the learner support and act as MAPs for the learner. One of the positives of the PiLN community is the connection that it enables between its members.

The final step in Phase 1 requires that each of the Steps 1 to 6 are re-visited to see if they need revision in order to reach a sufficient specification to enable the process to

move onto a first iteration of Phase 2; which requires that resource elements are described in terms that will permit the extent to which they may or may not act as forms of assistance for learners to be assessed.

4.2 Ecology of resources design framework – Phase 2: identifying relationships within and between resources and filters

Identifying the elements that make up the resources and filters of the ecology of resources is important. It is, however, the relationships between resource elements and between learner and resource elements that are the key to the process. It is these relationships that form the focus for Phase 2. These relationships are complex. Each category of resource element, and therefore each element in that category, is potentially related to every other element, as well as to the learner. These relationships are represented by the arrows in the ecology of resources model as illustrated in Figure 1, this relationship is one of influence: one element influences a second and that second element is influenced by the first.

The creation of the ecology of resources model representation as part of a particular design process requires the identification of the elements, their categories and the relationships between and within the element categories. Table 2 shows the relationships between examples of some of the resource elements and some of the filters as extended from Table 1 as identified after a first iteration through Phase 1 of this case study. Space constraints preclude the provision of the complete set of resources and filters, but the examples provided offer the reader a guide. This table is constructed in such a way that the influencing relationships can run either way, from top to bottom or from bottom to top; from left to right or from right to left.

Table 2 Phase 2, PiLN ecology of resources

Resource element		*Filter element*
Knowledge and skills: development of classroom technology practice and its integration into teaching and learning	*Influences*	*Example filter: organisation of content in the PiLN*, including: • pre-selected content and content rating *Filter:* school CPD and ICT policy
Influences		*Influences*
Tools and people: • *Human resources*, PiLN community members, and school colleagues, pupils and parents; and family members; and friends • *Digital resources*, PiLN: lesson plans and training materials	*Influences*	*Example filter:* search, including: • *human resources:* public/private communities • *digital resources:* pre-selected content and content rating
Influences		*Influences*
Environment: • *School:* school building, staff room, classroom, computer lab, desk • *Home:* home workspace, furniture	*Influences*	*Example filter: access*, may include: • *school:* bandwidth, firewall, timetable, peace and quiet, privacy • *home may include:* bandwidth, time, peace and quiet, family relationships

4.3 Ecology of resources design framework – Phase 3: identifying scaffolds and adjustments

The completion of a first iteration of Phases 1 and 2 of the design framework process has enabled us to map out some of the elements and relationships in a PiLN participant's ZAA. It is in Phase 3 that adjustment and scaffolding possibilities are identified and decisions made about how these are to be provided. Both the term 'adjustment' and the term 'scaffold' refer to the identification of ways of assisting and supporting learners and their learning [the differences are explained in Luckin (2010)]. When we consider supporting learners, it is useful to examine the manner in which the tabulated representations of the ecology of resources as illustrated in Table 2 can be combined with the learner's resources. In this way, we can start to identify the relationships between resource, filter, and the learner's resources that might benefit from scaffolding or adjustment. For example, in Table 3 for each of the resource categories, we have taken the example resource element identified in Table 2, an associated filter and a relevant learner resource. This enables us to look across the table and identify possible ways of supporting learners that would then be further explored in Phase 3.

For example, the relationships between knowledge about the integration of ICT into the teaching and learning process that is a component of CPD is filtered by the ICT and CPD policy of the teacher's school and the manner in which this is or is not 'tuned in' to the teacher's current classroom ICT knowledge and skill level. This relationship is identified in the first row of Table 3. Possible ways of supporting learners here might include making some adjustments to the matching of school policy to the diversity of teachers' existing level of expertise. The relationship between the highly rated lesson plans and the teacher's own class situation and their confidence that the lesson plan is appropriate, is identified in the second row of Table 3. This relationship might be supported by making adjustments by placing emphasis upon the ratings provided by community participants whose circumstances are similar. In fact, there may be an argument for such community participants to adopt the role of the MAP for a teacher with a similar profile. There might also be a role for what Wenger describes as a 'digital steward' in his work looking at technology ('digital habitats') used to support online COP. The role of the digital steward is to find the right technology to fit the needs of the specific community, and to customise that technology, its features and functionality as needed (Wenger et al., 2009).

The third row of Table 3 identifies the relationship between the physical location with which the teacher works at school and at home, the possible restrictions on access to and in this location and the teachers' skills at time management. The teachers need to have time available when working conditions are conducive. This relationship might be supported through ensuring access to the PiLN for teachers both in and out of school. This relationship could also benefit from further exploration, for example working with teachers to understand their daily routines and their approach to planning might highlight possible adjustments and scaffolding.

Table 3 Resource elements, filters and learner resources

Resource element		*Filter element*		*Learner resource*
Knowledge and skills: integration of technology into classroom teaching and learning practice	*Influences*	*Filter: school policy:* CPD and ICT	*Influences*	Current skill level and fluency with use and application of technology for teaching and learning
Influences		*Influences*		*Influences*
Tools and people: lesson plans posted and rated by other educators	*Influences*	*Filter: search:* highest-rated lesson plans by other teachers in the community	*Influences*	Confidence that new lessons will 'work' with their students in their school
Influences		*Influences*		*Influences*
Environment: • *school:* classroom, staffroom, library teacher, desk • *home:* workspace, computer	*Influences*	*Filter: access:* timetable and available planning time for teacher to work at a time when privacy and conducive working conditions are available	*Influences*	Planning and time management skills

In addition to considering each individual row in Table 3, the relationships between each cell and the others needs to be explored. For example, if we consider the resource: 'lesson plans posted and rated by other educators' in the left-hand cell of the second row of the table and its relationship with the other cells, the following possible scenario can be described: a teacher: John, manages to find a quiet time in his lunch break to get to the staff room computer and access the PiLN where he chooses to download a lesson plan from the PiLN. His choice is based upon the fact that this lesson plan is the most highly rated by other community members. He is concerned that the classes where this lesson plan was used previously may have been different to his class, but he is skilled at using ICT, which increases his confidence that the lesson plan will work, he is also aware that he can communicate with teachers from the PiLN who have rated this lesson plan highly to find out more about their class circumstances. John knows that he needs to demonstrate his ability to integrate his skills at using ICT with the learning needs of his pupils and that within his school such integration is highly valued within the CPD policy; he finds this motivating. Alternatively, the circumstances for a different teacher whose own skills, abilities and environment are different to John will play out into a very different scenario. Each of these teachers may have access to the same ZAA, but their needs for constructing a ZPA are different. The point here is that the ecology of resources framework enables us to work with teachers as part of a participatory design process to identify the possible resources and filters within each cell of Table 3 along with the relationships between them: the teachers' ZAA. We can then consider the implications of these resources, filters and relationships for individual teachers through the continuing participatory design process, we can populate the table with different possible values from different scenarios drawn from the design process. Through this process we can develop the appropriate scaffolding and adjustments to support each teacher to be able to identify and use the most appropriate resources to meet their needs and to construct their ZPA. This ZPA is drawn from resources both within and outwith the online community: it supports relationships throughout the teachers' context.

Once Phase 3 is completed for the first time, the design process may well begin again at Phase 1 until the team believe that they have achieved their objectives.

5 Conclusions

The ecology of resources approach has enabled us to build a model of the context of participants in the PiLN learning community and to start to analyse their relationships with resources, both those resources within and those resources outwith the PiLN. The process has identified some of the resources that are available to PiLN participants, the factors that might act as filters to their use of these resources and the possible resources that might act as MAPs. These resources and filters form the ZAA of the participants. The ecology of resources approach has also enabled us to identify some relationships that could potentially become the object of adjustments or scaffolding support to permit and engender the construction of a ZPA for individual participants. It is this process of ZPA construction that tailors the resources and filters of the ZAA to meet the individual needs of teachers.

There are also more general benefits to be gained from adopting an ecology of resources way of thinking about online communities, such as the PiLN and its participants. For example, in our discussion of Phase 3 of the design process we identified the role described by Wenger as a 'digital steward' who supports online COP by finding and customising the right technology to fit the needs of the specific community. The benefits of the ecology of resources approach for such a digital steward managing the digital habitat of the PiLN community would include helping them to gain a clearer idea of what might aid and prevent users from accessing resources on the site, or accessing the site itself, so that they can design or re-design accordingly. This kind of broad-brush analysis could be done by a variety of people: the digital steward of the site, or the Microsoft team, for example, and does not necessitate costly research.

However, the key output from such an early iteration of the ecology of resources design process as that reported here, is a clearer understanding about how to engage more participants in further study of the PiLN. The design process to date has resulted in representations, such as those illustrated in Tables 2 and 3, can be used as the basis for shared conversations with participants to ground their identification of more and different resources and relationships. The potential forms of adjustment or scaffolding that have been identified can also form the basis for workshop, role-play or low-tech prototyping with participants.

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