

Use of communities of practice in business and health care sectors:

A systematic review

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ABSTRACT

Background: Since being identified as a concept for understanding knowledge sharing, management, and creation, communities of practice (CoPs) have become increasingly popular within the health sector. The CoP concept has been used in the business sector for over 20 years, but the use of CoPs in the health sector has been limited in comparison.

Objectives: First, we examined how CoPs were defined and used in these two sectors. Second, the evidence of effectiveness on the health sector CoPs for improving the uptake of best practices and mentoring new practitioners was evaluated.

Methods: We conducted a search of electronic databases in the business, health and education sectors, and a hand search of key journals for primary studies on CoP groups. Our research synthesis for the first objective focused on three areas: (1.) the authors' interpretations of the CoP concept, (2.) the key characteristics of CoP groups, and (3.) the common elements of CoP groups. To examine the evidence on the effectiveness of CoPs in the health sector, we identified articles that (1.) evaluated CoPs for improving health professional performance, health care organizational performance, professional mentoring, and/or patient outcome; and (2.) used experimental, quasi-experimental, or observational designs.

Results: The structure of CoP groups varied greatly, ranging from voluntary informal networks to work-supported formal education sessions, and from apprentice training to multidisciplinary, multi-site project teams. Four characteristics were identified from CoP groups: (1.) social interaction among members, (2.) knowledge sharing, (3.) knowledge creation, and (4.) identity building; however, these were not consistently present in all CoPs. There was also a lack of clarity in the responsibilities of CoP facilitators and how power dynamics should be handled within a CoP group. We did not find any paper in the health sector that met the eligibility criteria for the quantitative analysis, and so the effectiveness of CoP in this sector remained

unclear.

Conclusions: There is no dominant trend in how the CoP concept is operationalized in the business and health sectors; hence it is challenging to define the parameters of CoP groups. This may be one of the reasons for the lack of studies on the effectiveness of CoPs in the health sector. In order to improve the usefulness of the CoP concept in the development of groups and teams, further research will be needed to clarify the extent to which the four characteristics of CoPs are present in the mature and emergent groups, the expectations of facilitators and other participants, and the power relationship within CoPs.

Keywords: Community of Practice, Learning Community, Systematic Review, Health Care Sector, Business Sector

BACKGROUND

One of the challenges to integrating research evidence into practice is that it involves a complex process of acquiring, converting and applying a mixed of explicit and tacit knowledge in clinical activities. Since being identified as a concept for understanding how people learn in a social environment,¹⁻³ the community of practice (CoP) has been used by an increasing number of groups and teams in the health sector to help practitioners make sense of the concrete information (e.g., practice guidelines) in the context where it is used.

The concept of the CoP was originally developed by Lave and Wenger, who suggested that learning took place in social relationships rather than through the simple acquisition of knowledge.¹ To illustrate the concept, they used the example of how midwives, meat cutters, and tailors learned new knowledge relevant to their trades. Many of the exchanges of practical information and problem-solving happened during informal gatherings where tradesmen exchanged stories about their experience. Novices could also consult with experts in a non-threatening environment. Through this process, gaps in the practice were identified and solutions were proposed. Individuals might apply the solution in their own practice and the outcomes were fed back to their colleagues for further refinement of the solution. Eventually these informal communications became the means for sharing information for improving practice and generating new knowledge and skills.¹

Lave and Wenger's observations have formed the basis of the *situated learning theory*, which describes the learning that takes place in a setting functionally identical to that where the knowledge will be applied,^{1;4;5} thus contradicting the traditional learning activities that tend to isolate knowledge from practice. Later, Wenger proposed three interrelated dimensions to

explain CoP: *mutual engagement* (the interaction between individuals that leads to the creation of shared meaning), *joint enterprise* (the process in which people are engaged and work together towards a common goal), and a *shared repertoire* (the common resources and jargon that members use to negotiate meaning within the group).²

In their latest publication, Wenger et al. refined the description of CoPs as “groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis” (pg. 4).⁶ They identified three essential characteristics of CoPs: *domain*, *community*, and *practice*. The ‘domain’ creates common ground (i.e., the minimal competence that differentiates members from non-members) and outlines the boundaries that enable members to decide what is worth sharing and how to present their ideas. The ‘community’ creates the social structure that facilitates learning through interactions and relationships with others. The ‘practice’ is the specific knowledge that the community shares, develops, and maintains. Wenger et al. purport that a well-developed CoP group (i.e., when the three elements work well together) provides an environment that facilitates learning and knowledge development,³ but the literature is less clear on how to foster the three elements, especially at the early stage.

To improve the understanding about the use of the CoP concept, we conducted a research synthesis project to explore how the concept was operationalised in the business and health sectors. The objective of this study was two-fold. First, we examined how CoP groups were defined and used by reviewing primary studies from the two sectors. Second, we assessed the evidence on the effectiveness of CoPs in health care settings.

METHODS

Search Strategy

To identify all existing descriptions of CoP groups in the health and business literature, we used the following strategy to search for studies published between 1991 and 2005:

- Searching electronic bibliographic databases, including Medline, CINHAL, HealthSTAR, EMBASE, ERIC, ECONLIT, AMED, and ProQuest. The search strings for Medline (Table 1) were adapted for other databases.
- Hand-searching key journals, including *Journal of Continuing Education in the Health Professions*, *Medical Education*, *Harvard Business Review*, and *Journal of Education*.
- Examining the reference lists of the included articles and books for additional literature.

In addition, we consulted with members of *CP Square* (www.cpsquare.org) about the search strategy and the review methodology through two teleconferences on November 19 and 23, 2004. *CP Square* is a “CoP of CoP” hosted by Wenger and colleagues.

The literature search was conducted in September 2005 by one of the researchers (LL) and a librarian/information scientist (JM). To examine how CoP groups were defined and used, we restricted our search to primary studies involving groups that were either labelled as CoPs or were developed using CoP and/or other related theories (e.g., situated learning, legitimate peripheral learning) as the guiding framework. To examine the evidence on the effectiveness of CoPs in the health sector, we identified articles that (1.) evaluated CoPs for improving health professional performance, health care organizational performance, professional mentoring, and/or patient outcome; and (2.) used experimental, quasi-experimental (controlled clinical trials (CCT), interrupted time series (ITS), controlled before-and-after (CBA), or observational designs (before-and-after studies, cross-sectional studies)).

The article selection involved a two-phase review. In the first phase, two reviewers (LL, CN) screened the titles and abstracts to identify primary studies that described or evaluated a CoP group. In the second phase two reviewers, LL and CD (a research coordinator), categorized the included articles into one of five sectors: health care, business, education, information science, and other. All disagreements were discussed and a third reviewer (MJ) was involved if no consensus was reached.

Data Extraction and Analysis

To understand how CoPs were defined and used in the business and health sectors, our literature review was guided by the meta-narrative technique.^{7;8} It began by studying the key theoretical publications, reviews, and critique papers; analyzing the key components of a CoP; and using the information to develop a data extraction form. The form was tested on three health sector articles by four research team members (LL, CD, CM, MJ) and a collaborator from a research funding agency (PM). The content was subsequently modified to capture the interpretation of the CoP concept, and the development, organization, and activities within CoP groups. The final version included the following categories: (1.) the study authors' definition of a CoP; (2.) duration of the CoP group; (3.) members and their disciplinary backgrounds; (4.) methods and frequencies of communication; (5.) administrative structure; and (6.) statements that described 'community,' 'domain,' and 'practice' as defined by Wenger et al.³ Data extraction of all health sector studies was done independently by two reviewers (LL, CD). The remaining papers were reviewed by CD, and the data were verified by LL.

We conducted concept analysis to explore the interpretation of the CoP concept and the

characteristics of CoP groups⁹. The analysis aimed to highlight the similarities and differences in findings across sectors. In this review we focused on three areas: (1.) the authors' interpretations of the CoP concept, (2.) the key characteristics of CoP groups in primary studies, and (3.) the common elements of CoP groups. The characteristics of these groups, reported in primary studies, were summarized in five categories:

- **Why** was the group formed?
- **Who** was included in the group?
- **How** did members communicate?
- **What** did the members do or produce, individually or collectively?
- **Where** did members interact with each other?

Each sector was reviewed separately and codes were inductively developed by LL. These codes were uncovered by identifying similarities or differences in phrases, as well as meaningful patterns and processes between and within the different sectors. They were then merged into broader themes. Key reviews and critiques were used to verify the analysis. Throughout the process, the reviewers had frequent discussions and sought input from other team members to identify additional codes and themes. We subsequently discussed the analysis with other researchers with an interest in CoPs¹ for further feedback.

To assess the effectiveness of CoPs, a separate data extraction form was developed to record the following information: (1.) number and type of participants; (2.) sex; (3.) age; (4.) the description of CoPs (interventions group) such as settings and organizational structures; and, (5.) the

¹ Ho et al. Technology Enabled Knowledge Translation Investigative Centre (TEKTIC), University of British Columbia (<http://www.tektic.ca/Home.htm>)

description of interventions received by the control group. For each continuous measure, the baseline value and standard deviation were extracted. Also, mean changes from baseline with standard deviations in outcome measures assessed at the end of the treatment period and at the follow-up period were recorded, if available. For dichotomous data, medians and interquartile ranges were recorded at baseline and the subsequent assessments.

Although we were unaware of the number of articles that would meet the eligible criteria, we anticipated extreme heterogeneity among the included studies. Hence, our analysis plan for RCTs, CCTs, and CBAs included: (1.) calculating standardized effect sizes for the continuous measures, and (2.) calculating the number of comparisons showing a positive direction of effect, median effect sizes, and number of comparisons showing statistically significant effects for the dichotomous measures. For the ITS comparisons, the significance of changes in level and slope would be reported. For observational studies, a descriptive summary would be presented.

RESULTS

The search of electronic databases found 1,421 articles, of which 303 were related to CoPs (Table 2; Figure 1). A total of 182 articles were identified as primary studies and a full review was conducted in 18 primary studies from the business sector and 13 from the health sector. Most of the CoP-related papers were published after 1998, with a publication peak in 2003, after which time the numbers began to decrease (Figure 2). The reason for the decline was unclear, but it should be noted that a few critiques published after 2005 challenged the completeness and usefulness of the CoP for conceptualizing social learning and knowledge management.¹⁰⁻¹²

Communities of Practice in Business

The term CoP emerged in business literature in the mid-1990s, but articles about social learning and knowledge management had already appeared in journals such as *Harvard Business Review* as early as the late 1980s¹³⁻¹⁷. Most (77.8%) of the primary studies were conducted in the USA (Table 3). The earlier studies focused on apprentice training, but the term was later used to describe a variety of groups, including formal training sessions¹⁸, informal learning groups¹⁹⁻²¹, multidisciplinary teams²²⁻²⁴, and virtual communities²⁵⁻²⁷. Most studies cited Wenger¹⁻³, but one²⁸ referred only to Brown and Duguid²⁹ and one did not cite any of the seminal work³⁰.

In 1996, Henning studied refrigeration service technicians and documented the information exchange and mentoring that took place during informal gatherings¹⁹. In addition to learning and building a professional identity, new workers gained confidence in making work-related decisions. Similar findings were reported by Attwell³⁰ on the experience of an apprentice in the train re-servicing industry. Harris et al. also highlighted the importance of the interaction with mentors in the workplace, which helped new tradespersons make sense of contradictory information that they learned in the classroom.³¹

A prominent characteristic of the business CoPs is a willingness to invest time and resources to facilitate activities for members to socialize. While some groups were encouraged explicitly by employers to connect with others on and off the job,^{19;21;22;25;27} others were provided with communication equipment to enable networking.^{26;27} Also, these groups tended to use a range of formal and informal activities. For example, Henning documented the on-the-job meetings and after-work telephone calls among refrigeration technicians,¹⁹ Robey illustrated the mix of formal face-to-face meetings and after-work social activities for workers of a soft goods manufacturing company who worked at different sites,²⁷ and Benner described the organized

monthly social outing of women working in the information technology companies.²¹

Communities of Practice in Health Care

Most (92.3%) primary studies of health sector CoPs were from the UK or the USA. The term “community of practice” began to surface in this field in the mid-1990s and was often used as a label for groups and teams, rather than a social learning concept. Learning, sharing information, and identity-building were the major focus of these groups, with situated learning and/or legitimate peripheral participation being the guiding concepts.

In 1995, Jenkins and Brotherton published a series of papers on the use of situated learning in the occupational therapy curriculum.³²⁻³⁴ They argued that occupational therapists consolidate their knowledge and skills most effectively while practising in the clinical setting (i.e., a CoP), and recommended early clinical placements as part of the professional training.³²⁻³⁴ In a later case study, Lindsay documented the growth of occupational therapy students as they practised applying clinical reasoning skills acquired from a seminar through working with mentors and patients.³⁵ As students gained experience and confidence in the clinical setting, they were advanced to more complex cases. This process, described by Lave and Wenger as legitimate peripheral participation,¹ helped to shape students’ career goals and identities as occupational therapists.

In nursing, Cope et al. also promoted the use of legitimate peripheral participation as a theory for students to gain skills and professional identity in their clinical placements.⁵ The term “communities of practice” began to appear in the medical literature around 2002 when Parboosing published an opinion article discussing the use of CoP groups to facilitate continuing

professional development for physicians.³⁶ Also, Winkelman and Choo envisioned a CoP as an intervention for patient empowerment.³⁷

All the primary studies were published in 2000 or later, and the term CoP was used as a synonym for a group of health professionals who are working together. Some authors even argued that a cohesive multidisciplinary team with a clear sense of identity was a CoP.³⁸ We found that 12 of the 13 primary studies cited Wenger and colleagues' definition of a CoP; however, the actual structure and function of these groups varied greatly. Examples of CoP groups include (Table 4): (1.) clinical placements where students interacted with and learned from expert practitioners,^{5;35;39} (2.) informal learning groups (e.g., journal clubs⁴⁰), (3.) health care agency collaboratives that aimed to achieve a common goal (e.g., to improve primary care for older people⁴¹), and (4.) virtual communities where practitioners from different sites discussed work-related issues.⁴²⁻⁴⁵ Grounded in situated learning and legitimate peripheral participation, studies on clinical placements and apprenticeship tended to focus on students' acquisition of knowledge, skills, and professional identities. However, in groups that focused on information-sharing/-creation, CoP was primarily used as a managerial tool for continuing professional development and improving quality of care, rather than identity development.

Compared to the business sector CoPs, the health care CoPs focus mainly on fostering social interactions at the workplace or during task-oriented activities (e.g., a journal club). Four studies^{42;43;45;46} described the use of information technology for members to hold informal discussions and formal meetings, but we did not find any study that supported off-the-job social outings.

Shared Characteristics of Communities of Practice in Business and Health Care

The structures of CoP groups in business and health sectors are summarized in [Tables 5](#) and [6](#) respectively. Learning and sharing information through socialization appeared to be the central characteristic of CoP groups. We found all groups demonstrated, to varying degrees, the following characteristics:

- **Social interaction** – Interaction of individuals in formal or informal settings, in person or through the use of communication technologies.
- **Knowledge-sharing** – The process of sharing information that is relevant to the individuals involved.
- **Knowledge-creation** – The processes of developing new ways to perform duties, complete a task, or solve a problem.
- **Identity-building** – The process of acquiring a professional identity, or an identity of being an expert in the field.

The knowledge-sharing/-creation CoPs and apprenticeship CoPs emphasized different points, with the latter being focused more on identity-building (e.g., student nurses learning to be a nurse, or new technicians learning to be an expert). Also, it appeared that the mature and cohesive groups tended to include processes that address all four characteristics,^{19;42;44;47} while the newer groups tended to invest more in activities that encourage social interaction and knowledge-sharing, but less in identity-development or knowledge-creation activities. Also, knowledge-creation was rarely a focus in the apprentice training because the goal was to learn existing skills rather than to develop new ones. While the process of knowledge-sharing could be observed in all CoP groups, the benchmarks for the other three characteristics were less clear in the emergent and maturing CoPs.

Responsibilities of Facilitators

A number of studies from both sectors highlighted the importance of facilitators, and some linked the success and failure of the CoP to this role.^{20;21;25;35;40-43;45;48-50} However, the actual responsibilities of facilitators and the organizational support required for this role were less clear in the literature. For example, some facilitators played a distinct role from that of the leader and conducted their activities under the direction of the group and/or the leader,^{42;45;48} while other groups merged the role of the leader and facilitator.^{40;49} The choice of management structure appeared to depend on the size of the group and the availability of human resources. Which model best suited which type of organization was unclear, but facilitator fatigue was mentioned as something that could lead to the downfall of CoP groups.⁴⁰

Power Relationships within Communities of Practice

Ambiguity was observed in the power relationships among CoP members. In the apprenticeship CoPs, the hierarchy of power was usually clearly defined by the roles of mentor-mentee or expert-novice. New practitioners moved from the periphery to a position of full participation as they developed their knowledge and skills by learning from skilled practitioners. Those with full participation would play a greater role, and subsequently had more power to direct the group's activities. In contrast, the power relationship was less clear in the non-apprenticeship CoPs. The inherent assumption was that members of a CoP are naturally collegial, honest, and respectful of each other, and that they put aside their personal agendas for the common good. However, in the non-apprenticeship CoPs, members might not necessarily develop beyond a position of peripheral participation (i.e., they remain as learners/observers rather than contributors) and so learning and negotiation of meaning might continue to be only a reflection of the dominant

source of power. This could therefore affect the effectiveness of the group when completing a task or achieving a goal.

One example of people remaining in peripheral participation over the evolution of a CoP group, and therefore of power imbalance, was the multistakeholder collaborative in the health sector reported by ⁴⁸ This group was formed to develop health care policies for elder care. Group members participated in scheduled meetings that were organized and facilitated by an experienced librarian. However, despite the facilitator's best efforts, the discussion was often dominated by the opinion and agenda of only a few members. As the group evolved, members like physicians, experienced nurses, and representatives from the health authority were entrusted with more power and their opinions were valued more by the rest of the group. This subsequently affected the policy development, and some key decisions were based on individuals' experience and preferences rather than the evidence.

Effectiveness of Communities of Practice in the Health Sector

CoP research in the health sector focused mainly on the exploration of how people shared information, created knowledge, and built a professional identity in a social setting. Researchers predominantly used in-depth interviews and participant observations (Tables 3 and 4). Action research methods, in which participants were involved in the development, growth, and evaluation of the group, were also used.^{41;44;48} In this review, we did not find any paper in the health sector that met the eligibility criteria for the quantitative analysis (Tables 3 and 4); and so the effectiveness of CoP in this sector remained unclear.

DISCUSSION

The purpose of this study was described how CoP groups were defined and used in the business and health sectors, and to assess the evidence on the effectiveness of CoPs in health care settings. One main observation is the wide variety of structures of CoP groups, which range from voluntary informal networks to work-supported formal education sessions, and from apprentice training to multidisciplinary, multi-site project teams. This indicates the broad range of interpretations of the CoP concept within the two sectors. A similar observation was also reported in another recent review of health care CoPs.⁵¹ Our analysis also identified social interaction, knowledge-sharing, knowledge-creation, and identify-building as the common characteristics of CoP groups; although it was unclear how these characteristics were defined in a mature group versus an emergent group.

Another important finding was that the majority of studies on CoP groups were set out to describe how they functioned or to study the complexity of developing and sustaining them. In contrast, there was a lack of empirical research on the effectiveness of CoP groups in the health sector despite their increasing popularity. Perhaps one of the reasons that the CoP has not inspired much evaluative research is that it is actually not a theory of social learning; rather, it is a broad conceptualization of how learning occurs in a social environment and forms the basis for middle-range theories that are more concrete and address specific problems. The process of developing middle-range theories is, however, complicated by the marked divergences in the focus of the CoP concept over the years. The concept originally promotes self-empowerment and professional development,^{2;52} but as it evolves, it becomes a tool for managing the knowledge flow within organizations with the main purpose of improving organizations' competitiveness.³ The tension between satisfying individuals' needs for personal growth in the

earlier version of the CoP concept versus the organization's bottom line is perhaps the most contentious of the issues that make the CoP concept challenging to interpret and apply.⁵³

One limitation of this review is that our eligibility criteria only include studies on groups that are labelled as CoPs, and so studies that feature teams and groups that do not call themselves CoPs but have the four characteristics would have been excluded. This may be addressed by revising the search criteria and include terms associated with the CoP characteristics; however, because the review was originally designed to assess how the CoP was operationalized in the literature, we chose not to modify the search and review strategy.

Another limitation was that we did not conduct a quality appraisal on the included qualitative studies. The use of quality assessment scales to determine the inclusion of qualitative studies has been a controversial topic. Daly et al. have recently proposed a hierarchy of evidence for qualitative studies, with 'generalizable studies' that use a rigorous sampling and analytical approach being the highest level of evidence and single case studies being the lowest.⁵⁴ A few tools and frameworks for assessing qualitative studies have also been created.⁵⁵⁻⁵⁷ However, the reliabilities of these tools within and between reviewers tend to be poor and are no better than simply relying on the unprompted opinions of expert qualitative researchers.⁵⁸ The current quality assessment approaches are also criticised as being reductionist and problematic because they often fail to take into account the broader rationale, context and assumptions of qualitative research.⁵⁹ It has also been argued that none of the existing tools are sufficient to incorporate the various conceptions of 'good quality' and 'rightness',⁶⁰ and so studies should not be excluded based on the quality assessment. In light of this debate, we decided to include all eligible qualitative studies in this review regardless of their quality.

This review has identified several areas for further research in order to improve the usefulness of the CoP concept. First, as we have identified four common characteristics from CoP groups that were developed over a period of 15 years, the next step will be to develop specific indicators that expand on these characteristics, so that one can distinguish “CoPs” from “non-CoPs” and identify the stage of development of a CoP group. Second, there needs to be a better understanding about the expectations, roles and responsibilities of facilitators and other participants, and the power relationship within CoPs. Wenger and colleagues suggested that an ideal CoP group should include a leader(s)/champion(s), a facilitator(s), a core group of experts who regularly interact with the group, and a dedicated group of members with varying levels of expertise.³ Future research should explore the specific responsibilities of members in different roles and their interaction in different types of CoPs. Finally, more research will be needed to understand the power relationship within the non-apprenticeship CoPs. This is the subject of a few recent critiques which have pointed out that the lack of clarity on how to handle power dynamics within a CoP has hindered its use as a knowledge-management tool in organizations.^{12:61}

In conclusion, the CoP remains relevant as a concept to provide guidance for the development of groups, teams, and networks, but it requires further research to develop indicators for identifying CoP groups and for describing the stages of existing and emergent CoPs. We believe that this will enable the development of interventions to facilitate the growth of loosely connected networks to become CoP groups that share and create relevant knowledge, skills, and best practices.

Competing interests

None of the authors have any competing or conflicting interests.

Authors' contributions

LCL, JMG, IDG developed the concept. LCL, MJ, CPN participated in the literature review.

LCL analysed the data and drafted the manuscript. All authors provided comments and approved the final version.

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Table 1: Medline search

1. (communit\$ adj practi#e).tw.
2. situated Learning.tw.
3. practice based research network\$.tw.
4. primary care research network\$.tw.
5. apprenticeship model.tw.
6. legitimate peripheral participation.tw.
7. or/1-6
8. limit 6 to yr=1991-2005

Table 2: Electronic database search results

Source	Retrieved (N = 1421)	CoP-related (N = 303)	Primary studies on CoPs (N = 182)
Medline	588	30	19
CINAHL	202	31	11
ERIC	516	148	77
ECONLIT	20	19	3
AMED	5	0	0
ProQuest – Dissertation Abstracts	89	75	72
Other [†]	1	0	0

[†] One article, which was not picked up by the electronic search, was identified by one of the team members during discussions with other CoP researchers.

Table 3: Communities of practice in the business sector – summary of 18 primary studies

Type of CoP groups	Description	Goals	Examples from the literature	Findings
Apprenticeship	<ul style="list-style-type: none"> • Experts interacted with novices in the practice setting. • “CoP” was used synonymously with “profession” or “trade.” 	<ul style="list-style-type: none"> • To learn and consolidate skills. • To acquire a professional identity. 	<ul style="list-style-type: none"> • <i>Attwell (1997)</i>: A train re-servicing worker at the Great Western Railway transitioned from an apprentice to a skilled tradesman.³⁰ (England) • <u>Study design</u>: Case study; face-to-face interview. 	<ul style="list-style-type: none"> • Socialization with other tradesmen was an essential process for a novice to learn skills and gain acceptance by their colleagues. The latter was described as gaining “entry into communities of practice.”
			<ul style="list-style-type: none"> • <i>Harris (2003)</i>: On-the-job and off-the-job training for new workers in the building and construction industry.³¹ (Australia) • <u>Study design</u>: Semi-structured interviews. 	<ul style="list-style-type: none"> • Tradespersons were often required to integrate contradictory knowledge that they learned from the classroom versus on the job. • CoPs appeared to provide a structure whereby new workers could make sense of contradictory information by working with more experienced workers.
			<ul style="list-style-type: none"> • <i>Machles (2004)</i>: Employees of a biotechnology company learning about occupational safety practices.⁶² (USA) • <u>Study design</u>: Semi-structured interviews. 	<ul style="list-style-type: none"> • Participants felt that learning occupational safety practices occurred through experience with equipment and within their work environment. • Workers learned from their mentors and peers by sharing stories about occupational safety practices.
Formal education program	<ul style="list-style-type: none"> • Professionals interacted with instructors and peers in an adult education program. 	<ul style="list-style-type: none"> • To acquire work-related knowledge and the identity of an “expert.” 	<ul style="list-style-type: none"> • <i>Ball (2003)</i>: Trade union representatives participated in education programs to improve their knowledge and ability to represent their fellow members. The program was attended by both experienced and new members.¹⁸ (UK) • <u>Study design</u>: Mail survey, interviews, life-history narratives. 	<ul style="list-style-type: none"> • Formal and social interaction with experienced members helped newcomers to gain knowledge, skill, and confidence to act as a union representative.

Type of CoP groups	Description	Goals	Examples from the literature	Findings
Informal network	<ul style="list-style-type: none"> Professionals interacted in informal, social settings to share trade-related information. Most meetings were face-to-face. 	<ul style="list-style-type: none"> To share information so that people can do their own job better. 	<ul style="list-style-type: none"> <i>Henning (1996)</i>: Seven refrigerating technicians, at various level of expertise, met socially to share information about work.¹⁹ (USA) <u>Study design</u>: Ethnographic field study. 	<ul style="list-style-type: none"> Social interactions among these technicians enabled them to improve skills, and helped the newcomers to develop a professional identity.
			<ul style="list-style-type: none"> <i>Yi (2000)</i>: Engineers at Motorola participated in an informal community called SMART CoP.²⁰ (USA) <u>Study design</u>: Case study. 	<ul style="list-style-type: none"> Engineers noted that being a member of a CoP was beneficial for their learning and professional development. Participation in the CoP increased their awareness of the need for collaboration and sharing. Clear ground rules, roles, and responsibilities were important for members to establish boundaries and for orienting newcomers.
			<ul style="list-style-type: none"> <i>Benner (2003)</i>: Women in Internet design and development occupations participated in a group called <i>Webgrrl</i>. Members interacted through listserv and monthly social outings to share tips about working in the industry.²¹ (USA) <u>Study design</u>: Case study. 	<ul style="list-style-type: none"> The informal interactions enabled members to share information, to exchange job and business leads, and to learn about new technologies. This was particularly valuable to newcomers. The high levels of trust and openness contributed to the success of this group.
Multidisciplinary team	<ul style="list-style-type: none"> People from different disciplines, who normally would not work together, collaborated on a common task. 	<ul style="list-style-type: none"> To develop/build a product. 	<ul style="list-style-type: none"> <i>Schermer (2002)</i>: Chrysler commissioned a group of professionals to design and build the Chrysler Technology Centre. Architects, designers, and construction professionals met formally and socially to discuss work-related issues and problems.²² (USA) <u>Study design</u>: Case study; face-to-face interviews. 	<ul style="list-style-type: none"> Architects in a commissioned project had to work with professionals from other disciplines and organizations. CoP-type groups helped them to learn about each other's expertise, viewpoints, and working style, which helped to facilitate the progression of the project.

Type of CoP groups	Description	Goals	Examples from the literature	Findings
			<ul style="list-style-type: none"> ▸ <i>Carlson (2003)</i>: A proposal-writing team, consisting of scientists, engineers, technical managers, editors, graphic artists, text processors, and production coordinators, collaborated in a research and applied engineering laboratory.²³ (USA) ▸ <u>Study design</u>: Case study; face-to-face interviews. 	<ul style="list-style-type: none"> ▸ The research discovered five processes that occurred in a proposal-writing CoP: owning, visioning, producing, contributing, and reviewing, all of which are vital to the maturation of the CoP. ▸ Newcomers benefited from the mentoring provided by the experienced team members.
	<ul style="list-style-type: none"> • Online groups for practitioners to discuss issues related to work or the trade. 	<ul style="list-style-type: none"> • To help participants from various geographic locations to do their work better. 	<ul style="list-style-type: none"> • <i>Ardichvili (2002)</i>: A Fortune 100 construction and mining equipment company developed >600 online groups for 16,000 employees worldwide to facilitate knowledge-sharing.²⁵ (USA) • <u>Study design</u>: Case study; face-to-face interviews. 	<ul style="list-style-type: none"> • Elements contributing to the success of an online CoP included: (1.) the corporate culture of knowledge-sharing, (2.) the belief that knowledge belongs to the whole organization, (3.) freedom for employees to organize new CoPs around specific performance-related problems or professional interests, and (4.) the presence of competent CoP facilitators and the active participation of content experts. • Barriers included: (1.) discomfort about posting something online for all to see, (2.) security issues, (3.) concerns about the accuracy of the information, and (4.) potential information overload.

Type of CoP groups	Description	Goals	Examples from the literature	Findings
			<ul style="list-style-type: none"> • <i>Beamish (2000)</i>: Ford developed an online distance education system, <i>Fordstar</i>, for salespersons, mechanics, and parts and service personnel within dealerships.²⁶ (USA) • <u>Study design</u>: Participant observation, documents analysis, interviews. 	<ul style="list-style-type: none"> • The availability of online technology alone did not ensure information flow to the end users. • Obstacles to information flow could include: (1.) content (positive vs. threatening), (2.) medium (ease of use), (3.) physical environment (noise, transmission quality), (4.) cultural and social environment, (5.) work environment (salary system, competition), and (6.) individual issues (position, beliefs, attitudes, memory, ability to act).
	<ul style="list-style-type: none"> • Teams, often from the same company, collaborated from different locations by using communication technologies. 	<ul style="list-style-type: none"> • To share information and complete assignments. 	<ul style="list-style-type: none"> • <i>Robey (2000)</i>: Members of three cross-functional virtual teams from a soft goods manufacturing company worked and learned together through e-mails, phone calls, fax, videoconferencing, and face-to-face meetings²⁷. (USA) • <u>Study design</u>: Face-to-face, semi-structured interviews. 	<ul style="list-style-type: none"> • A virtual community can facilitate learning among workers from different geographic locations. • Online interactions reduced the need for face-to-face meetings, while maintaining the level of productivity and learning.
Primary studies that used CoPs as a learning theory	<ul style="list-style-type: none"> • <i>The term “CoP” was used in the study, but there was no information about the structure of the group or the effect on participants.</i> 			<ol style="list-style-type: none"> 1. <i>Gieskes (2002): The learning style and barriers to learning in a multi-national telecommunication company were examined. CoP was discussed as a learning theory.</i>²⁸ (Multinational: the Netherlands, Sweden, Australia) 2. <i>Beers (2003): The role of knowledge-brokering was examined in a qualitative study. CoP was used as the underlying theory of social learning. It was proposed that knowledge brokers might help to increase collaborations among CoP-type groups.</i>⁵⁰ (USA) 3. <i>Boyer (2003): A survey was administered to the employees of a computer service business to assess the extent to which the CoP theory supported the company’s competence in knowledge-management.</i>⁶³ (USA) 4. <i>Kull (2003): A case study that compared CoP theory and other knowledge-management concepts. Twenty-eight knowledge-management experts were interviewed.</i>⁶⁴ (USA) 5. <i>Sinha (2004): A Web-based survey was administered to managers and workers of 42 organizations, including banks, engineering firms, information technology companies, and manufacturing companies, to assess whether the existence of CoP-type groups increase an organization’s competitive advantage.</i>⁶⁵ (USA)

CoP = Community of practice

Table 4: Communities of practice in the health care sector – summary of 13 primary studies

Type of CoP groups	Description	Goals	Examples from the literature	Findings
Apprenticeship	<ul style="list-style-type: none"> • Expert practitioners interacted with novices in the practice setting. • “CoP” was used synonymously with “profession.” 	<ul style="list-style-type: none"> • To learn and consolidate clinical skills. • To acquire a professional identity. 	<ul style="list-style-type: none"> • <i>Cope (2000)</i>,⁵ <i>Burkitt (2001)</i>⁶⁶: Student nurses learned from mentors and other nurses during clinical placements (UK, USA). • <u>Study design</u>: Semi-structured interviews, focus groups, field observations. 	<ul style="list-style-type: none"> • Students gained acceptance in the workplace through interacting with mentors and colleagues.
			<ul style="list-style-type: none"> • <i>Hudzicki (2004)</i>: The transition of medical technologists from novices to experts.⁶⁷ (USA) • <u>Study design</u>: Semi-structured interviews. 	<ul style="list-style-type: none"> • Transition from novice to expert required individuals to be self-directed and reflective, and to have access to mentors. The latter required being a member of a CoP.
			<ul style="list-style-type: none"> • <i>Lindsay (2000)</i>: Fieldwork program at a community mental health centre for junior OT students.³⁵ (USA) • <u>Study design</u>: Case study. 	<ul style="list-style-type: none"> • Through participation in individual meetings with clinical instructors and team meetings, students reported an increase in confidence in clinical reasoning and in setting career goals and objectives.
			<ul style="list-style-type: none"> • <i>Plack (2003)</i>: PT students and novice clinicians transitioned from an academic to clinical setting.⁶⁸ (USA) • <u>Study design</u>: Semi-structured interviews and questionnaires, focus groups. 	<ul style="list-style-type: none"> • Active engagement in practice and dialogue with experienced clinicians was critical for novices to form their professional values, beliefs, attitudes, and identities.
Informal learning group	<ul style="list-style-type: none"> • Groups of clinicians engaged in continuing professional development activities. 	<ul style="list-style-type: none"> • To share knowledge so that members can do their own job better. 	<ul style="list-style-type: none"> • <i>Pereles (2002)</i>: Physicians met regularly at journal clubs.⁴⁰ (Canada) • <u>Study design</u>: Semi-structured interviews. 	<ul style="list-style-type: none"> • Members of these groups appeared to be supportive of each other’s learning. • Mutual respect was a major contributor to the success of a group. Members preferred to agree to disagree rather than pursue a “right” answer or consensus. • Facilitators in these groups played a key role in providing administrative support. Burnout was an issue that could lead to the

Type of CoP groups	Description	Goals	Examples from the literature	Findings
				demise of these groups.
Health care agency collaborative	<ul style="list-style-type: none"> Representatives of health care agencies, who normally would not work together, collaborate to achieve a common task. 	<ul style="list-style-type: none"> To provide quality health care. 	<ul style="list-style-type: none"> <i>Lathlean (2002)</i>,⁴¹ <i>Gabbay (2003)</i>⁴⁸: Multi-agency groups with a mandate to develop evidence-based policies to improve health and social services for older people. (UK) <u>Study design</u>: Action research. 	<ul style="list-style-type: none"> Even with challenges, CoPs might improve interagency communication and local services.⁴¹ Policy was not always developed based on the research evidence, even within a well-facilitated CoP. Decisions might be heavily influenced by the power dynamics within the group.⁴⁸
Virtual community	<ul style="list-style-type: none"> Online groups that helped practitioners to use/adopt an innovation (e.g., a new tool, new guidelines), or to discuss practice-related issues. 	<ul style="list-style-type: none"> To help participants from various geographic locations to do their work better. 	<ul style="list-style-type: none"> <i>Wild (2004)</i>: Eleven states and local public health agencies, which engaged in developing and implementing a children's health information system, participated in <i>Connections</i>, an online forum, to share best practices.⁴² (USA) <u>Study design</u>: Web-based survey, individual and group interviews. <i>Richardson (2003)</i>: A Web-based network, <i>Health Voice</i>, for students of post-graduate degree programs in health disciplines to facilitate inter-professional collaboration.⁴³ (UK) <u>Study design</u>: Program evaluation, interviews. 	<ul style="list-style-type: none"> Members felt that <i>Connections</i> offered a safe haven where they felt comfortable sharing their successes and failures without the fear of being judged. Membership diversity was considered a strength. Site visits were the most useful activity for both the hosts and the visitors. Technical challenges hindered the use of the interactive website by members. <i>Health Voice</i> provided an alternative medium to face-to-face interaction for learning and for developing an identity as a member of an inter-professional learning group.

Type of CoP groups	Description	Goals	Examples from the literature	Findings
			<ul style="list-style-type: none"> ▸ <i>Tolson (2005)</i>: A “virtual practice development college” for gerontological nurses across the country. Thirty-six nurses and academics interacted in this Web-based group and at real-time meetings for two years.⁴⁴ (UK) ▸ The group developed, piloted, published, and implemented evidenced-based nursing care recommendations. ▸ Patients and their families were involved where possible. ▸ <u>Study design</u>: Action research. 	<ul style="list-style-type: none"> ▸ Nurses felt that being a member of a national CoP afforded status and strengthened their sense of professional identity. ▸ Discussions with other nurses helped participants to approach best practices from the nursing perspective, in addition to the traditional medical perspective. ▸ Major challenges of being in a virtual CoP included the absence of a “learning-at-work culture,” lack of time, and doubts about the legitimacy of Internet-based learning.
			<ul style="list-style-type: none"> ▸ <i>Russell (2004)</i>: CHAIN, an informal e-mail network for people working in health care, or with an interest in evidence-based health care, to share expertise, make new contacts, and provide mutual support.⁴⁵ (UK) ▸ <u>Study design</u>: Illuminative evaluation. 	<ul style="list-style-type: none"> ▸ The network served as a rich source of information by providing access to members’ experiences, suggestions, and ideas. ▸ Ad hoc groupings emerged spontaneously as members discovered common areas of interest. ▸ A skilled facilitator and support staff served an important role in linking members with the same interests.
Primary studies that used CoP as a learning theory	<ul style="list-style-type: none"> • The term “CoP” was used in the study, but there was no information about the structure of the group or the effect on participants. 	<ul style="list-style-type: none"> • <i>Haigh (2004)</i>: This study described a “community of communities” as a peer evaluation process to maintain service standards in community mental health organizations.⁶⁹ [UK] 		

CoP = Community of practice

OT = Occupational therapy

PT = Physical therapy

CHAIN = Contact, Help, Advice and Information Network for Effective Health Care

Table 5: The structure of community of practice groups in the business sector

Reference	Why (purpose)*	Who*	How* / What*	Where*
Henning (1996)¹⁹	To become a refrigeration technician; to develop new ways to solve technical problems.	Novice and expert refrigeration technicians.	How: Roles of mentors and mentees were pre-determined. What: Students learned the use of trade jargons by interacting with expert technicians.	Formal one-on-one meetings; off-work telephone calls.
Attwell (1997)³⁰	To become a skilled train re-servicing worker.	An apprentice learning to refurbish railway cars, and the foreman.	How: Roles of mentors and mentees were pre-determined. What: The apprentice acquired the complex skill of refurbishing railway cars.	The mentees work alongside the mentors every day at the shop.
Robey (2000)²⁷	To share knowledge.	Office workers from two geographic locations.	How: Individuals travelled to business meetings, and then met socially after the meetings. What: Workers supported each other to reach their performance goals.	Videoconference, formal and informal meetings, telephone calls.
Yi (2000)²⁰	To complete a task: to build an online learning tool.	Engineers at Motorola.	How: The group started with a kick-off meeting, followed by facilitated online chats. Members collaborated on specific projects and presentations. What: The group archived online questions and responses.	Online discussion groups through the intranet.
Ardichvili (2002)²⁵	To share knowledge and solve work-related problems.	Engineers at the Caterpillar company.	How: Employees posted questions on the intranet. Community managers forwarded the questions to experts in various disciplines and initiated discussions. What: Employees collaborated on projects and discussed work-related issues.	E-mails and intranet online forums.
Beamish (2002)²⁶	To share knowledge	Car salespersons and service technicians at a Ford dealership.	How: Peer learning on increasingly difficult tasks; Ford sent out newflashes on problems and solutions reported by dealerships. What: Documents on best practices were shared.	Satellite broadcasts, face-to-face meetings.
Schermer (2002)²²	To complete a task: to build a building for Chrysler.	Architects, engineers, construction managers, clients (representatives from Chrysler)	How: Team member interaction was facilitated by formal training sessions on teamwork, the code of conduct, and the design of the office (e.g., low partitions in the office space to encourage conversations). What: Members exchanged work-related information.	Formal group meetings, informal discussions at worksite.

Ball (2003) ¹⁸	To become a competent trade union representative.	New and experienced trade union representatives.	How: Roles of mentors and mentees were self-selected. What: New union representatives learned from the experienced ones about the role.	Weekly trade union education session, informal discussions with peers.
Benner (2003) ²¹	To share knowledge.	Women working in Web-related occupations in Silicon Valley.	How: Old members greeted new members at social events and oriented them toward the online activities; members also get together informally every month. What: Members shared technical, career, and business advice.	E-mails, listserv, scheduled social events.
Carlson (2003) ²³	To complete a task: to produce a proposal.	Scientists, engineers, graphic artists.	How: Team members collaborate to produce a proposal. They provide constructive critiques for each other. What: Meeting minutes were kept as both electronic and hard copies.	Formal group meetings.
Harris (2003) ³¹	To become a competent tradesperson.	New workers and instructors in the building and construction industry.	How: Roles of mentors and mentees were pre-determined. What: Through classroom and on-the-job interactions with the instructors, new workers gained independence and confidence in their skills and roles.	Small group meetings, on-the-job learning from experienced workers.
Barrett (2004) ²⁴	To produce a good product.	Engineers and labourers at a shop that produced moulds for packaging and bicycle helmets.	How: Members from different disciplines collaborated at the shop to produce a product. What: A collection of work-related stories, training modules, and databases that can be used by the current and new employees.	Informal daily interaction at work.
Machles (2004) ⁶²	To become competent in work safety practices.	Employees at a biotechnology company.	How: Employees learned about occupational safety practices. Role modelling – roles of mentors and mentees were self-selected. What: A collection of occupational safety-related stories from workers, friends, and acquaintances.	Small group sessions, informal discussions with peers.

***Legend:**

- **Why** was the group formed?
- **Who** was included in the group?
- **How** did members communicate?
- **What** did the members do or produce, individually or collectively?
- **Where** did members interact with each other?

Table 6: The structure of community of practice groups in health care sector

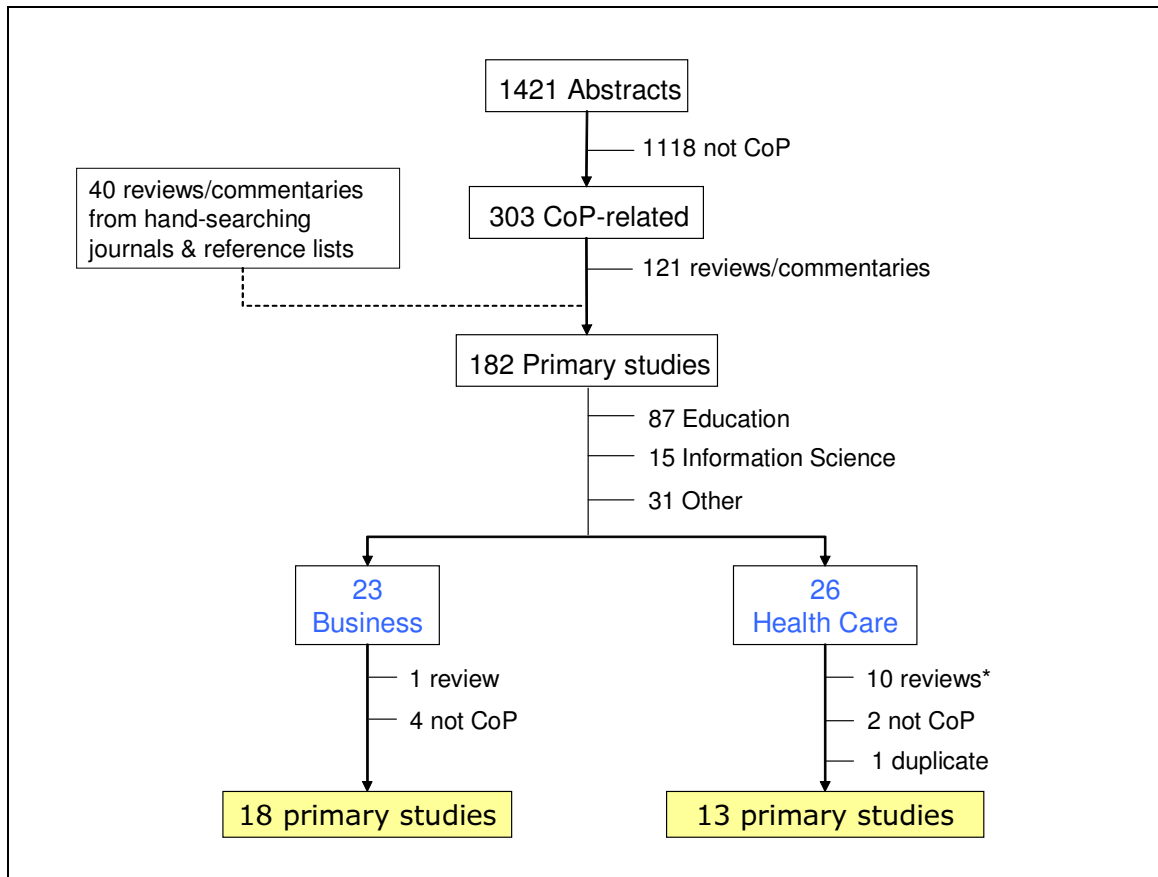
Reference	Why (purpose)*	Who*	How* / What*	Where*
Cope (2000) ⁵	To become nurses	Clinical nurse instructors and nursing students.	How: Roles of mentors and mentees were pre-determined. What: Students learned by doing, observing, and discussing with mentors.	One-on-one meetings.
Lindsay (2000) ³⁵	To become occupational therapists	Clinical instructors and occupational therapy students.	How: Roles of mentors and mentees were pre-determined. What: Students learned by doing, observing, and questioning the mentors.	Scheduled one-on-one meetings, small group discussion.
Lathlean (2002) ⁴¹ Gabbay (2003) ⁴⁸	To complete a task: Create policies	Government agencies, hospitals, social services, voluntary sector organizations, local citizens.	How: Members met at formal meetings to discuss a list of topics pre-determined by the group. Communications among members were guided by a facilitator. What: Members exchanged stories based on their work-related experiences and developed a framework for shared decision-making.	Scheduled group meetings.
Pereles (2002) ⁴⁰	To share knowledge	Physicians.	How: Small group learning facilitated by a coordinator who provides group material. What: Members shared stories based on practice experience.	Scheduled small group meetings.
Stuckey (2002) ⁷⁰	To share knowledge	Physicians.	How: The group consisted of physicians and invited experts from various fields. Members were encouraged to submit questions and discussion topics through an online facilitator. What: Consultation to provide options for prescribing and also avoiding drugs.	Website, e-mails.
Plack (2003) ⁶⁸	To become physical therapists	Clinical instructors and supervisors, physical therapy students, and new physical therapists.	How: Roles of mentors and mentees were pre-determined. What: Students learned from instructors by doing, observing, and sharing stories.	One-on-one meetings.
Richardson (2003) ⁴³	To share knowledge, and to develop an identity as a member of an inter-disciplinary learning group.	Post-graduate students in a health discipline.	How: Facilitator plans and organizes meetings. Students also planned their own online and off-site meetings with other students and faculty members. What: Attend online seminars; students gained feedback from researchers.	Online seminars, off-site group meetings.

Reference	Why (purpose)*	Who*	How* / What*	Where*
Tolson (2003) ⁴⁴	To share and create knowledge.	Gerontology nurses.	How: Problem-solving as a group. What: Members developed, piloted, and published practice statements.	An online college.
Russell (2004) ⁴⁵	To share knowledge.	Researchers and practitioners working in health care-related areas.	How: CHAIN staff forward e-mails to appropriate group members. Members may also contact or consult with each other directly, or by asking CHAIN staff to initiate an introduction. What: Facilitator pre-screened all incoming e-mails and forwarded to the relevant members. Members share best practices and network with each other.	E-mail network.
Wild (2004) ⁴²	To complete a task: Integration of child health services, finding new ways to solve problems, sharing and creating new knowledge.	Local, State, and Federal Child Health Agencies.	How: Member agencies engaged in planning and developing projects. They reviewed each other's work and collaborated on projects. What: Produced newsletter and presentation CDs.	Teleconferences, e-mails, listserv, group meetings, planned social events.

***Legend:**

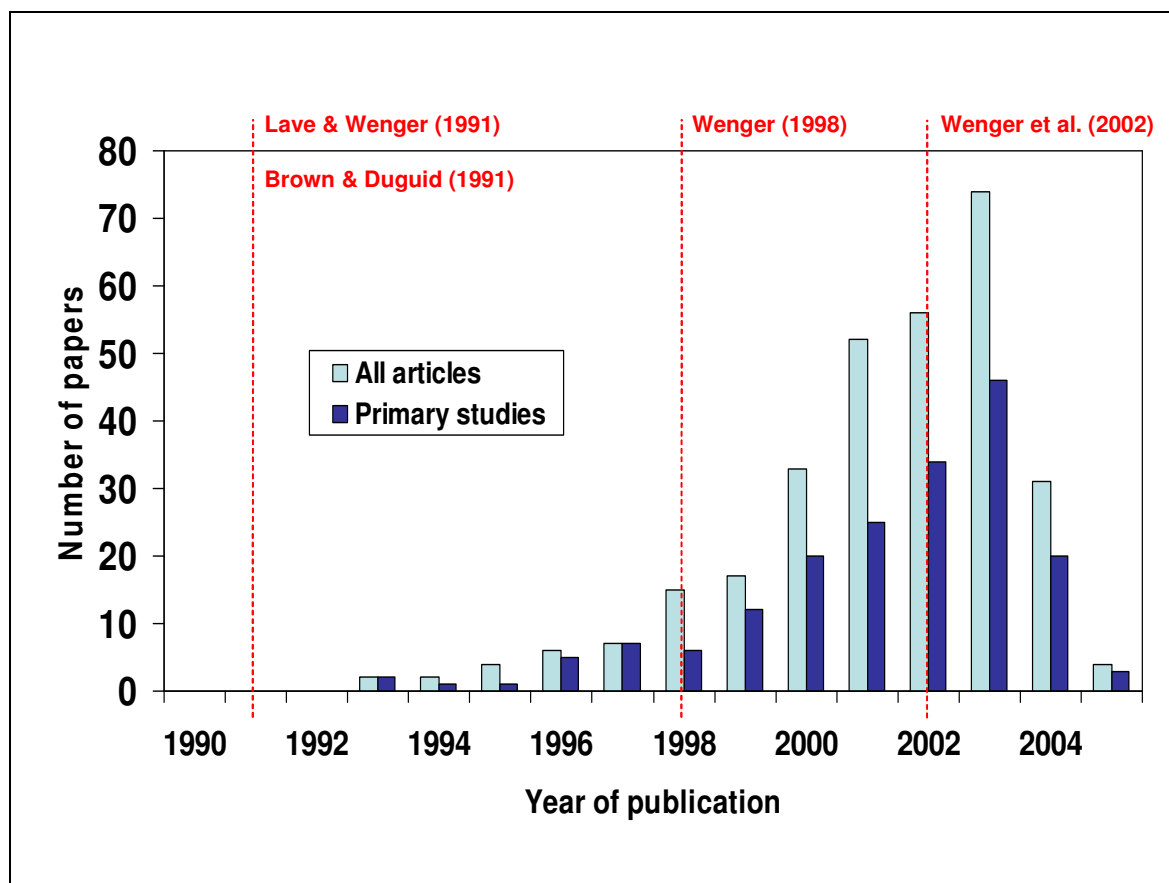
- **Why** was the group formed?
- **Who** was included in the group?
- **How** did members communicate?
- **What** did the members do or produce, individually or collectively?
- **Where** did members interact with each other?

Figure 1: Literature search strategy



* Reviews include review articles, editorials, and commentaries

Figure 2: Number of papers about community of practice (N = 303) and number of primary studies (N = 182) by year



Additional files provided with this submission:

Additional file 1: abstract_evolution of wenger.doc, 42K

<http://www.implementationscience.com/imedia/1192978768249940/supp1.doc>