

Collaborative Visual Annotations For Knowledge Exchange in Practical Medical Training

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Abstract. This paper presents an approach to applying a visual annotation system for informal learning through knowledge exchange between physicians in post-graduate training in general medicine. The system is part of an online platform for creating and sharing physician-generated medical cases from their work practice. Collaborative visual annotations of medical images are used to support knowledge exchange through online discussion and cooperative creation of medical cases. First results suggest that this can provide valuable support for informal learning through knowledge exchange in this specific domain.

1 Introduction

Knowledge exchange in practical medical training plays an important role in connecting theory and practice. After obtaining their degree physicians go through a period of post-graduate education of five to six years to specialize in a given medical field. An important part of this is practical training through independent work practice supported by experienced physicians. During this specialization, general physicians run through different medical institutions, which are geographically dispersed and functionally not related (e.g. hospital, general practitioner's surgery). Thus, it is a challenge to keep their peer-network stable and to use it for informal learning through peer-based exchange. We present an approach to support such settings by building specific tools for facilitating problem-oriented knowledge exchange in work practice. We focus on the use of collaborative visual annotations within a community platform for the creation and sharing of medical cases between general physicians in post-graduate training (the KOLEGEA project¹).

¹ <http://www.kolegea.de/>

2 Collaborative annotations of medical images for physicians

2.1 Related work

Current research on knowledge exchange through user-generated content in medicine has largely addressed patient portals and online medical communities. Solutions for knowledge exchange between physicians have been little addressed. Several community platforms for physicians exist (e.g. DocCheck, Coliquio²) but they largely offer general-purpose solutions, with forum-based support for discussing patient cases. Little work has considered how to support physicians in specific medical domains. In this context, we have been investigating the application of collaborative visual annotations to support work-related knowledge exchange in practical specialization in general medicine. On one hand, this builds on current research in collaborative visual analytics and CSCW that has explored new kinds of collaborative commenting and analysis (e.g. Willett et al. 2011) for knowledge exchange. On the other hand, previous work on collaborative learning has also shown the usefulness of collaborative annotations for engaging users in learning-related behaviors such as showing support, self-reflection or internalization (Gao et al. 2013). In addition, healthcare professionals are increasingly accessing visual information from the Internet such as medical images (Carro et al. 2006) to support their work-related problem solving and continuing education. This points to increasing importance of visual support for knowledge exchange in medical practice.

2.2 Application concept and design

The KOLEGEA¹ platform supports the creation and sharing of medical patient cases from the daily practice of general physicians. A core concern is the design of tools for cooperative creation and use of patient cases. These cases are conceived as visual artifacts combining a medical structuring with multimedia information (Novak et al., 2013). A patient case is presented as a slideshow (Fig. 1) organized by phases of medical consultation (examination, diagnostics etc.). Different types of media like text, video, audio (e.g. voice memo) and image files (skin

² <http://www.doccheck.com/>, <http://www.coliquio.de/>

eruption, injury etc.) can be uploaded through mobile devices (tablets) or the web.



Fig. 1.0 Visualization of a patient case / cooperative visual annotations

The cases can be linked to medical guidelines (best practices) and tagged with symptoms, diagnosis keywords or counseling purposes. In order to stimulate peer-exchange the author adds an initial question to state his motivation for posting the case (e.g. asking about unusual symptoms). Physicians can discuss the case through plain comments or by using the special visual annotation tool. The latter allows them to highlight a region of interest in a case image and add a comment (“*Can this skin eruption be a side-effect of the furosemide medication?*”) as in Fig. 1 (left). Medical discussions often revolve around specific details, such as direct observations of patient symptoms or diagnostic information (e.g. EEC diagrams). Linking comments to specific parts of visual material could improve the quality and precision of knowledge exchange among the physicians and increase the motivation for participation under time pressure of work practice. Such annotations could also help gain new insights in complex cases that might be difficult to recognize otherwise. By stimulating collaborative analysis and discussion of problems from practice they could increase the effectiveness of informal learning in the workplace and connect it with problem-based learning in formal medical education (Ziebarth et al., 2013).

3 Preliminary evaluation results and discussion

To evaluate the practical suitability of our approach, we conducted a formative evaluation of the patient case application in two sessions of

1.5h each with 5 participating physicians (in total). The participants performed typical tasks that would occur in practice: creating a patient case, sharing it with their learning group and discussing it online with their peers and a mentor. To assess user acceptance we applied selected elements of the UTAUT model (Venkatesh et. al 2003) elicited by a Likert-scale questionnaire. All users perceived the application as useful for their medical training (“strongly agree”) and all but one perceived that it simplifies their medical training (“strongly agree”). Regarding the functionalities for visual annotations, the participants found the possibility of marking regions of interest on medical images and commenting them directly very useful (four out of five “strongly agree”). The same result applies to adding free comments and linking them to an entire image. The usefulness of the related knowledge exchange through peer-based and mentor-assisted discussion also obtained the same level of agreement (four out of five “strongly agree”). Such findings indicate that the specific functionalities of collaborative visual annotations for case discussion could provide appropriate support for stimulating knowledge exchanges between the physicians in this specific domain. Accordingly, this suggests that visual annotations *could* provide specific support to improve the process of informal problem-based learning through peer-based knowledge exchange in workplace-based training and related settings. This explorative hypothesis will be investigated through further work and evaluations, such as a planned real-world (longitudinal) pilot study.

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