Science Education International
Vol. 25, Issue 1, 2014, 60-67

Intensifying innovation adoption in educational eHealth

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ABSTRACT: In demanding innovation areas such as eHealth, the primary emphasis is easily placed on the product and process quality aspects in the design phase. Customer quality may receive adequate attention when the target audience is well-defined. But if the multidimensional evaluative focus does not get enough space until the implementation phase, this means a delay. The study examines how the adoption and diffusion processes of educational eHealth innovations could be enhanced from the viewpoint of design. Explorative, critical analysis of the multidisciplinary literature with a pragmatic approach serves this aim. The prerequisites identified in general adoption models and theories refer to several quality aspects. When designers understand the meaning of versatile quality framing in the early design phase, this may ease the adoption processes of eHealth. Questioning that focuses on the quality of eHealth innovations rather than on adaptation problems is more fruitful from the viewpoint of design. In demanding development areas, the maturation processes of products may be laborious, and therefore, rapid diffusion processes are not always possible and not even useful if these occur at the expense of quality.

KEY WORDS: eHealth, design, innovation, adoption, education

INTRODUCTION

Digital products with informative and educational purposes are targeted for health professionals and health consumers. In demanding innovation areas, process- and product-related quality categories are easily the aspects requiring the most concentration in the design process. Customer quality typically receives adequate emphasis in well targeted applications. Technology acceptance models explain the adoption process for innovations, and in the health sector, several theories complement these models. A closer look reveals that many of the identified attributes connected to adoption intensity refer to different aspects of quality. Thus, versatile quality thinking at the early design phase may ease the adoption and diffusion processes for innovations. This study examines the prerequisites for the adoption and diffusion of educational eHealth from the viewpoint of quality and design. An explorative and critical versatile literature review that connects technology adoption, eHealth, and quality

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attributes sheds light on this dilemma. A pragmatic approach integrates sector-related design challenges and connected theoretical aspects, offering catalytic validity value for design efforts.

INNOVATION AND PREREQUISITES FOR ITS ADOPTION

Innovations "*add value to customers*" and "*can involve radical or incremental changes that help an organization to grow*" (O'Sullivan & Dooley, 2009), meaning, in educational technology, "*a new and useful way of solving existing educational problems*" (Cox, 2010). Adoption means an individually or organizationally made decision to accept or reject an offered innovation (Rogers, 1995). Several theories have been proposed to describe technology acceptance; they are, however, incomplete in terms of explaining acceptance of future information and communication technologies (Röcker, 2010). Well-known adoption models include, for example, innovation diffusion theories, technology acceptance models (TAM), the task-technology fit model (TTF), the unified theory of acceptance and use of technology (UTAUT), and theories of reasoned action (TRA) and planned behaviour (TPB) (e.g., Röcker, 2010). Information and system quality in the success of information systems are widely emphasized (e.g., Seddon, 1997), and in educational applications, aspects of content and presentation both form meaningful aspects of information quality.

Customer and efficiency categories (effectiveness, productivity, safety, satisfaction) are represented in the quality in use model (ISO, 2004). The need for a purpose-oriented framework is also recognized in the development of user experience quality models (Kerkow, 2007). Likewise, adoption requirements are considered in health-related models and studies. Parameters like user attitude, perceived usefulness, managerial support, subjective norm, perceived ease of use, and innovativeness affect physicians' decisions to use eHealth care systems (Yang & Wang, 2012). The quality of health-related IS innovations can be evaluated through attributes like efficacy, effectiveness, efficiency, optimality, acceptance, legitimacy, and equity (Donabedian, 2002), which many authorities use to explain IS innovation deployment (Sharma et al., 2012). In health-related acceptance models (e.g., AMUSE model) aspects such as effectiveness, productivity, joy, appreciation, and trust are underlined (Doerr et al., 2007). The eHealth-related readiness for implementation model covers attributes like organizational environment and motivation, technology usefulness, promotion, implementation process, department-technology fit, key personnel awareness, and support (Gustafson & Brennan, 2007). All these theories and acceptance models predict prerequisites for the adoption of innovation. Interestingly, these

attributes can also be placed into different quality categories known in common quality thinking.

Many of these attributes may refer to more than one quality aspect, and hence, a primary category must be selected. Falling into the *product quality* category are aspects like relative advantage, innovativeness, compatibility, complexity, trialability, observability, task characteristics, technology functionality and usefulness, safety, information, and system quality. On the other hand, effectiveness, optimality, productivity, performance, and effort expectancy fall into the *cost/value or efficiency* category. Management objectives, beliefs about consequences, top-level goals, and organizational motivation refer to *mission fitness*. Joy, appreciation, attitude, and satisfaction refer to customer quality. Perceived usefulness, ease of use, key personnel awareness, and support may refer to the *customer*, *product*, and *process quality* categories. Promotion, department-technology fit, and implementation process refer to *process quality*. *Ethical quality* covers aspects like legitimacy, availability, and equity. Image, trust, and subjective norms can be categorized as *image quality* factors. Besides these quality-related aspects, other prerequisites represent aspects referring to facilitating conditions like managerial support or other aspects such as social influence. The product quality category receives the most attention; however, several quality categories are represented. This reveals the phenomenon that *versatile quality thinking is a catalyst that empowers innovation adoption through necessary facilities and social aspects*.

INNOVATION ADOPTION AND VERSATILE QUALITY CHALLENGE

The health sector lacks detailed information about information technology acceptance (Aggelidis & Chatzoglou, 2009). In the early design phase, a product quality category such as innovativeness generally is easily emphasized, because of the necessity to concentrate on primary design challenges like usefulness. However, other quality parameters are also recognized as prerequisites for adoption. Versatile, no doubt demanding quality thinking needs attention in the early design phase of innovations: "*it is easy to investigate user experience with existing products but much harder to investigate it with an early concept idea*" (Roto, 2007).

The mission and value of the innovation should be understandable for its designers and potential users. Obvious value means better adaptation (Denis et al., 2002). In novel areas, there is also plenty of space for the evaluation of "previously solved problems." The main mission of eHealth is clear: it is one piece in a process that tries to produce optimal care intensity with better health outcomes. Adaptation improves if eHealth systems have a positive impact on interactions between different user

groups, with a fit for organizational goals (Murray et al., 2011), but also corrects these when required.

Guidelines, "roadmaps," and "pathways" try to help designers to understand features that make eLearning more effective and adaptable. However, in challenging fields, product quality is not always easy to obtain at once. Applications that need additional refinements are one of the reasons for complex diffusion (Koppel, 2006). Maturation procedures may take years. The high dropout rates of self-management eHealth applications are evidence of this fact (Eysenbach, 2005). *Product quality* in eHealth naturally means the innovativeness and advantageousness of products and their usability or "fitness for use" with adequate user support. In educational areas, the quality of both information content and presentation is essential.

Educational eHealth tries to respond to *customers' demands*. New information channels replace earlier protocols and tools, but the difference between web-based and traditional education methods is not always noticeable (e.g., Cook et al., 2008). eLearning readiness is partially connected with learner characteristics, e.g., ICT skills and the motivation of trainees (Scheurs et al., 2008). Proper user-friendliness is still a design challenge in the area (Coughlin et al., 2006); older adults need to be better informed about available eHealth options (Jung & Loria, 2010) and connected skills in technology use (Coughlin et al., 2006). A better understanding of real customer needs (Jung & Loria, 2010) is necessary, and some applications are too time-consuming (van Gemert-Pijnen, 2011). Requirements of flexibility mean that products should somehow embody straightforwardness; however, this should never come at the expense of quality. Plain applications are user-friendly and straightforward enough but may contain too simplified or superficially compressed information, worsening their content quality.

"*By developing the technology, not only technical aspects are developed, but the whole process, including system, content and service is redesigned*" (Kelders et al, 2013). Educational products try to support the informational and educational processes of health professionals and service users (e.g., curative or preventive care, health record-related education, guidance, professional education and support). A sharp-eyed perspective is needed to identify which processes are more flexible in current praxis and where eHealth offers added value. Educational or informational processes can be reorganized with the aid of eHealth technologies, but some processes could be more successful in "blending category", only empowered with new eHealth innovations. Sometimes the help desk-type personal assistance of health professionals will produce more quality than general guidelines offered online. A genuine process evaluation is one requirement for the reasonable development policy and adoption.

There is still a lack of evidence of the *cost-effectiveness* and beneficial impact of eHealth technologies (Black et al., 2011). Paper-based guidelines may take less time to use than computerized guideline tools (Yaphe, 2013). Process evaluation and cost management go hand-in-hand. Many educational functions are already allocated to a certain degree to the eHealth sector (e.g., information delivery, follow-up guidance, supporting self-management). eHealth applications often play a helping role, but there is a need to reconsider which areas could be more flexible without the human touch. Personnel costs constitute the main cost factor in the health sector (as well known); therefore, it is useful to identify the areas where educational applications can at least partially substitute for professionals. When eHealth applications substitute for human resources, a real return on investment can be anticipated, but only if this does not happen at the expense of quality of care. Reasonable cost-intensity in itself is always a secondary task in the health sector, but reasonable cost-intensity in the sense of optimal care intensity and better health outcomes is a task worth aspiring to. A well-functioning product is not enough; if it clashes with ethical values, this points to less sophisticated quality thinking. There are many ethical codes proposed specifically for the eHealth sector; however, the principles of autonomy, fidelity, and justice need continued discussion (Layman, 2003). Privacy, security, safety, confidentiality, availability, and awareness are features to be included more intensively in the *ethical quality* of eHealth (e.g., Hong et al., 2008).

DISCUSSION AND CONCLUSIONS

The understanding of why and how organizations adopt and implement innovations (Meyer & Goes, 1988) and why health-related complex interventions do not work (Shepperd et al., 2009) is still incomplete. The overall quality of products is one of the recognized requirements. From the viewpoint of design, it is more fruitful to determine how to enhance the maturation level of innovations than to think about aspects that enhance adoption (Greenhalg et al., 2004). Versatile quality thinking could enhance innovation adoption, but only if sustainable values control the essence of these quality frames. However, because product design and quality thinking originate from a conscious or less conscious value basis, there is a need for continuous assessment of these controlling values. It is also meaningful to refine systems, once introduced (Black et al., 2011). Newness, improvement, and the overcoming of uncertainty are typical features for innovations (Gordon & McCann, 2005). In eHealth, improvement and overcoming of uncertainty still need to mature.

It is understandable that product and process perspectives emphasize innovation design in the early design stage. However, if multifaceted quality evaluation receives enough attention only in the implementation

phase of innovations, this causes a delay. Versatile quality framing in the early design phase makes the process of development more demanding, but this is one key to more fluent adoption of innovations. If customers' needs, aspects of efficiency, ethics, and image, and a more intensive mission fit are given enough space in the ideological framing at the very beginning of the design process, a more intense adoption rate is expectable. Nonprofessional or immature products are also sure to have a chance on the market, thanks to a successful image, newness, or even lack of competition. But the question of diffusion and dissemination is not as critical as the quality dilemma with regard to eHealth applications. If the maturation level of products is acceptable enough, this lessens the barriers to adoption. But if the value of an innovation is not obvious, a user will not consider it (Rogers, 1995). However, value-added applications also need their own reframing periods (Ferlie et al., 2001). In demanding areas, maturation efforts are laborious, and rapid diffusion processes are not always possible and not even useful if these appear at the expense of quality. It is known that limited resources and infrastructural issues may weaken the rapid dissemination of eHealth. However, design decisions have their influence on adoption policy. This study offers catalytic validity value by underlining the essential meaning of versatile quality framing in eHealth design.

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