Computers in Human Behavior 53 (2015) 149–160

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Full Length Article

Moving beyond cognitive elements of ICT literacy: First evidence on the structure of ICT engagement

Johannes Zylka [a,*], Gabriela Christoph [a], Ulf Kroehne [a], Johannes Hartig [a], Frank Goldhammer [a,b]

[a] German Institute for International Educational Research (DIPF), Frankfurt, Germany
[b] Centre for International Student Assessment (ZIB), Germany

ARTICLE INFO

Article history:
Received 15 April 2015
Revised 1 July 2015
Accepted 3 July 2015
Available online 9 July 2015

Keywords:
ICT engagement
ICT literacy
ICT competence
ICT self-concept
ICT interest
Social exposure to ICT

ABSTRACT

The use of Information and Communication Technology (ICT) is of immense importance in today's digital knowledge society. As a basis for private and vocational participation in society, ICT literacy has been widely discussed in recent decades. Although motivational and metacognitive facets play an important role in developing ICT literacy and competence, studies assessing media, computer or ICT literacy often fail to present a comprehensive concept on these motivational and metacognitive facets. This article addresses this issue by integrating them into the concept of ICT engagement. Its theoretically deduced dimensions of ICT-related interest, self-concept related to the use of ICT, and social exposure to ICT were analyzed in an explorative study assessing $N = 445$ students aged between 14 and 17 years in the German federal state of Baden-Wuerttemberg. The obtained dimensional structure included the assumed factors, and suggested to distinguish a positive and a negative self-concept on using ICT as well as to separate interest in computers and interest in mobile devices factor. The ICT engagement dimensions were related to individual differences in behavioral, cognitive and emotional ICT constructs as expected.

1. Introduction

As computer technology has increasingly pervaded most areas of people's life in recent decades, individual competencies related to the use of information and communication technology (ICT) have become a necessary precondition for professional success as well as a crucial factor for private life (Blossfeld, 2010; Kozma, 2009; Partnership for 21st Century Skills, 2007). Over the past two decades, diverse approaches on ICT competencies have been proposed, amongst others in the field of empirical educational research (ETS, 2002; Gonzalez, Ramirez, & Viadel, 2012; Richter, Naumann, & Horz, 2010). The variety of approaches corresponds to a diversity of applied terms, for instance, media literacy, media competence, computer literacy, information literacy, or digital literacy (cf. Lee & So, 2013; Zylka, Mueller, & Martins, 2011). In empirical educational research, approaches have lately focused on the construct of ICT literacy (ETS, 2002; Goldhammer, Kroehne, Keßel, Senkbeil, & Ihme, 2014).

According to ETS (2002, p. 2), ICT literacy is to be understood as a meta-competence not only relating to technical knowledge but also to enabling individuals to use "digital technology, communication tools, and/or networks to access, manage, integrate, evaluate and create information in order to function in a knowledge society". These abilities are highly important for getting along in a changing global society as well as for life-long learning (Johnson, Adams Becker, Estrada, & Freeman, 2014, p. 19). ICT literacy can be perceived as a continuum comprising the above-mentioned five abilities (i.e., access, management, integration, evaluation and creation of information), thus comprehending a specific set of skills that changes over the lifespan (ETS, 2002, p. 2; Senkbeil, Ihme, & Wittwer, 2013). Although it is well known that literacy is subject to change over time and that diverse factors such as gender, personal experiences or social involvement influence learning and the development of literacy, a comprehensive concept integrating these conditions and factors has not been presented so far.

As regards ICT literacy, previous research has actually emphasized the relevance of motivational factors for ICT usage, performance and knowledge (e.g. Igbaria, Iivari, & Maragahh, 1995; Richter et al., 2010; Senkbeil, Marten, & Wittwer, 2013; Shu, Tu, & Wang, 2011; Sáinz & Eccles, 2012; Wit, Heerwegh, & Verhoeven, 2012) and the connection between using ICT and general learning motivation in specific didactic scenarios (e.g., Leng, Ali, Baki, & Mahmud, 2010). At the same time, no comprehensive approach has been presented integrating motivational and metacognitive facets as conditioning factors for developing and

* Corresponding author at: Department of Educational Quality and Evaluation, German Institute for International Educational Research (DIPF), Schloßstraße 29, 60486 Frankfurt, Germany.
E-mail address: zylka@dipf.de (J. Zylka).

http://dx.doi.org/10.1016/j.chb.2015.07.008
0747-5632/

adapting ICT skills in a self-regulated. Thus, a theoretically justifiable conceptualization and measure is necessary, enabling researchers to investigate those metacognitive and motivational factors that are assumed to facilitate intrinsically motivated use of ICT and the development of related skills through life span.

2. Connecting ICT and media literacy to ICT engagement

The terminology that is applied to knowledge of and skills to use digital technologies differs strongly and depends on countries and scientific discourse (Badke, 2009; Zylka et al., 2011). (Digital) media-related abilities are often discussed in the context of media education, to a lesser degree also in computer science, and also from the measurement perspective also in empirical educational research. Besides ICT literacy, the following terms can be found: media education (e.g. Parola & Ranieri, 2011), media competence (e.g. Fedorov, 2011), media literacy (e.g. Hobbs, 2011; Inan & Temur, 2012; Moore, 2013), media literacy education (e.g., Schmidt, 2013), computer competence (e.g., Killian, 1984), computer literacy (Richter et al., 2010), computer education (Özdener & Bryik, 2007), ICT competencies (Hus, 2011), technology literacy (Davies, 2011), digital literacy (Media Awareness Network, 2010) and digital competency (Cartelli, 2009). Whichever term is being used, literacy related to ICT is mostly seen as an essential key competence of individuals living in today's knowledge-based society (e.g., ETS, 2002; European Commission, 2014).

2.1. Connecting ICT literacy and media literacy

Media literacy is one of the most frequently applied terms to refer to (digital) media abilities and skills. Its use is widespread, especially in the Anglo-Saxon countries such as the United Kingdom, Australia, the United States and New Zealand. These countries generally have a long history of media-related discourse that can be traced to the development of mass media in the 1950s and 1960s (cf. Zylka et al., 2011). The original considerations of that time which are related to non-digital media are partially still implemented today, enhanced by the more recent ICT-related developments (Hobbs & Jensen, 2009). Over time, discussions have shifted toward media literacy education, initiated by the US National Association of Media Literacy Education (NAMLE).

Other terms, such as digital literacy or ICT literacy, evidently focus upon digital technologies that have been developed over the past two decades, and regularly emphasize that specific aspects of digital media – such as collaborative working, socializing or gaming – are to be regarded when discussing media-related abilities. "The increasing role of technology in our lives requires us to expand our notion of literacy. It is obvious that [...] individuals must be literate in terms of traditional domains such as reading [...]. But today it is becoming increasingly clear that ICT literacy joins the ranks of essential and fundamental requirements" (ETS, 2002, p. 16). Another reason for the rising importance of ICT literacy can be found in the concept of literacy itself. It is often understood as "the ability to identify, understand, interpret, create, communicate and compute, using printed and written materials associated with varying contexts" (UNESCO, 2004, p. 13). Furthermore, it also involves an understanding of ongoing learning enabling individuals to achieve their goals, to develop their potential, and to participate in their society (UNESCO, 2004). Thus, literacy, competencies and skills of individuals are expected to change over time, and this change is supposed to be most strongly influenced by individual motivational factors.

Quite many studies on ICT and media literacy have assessed individual differences in skills and abilities; however, approaches that extensively address motivational dimensions of ICT and media literacy are scarce. Nevertheless, constructs reflecting processes of the continuous and self-regulated development of these competencies are of major interest for empirical research and intervention studies.

2.2. Connecting ICT literacy and ICT engagement

Referring to constructive theories of learning, it is assumed that motivational facets play an important role for the development of individual abilities and knowledge (Craven & Marsh, 2008). For instance, being interested in and having a positive self-concept related to a specific activity – in other words: being engaged in a task – can be understood as a highly effective form of learning (cf. Mondi, Woods, & Rafi, 2008, p. 242). Therefore, metacognitive, motivational and cognitive facets can be assumed to be strongly interrelated.

2.2.1. Engagement

The concept of engagement is already well known, amongst others from the theoretical framework of reading engagement in PISA studies (OECD, 2007/2009) where it was introduced by Guthrie (1996; see also Guthrie et al., 1996, 2004). Guthrie argues that literacy is often understood as most important aspect for the regulation of a cognitive system (cf. Anderson & Pearson, 1984). He accentuates the relevance of motivational facets and states that persons who are engaged in reading choose to read for enjoyment, for gaining knowledge and/or for interaction in social relations (Guthrie et al., 1996, p. 309). He therefore connects individual motivational needs to the individual's social milieu as well as to traditional understandings of cognitive competence (Guthrie, 1996, pp. 435). By developing this comprehensive understanding of literacy-fostering dimensions, Guthrie moves beyond established notions of literacy and developed a concept of engagement, which seems highly valuable to be transferred and adapted to the context of ICT-related literacy.

2.2.2. Computer engagement

The concept of engagement was not only used in terms of reading engagement by Guthrie, but also by other researchers who connected it amongst others to digital media. Previous research work investigated the assessment of computer apathy and computer anxiety (Charlton & Birkett, 1995). Further developments in this context aimed at distinguishing the addiction of students to computers and computer engagement (Charlton, 2002), for instance in the context of online games (Charlton & Danforth, 2007) which is linked to the work by Brown (e.g., 1991, 1993). Bygone years showed uprising research interest in this area, again. Some researchers discussed the concepts of computer or ICT engagement, but usually with a focus on the enhancement of student's general learning engagement through their use of ICT (cf. Coates & Friedman, 2009; Varol, 2013). These approaches therefore understood ICT as supportive tool for enhancing learning engagement, but did not discuss the engagement in ICT or its connection to the area of ICT literacy. In contrast to these approaches, the concept of ICT engagement presented in this study does not concern computer-related engagement in the sense of addiction or general learning engagement, but it focusses to integrate metacognitive and motivational facets of ICT usage fostering the continuous development of ICT literacy.

3. Introducing ICT engagement

In today's digital knowledge societies, ICT literacy is required in nearly all areas of work and ICT-related competencies are an essential component of employability (e.g., Drigas, Ioannidou, Kokkalia,