

Ubiquitous Learning and Digital Literacy Practices Connecting Teacher and Learner

Andreja Istenič Starčič
University of Primorska
& University of Ljubljana
Cankarjeva 5
SI-6000 Koper
+3861 4768500, SLOVENIA
Andreja.Starcic@gmail.com

Žiga Turk
University of Ljubljana
Jamova 2
1000 Ljubljana
+3861 4768500, SLOVENIA
Ziga.Turk@gmail.com

ABSTRACT

In this paper, we discuss digital literacy and preservice teacher education and reflect on the current state of web-based education and development of digital literacy in teacher education in Slovenia. The literacy context is discussed in the context of the Educational Technology course which is delivered in teacher education. The aim of this course for preservice preprimary and primary classroom teachers is to develop student teachers' digital literacy and prepare them for the efficient integration of ICT into their teaching. This will in turn influence learners' digital literacy and competence for active engagement in the emerging culture of participation. The paper discusses web-based teaching methodology with a focus on instructional design, learning resources and high-order learning outcomes. The affordance of mobile technology fosters ubiquitous learning which has been integrated into the teacher education curriculum. The notion of tools in learning and literacies is discussed in the context of the transition from traditional written culture to digital culture. In integrating mobile learning, three important dimensions converge, underlining the development of digital literacy: the technology dimension of wireless mobile providing instant access, the social dimension and the learning behaviours dimension. A survey was conducted to examine undergraduate student-teachers' attitudes on the application of ubiquitous education and the development of digital literacy through the integration of mobile learning. The results indicate that student-teachers have developed competences in a variety of mobile learning and teaching activities. They believe that mobile technology increases connection between learner and teacher but are neutral about the integration of children's social practices from their free time to school environment.

Keywords

Web literacy curriculum, Web education, "Mobile Technology", "Teacher"

1. INTRODUCTION

The set of traditional literacies of writing, reading and computing is facing shifts with the development of information and communication technology.

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Preservice teacher education and continuous professional development both face major changes in all domains and especially in the domain of teachers' competences.

Due to rapid technological developments, there is disagreement about the competences required for integration of ICT into teaching and professional learning. Information literacy skills including searching, accessing, comprehension, critical evaluation and the informed use of data and information [1] have emerged within the information society. Computer literacy, which is more concerned with computer technology and how to operate it [2], was addressed by the elementary school curriculum objectives on the technology, operation of technology, and technological concepts and programming including problem solving skills [3]. ICT literacy refers to applying information communication technology in all aspects of human life [4]. ICT literacy is defined as information literacy "*applying technology to communicate and use information resources highlighting critical assessment of information* [5]". Ubiquitous technology and rapid development is calling into question the definition of ICT literacy. Web 2.0 has brought a shift from manipulation and consumption of information to production and sharing of information [6].

Digital literacy is defined as a mix of technical proficiency and meaningful engagement in digital environments [7], web environments and networks. Digital competence involves problem solving, communication, managing information, collaboration, creation and sharing of content, and knowledge building [8]. Competences for creative expression and online production are required, both in school and in the work environment [9]. Digital literacy requires competences for engagement in web based environments combining modes of representations with multiple sign systems exploiting the affordance of web technologies and multimodal literacy embedded in social systems [7] and is required for autonomous participation in a networked society where participation means production. Participation requires the ability to design and create multimodal texts and web resources to present knowledge and to communicate with others [10].

The notion of tools in learning [11] moving from the traditional written culture of pencil and paper technology to digital technology is challenging for cognition and learning. Both in school curricula and out of school, the genres of both text and interpersonal interaction or communication are migrating from print form to digital form. This involves merging characteristics of oral

communication and written communication along with multimedia and multimodal affordance. Multimodal literacy requires that [12] *“The use of different modes of expression in student work should be integrated into the overall literacy goals of the curriculum...”*. The main requirement is problem solving and critical thinking ability in all digital environments applying a variety of modes of expression. Multimodal literacy makes a significant contribution to the comprehension of concepts and to their application through procedural knowledge [12]. From the technological angle, integration of various modes (or channels) in a single communicational act using the same protocol is conceptualized as multimodality. Multimodality is applied in personal communication and also in human-computer interaction (e. g. multimodal interfaces) [13]. Multimodal literacy therefore integrates understanding and manipulation with technology in terms of understanding multimodal systems and producing and transferring multimodal products in communication acts of all sorts.

In integrating mobile learning three important dimensions converge, underlining the development of digital literacy: the technology dimension of wireless mobile providing access, the social dimension and the learning behaviors dimension. Transforming literacy from oral to written culture [14] involves a shift in cognition. Digital literacy and mobile technology affordance have impacts on cognition. Manipulation with mobile devices is characterized by:

- touch interaction
- instant access to information
- hyperconnectivity and networking
- dynamic interactive and multimodal representations facilitating spatial awareness and multimodal communication.

Mobile technology affects social practices of students and how students learn ubiquitously in day-to-day activities. Short learning events are typical and multitasking is common. Apps are becoming wide-spread learning resources [15]. Literacy incorporates technical skills and social practice which interact and influence each other. Ubiquitous technology facilitates new social practices and both lead and set the literacy requirements.

Since ubiquitous mobile technology transforms social practices and preferences of younger generations, the teacher has to consider teaching and learning approaches aligned with preferences of students and digital literacy *“grammar and spelling of the digital [16]”*. This paper discusses student-teachers’ digital literacy, outlining the curriculum and approaches applied in initial teacher education. The study presents undergraduate student-teachers’ attitudes towards applying ubiquitous education and developing digital literacy through the integration of mobile learning. The Educational Technology course for preservice preprimary and primary classroom teachers aims to develop student teachers’ competences and prepare them for the efficient integration of ICT into their teaching, which will in turn influence learners’ digital competence for active engagement in a culture of participation.

In 2006, teacher’s ICT literacy in Finland was defined with respect to pedagogical competency and the use of ICT tools on three levels. The first involves the pedagogical use of ICT and use of basic software for text editing and email; the second involves the more advanced pedagogical knowledge required for designing and developing learning resources and the third involves multimedia, distance learning systems, networking, programming, information systems for administration, ICT supported research and innovation. Finnish researchers indicated that in 2006 10% of teachers achieved the third level of ICT competences [17]. With the development of

Web 2.0 the third level has become a basic requirement for all teachers. The use of ICT in teaching and learning for high order learning outcomes is a predominant concern. ICT is applied in teaching for examining concepts, solving problems, creativity and innovation [18]. Moving away from a pencil and pen technology to digital technology, students need digital competence as enabler of their literacy. The development of digital competences has to take place in a cross-curricular context and according to the TPACK technology integration model. The TPACK model provides integration on three levels: technology, pedagogy and content knowledge [19].

2. Digital literacy to facilitate high-order learning objectives: The curriculum structure

Competences developed within the Educational Technology course for preprimary teachers and primary classroom teachers are connected with the objectives of pre-school and primary school curricula, educational processes and the interactions and experiences from which children learn. The course covers information and communication technology as well as media in teaching and learning, underpinned by concepts of participatory culture, networking, and creative expression and production, underpinned by collaboration and sharing. Competences are needed for participation in digital societal media, and the gap in participation is caused more by the lack of competences than by a lack of technology [20]. The findings of research on different educational levels indicate that younger generations who have grown up using digital technologies lack adequately developed competences for online participation. These are defined as creative expression, problem solving, collaboration and sharing [9]. The use of computers and the Internet is part of the world of young people who are early adopters of novelties - especially in their spare time [21]. Spread among students is faster than among teachers [22]. The lack of ICT applications and their alignment with curriculum objectives towards digital literacy is maintained if teachers are not digitally literate and lack competences for ICT supported teaching [23]. Web education teaching methodology includes instructional design and learning resources applying mobile technology. They are implemented in the Educational Technology curriculum with regard to high-order learning objectives. Students become engaged in the following activities: digital storytelling applying multimodal design, mobile game based apps application, social networking sites, sharing documents, designing personal web sites and designing web sites to support classroom instruction, classroom management utilising learning management systems, Web 2.0 tools and smart boards.

2.1 Survey on student-teachers’ attitudes and digital literacy

The TPACK model was applied as the teaching approach to provide an authentic context for student-teacher learning. The instructional design for the Educational Technology course is focused on examination of children’s day-to-day practices when using mobile technology and web. The role of school and teachers is to inform parents and children and to facilitate digital literacy and the appropriate implementation of the mobile technology in day-to-day activities. Learning at the stage of early learning is based on creative activities, whole body movement, play and collaboration. Learning is processed with concrete non-symbolic representations of concepts. Manipulation of concrete physical objects and various materials is combined with visual representations. According to Piaget [24], children’s developmental level in pre-school and during the first period of primary school is defined as the level of

concrete operations, and according to Bruner [25] it is processed through action in this enactive stage. The computer provides approaches and techniques of expression and creation, play and collaboration and facilitates visualization and virtual representations. Kress [26] points out that web based learning provides efficient and effective access to multiple modes of representations and therefore influences thinking. The creation, representation and communication of meanings is multimodal [27].

The research questions for the study were: What are student-teachers' digital practices and attitudes towards educational technology? How student-teachers assess their own digital literacy?

2.2 Methods

A survey and semi-structured group interviews were conducted at the end of the course to identify student-teachers' attitudes about educational technology and their digital literacy. The instruments were designed based on the three modes for presenting interconnected relationship TPACK [19], FRAME [28] and van Dijk [29]. The TPACK model of teacher's competences provide the framework of pedagogical knowledge, technical knowledge and content knowledge for the discussion of digital competences. The FRAME model identifies three main dimensions in mobile learning: those of a learner, of a device and of the social context. Van Dijk is concerned with digital skills which he presents within particular contexts: medium related skills, content related skills and strategic skills of a learner. In our discussion Van Dijk's model is applied to examining the learner within a social context where digital literacy is applied.

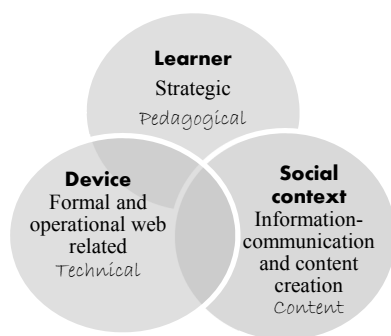


Figure 1. Digital literacy dimensions

The survey questions were designed in three sections, (1) the learner/strategic/pedagogical dimension, (2) the device / formal and operational web related / technical dimension and (3) the social context / information communication and content creation unless / content dimension.

The semi-structured interview followed the same structure as the survey. Participants were drawn from student-teachers from the faculty of education during the years 2013, 2014 and 2015. In total 117 students aged 19-20 years, 106 females and 9 males, participated in the study.

2.3 Findings

The findings identify students' attitudes towards and general use of educational technology as well as their proficiency in both learning and the instructional process (i. e. course Educational Technology). Self-assessment was conducted on a scale from 5 - very high to 1 not at all.

The research questions were: 'What are student-teachers' digital practices and attitudes towards educational technology?' and 'How do student-teachers assess their own digital literacy?'

To address the first research question, students' mobile technology practices were examined. They were also asked to assess their own proficiency in both learning and instruction.

To address the second research question the model presented in figure 1 was designed. Digital literacy consists of overlapping or interconnected relationships, which take place between the three dimensions as indicated in figure 1. The objective was to examine digital literacy in a cross-section of technical, pedagogical and content knowledge. As these processes are complex, the three models were integrated. The learner dimension concerns the pedagogical dimension in a learning process and strategic dimension when interaction occurs with (a) formal and operational engagement with the web (e.g. technical) and (b) information-communication technology and content creation (i. e. social context). In the first table the technical dimension is examined, referring to activities and self-assessment of proficiency of students' own learning and instructional ability. In the second table the learner strategic and pedagogical dimension is examined indicating proficiency in learning and instruction. The third table shows the social context of the informational-communicational dimension and content creation and self-assessment of learning and instruction.

Table 1. Device / formal and operational web related / technical activities and self-assessment of frequency of general use and level of proficiency for own learning and for instructional use

Activities	Frequency of general use - Mean (SD)	Level of proficiency for own learning – Mean (SD)	Level of proficiency for instructional use – Mean (SD)
Microsoft office / Open Office	5.0	5.0	5.0
Video editing	3.2	1.1	1.0
Photo editing	4.4	2.1	2.2
Web site design	2.7	2.2	2.5
Learning management system	1.9	4.5	3.7
Smart board	1.9	2.2	2.8
Digital storytelling tools	2.4	2.0	3.5
Game based apps application	4.3	3.9	2.2
Social networking sites	4.7	4.5	2.4
Sharing documents	4.9	4.8	4.0
Classroom organisation and management applying mobile technology	4.4	4.4	3.2

Student-teachers assessed their frequency of use of various practices and technologies. Some practices are assessed quite high in terms of frequency of use but proficiency for their own learning and instruction is assessed much lower (video editing, photo editing). The results indicate that student-teachers have developed competences in a variety of mobile learning and teaching activities. They have applied the technology in the Educational Technology course in instructional design and accordingly assess their level of

proficiency. They have not, however, used some of these practices (smart board, digital storytelling) for their own learning. For other practices, however, proficiency levels are higher in their own learning and much lower for instructional use (learning management system, classroom organization and management applying mobile technology).

Table 2. Learner/strategic/pedagogical dimension - own learning and for instructional use

Statements	Own learning - Mean (SD)	Instructional use - Mean (SD)
Affordance of mobile technology enhances quality of learning.	4.2	4.1
Teachers should use more mobile learning.	4.7	4.7
I am inclined to use mobile learning.	4.2	4.2
I am confident using mobile technology.	4.5	3.8
I learn about new mobile learning strategies.	3.2	4.4
I discuss mobile technology with colleagues.	1.2	3.3
I enjoy creating multimodal content for mobile learning.	2.2	3.8
My time management is better with mobile technology.	4.3	2.8
I am effective in using mobile technology.	4.5	3.8
I am effective in applying computers for problem solving.	3.5	3.4
I can critically evaluate information on the internet.	4.4	4.4
My competency for creative expression and content production is in general sufficient.	2.9	2.9
Mobile technology encourages learners to get connected more for the purpose of learning in their free time.	2.2	3.0
Interactive tangibles facilitate learning combining representations: tangible, visual and abstract.	4.4	4.4

Student-teachers indicate that they feel very positive with regard to mobile technology in learning and teaching. They believe that mobile technology successfully facilitates learning by combining different representational modes. They are happy to use mobile learning and are learning new approaches with mobile technology, but indicated that the last was used more in instruction than in their own learning. With regard to discussions about mobile technology and for digital storytelling it is obvious that this is more common for instruction than for their own learning. It seems that during the Educational Technology course more effort is dedicated to instructional design than to implementing new practices in students' own learning.

Time management use is higher in their own learning than in instruction. Apparently their competences with regard to time planning for instruction are not as developed yet. Belief in the usability of mobile learning for more engagement in learning is not as strong among student-teachers.

Table 3. Social context / information-communication dimension and content creation / content - own learning and instructional use

Statements	Own learning - Mean (SD)	Instructional use - Mean (SD)
I use mobile technology for collaboration.	4.2	3.6
I am more connected due to mobile technology.	4.5	3.3
I share my learning resources with mobile technology.	4.5	3.6
I participate in professional discussions about mobile technology.	1.1	2.2
Participation in social networks enables me to develop my professional identity.	3.6	3.6
I like content creation in collaboration.	4.2	4.2
I like to search for and share content in groups.	4.1	4.1
In group communication I use multimodal means.	2.7	2.7
Mobile technology connects learner and a teacher so that the interaction between a teacher and learner is more intensive.	4.2	4.2
Mobile technology assisted social practices in free time could be effectively transferred and integrated in school environment.	3.1	3.1

Students are positive about the social and collaborative use of mobile technology in their own learning and less in instruction (in terms of using mobile technology for collaboration, connectedness and sharing learning resources). They are cautious about whether social practices using mobile technology in children's free time could be efficiently integrated into the school environment. They believe that mobile technology increases connection between learner and teacher but are neutral about the integration of children's social practices from their free time to school environment.

3. Conclusions

For efficient ICT integration four dimensions are crucial in preventing the digital divide: motivation, physical access, digital skills and different usage [29]. Our study focused on the digital literacy of preservice preprimary and primary classroom teachers. The role of the teacher in fostering digital literacy in the next generation of students should be to enhance their competency in the domain of web based learning in which digital literacy is both a prerequisite and an outcome. In the teacher education, the preparation of pre-service/student teachers' competency in digital literacy will be enhanced by merging dimensions of technology,

pedagogy and content knowledge. The contemporary requirement is a production and not a consumption which requires of teachers creative and innovative skills in instructional design and delivery. The development of digital technology providing new contexts in which interaction is mediated by tools, contexts and contents (Figure 1) and foster migration from print culture to a digital culture defined as a multimodality. The capability for reading and producing multimodal texts needs to be integrated into the curriculum. The younger generations utilise digital social practices which are by their nature ubiquitous and as such have a potential for integration into the school curriculum.

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