

Analyzing ICT literacy of German Teachers: Focusing age and gender issues as well as identifying knowledge levels

Johannes ZYLKA

*Center for Research on Educational Quality and Evaluation,
Centre for International Student Assessment (ZIB),
German Institute for International Educational Research (DIPF),
Frankfurt, Germany
zylka@dipf.de*

Abstract: Owing to the increasingly fast development of media and especially the advancement of computer technology in recent decades, the topic of ICT integration in classrooms is being intensively discussed on different levels and media educators argue about the missing link between school education and the use of ICT in schools. In this respect, ICT-related competencies of teachers are supposed to play an important role, but approaches assessing ICT-related competencies – in general as well as in terms of the teacher profession – rarely exist and, thus, extensive data on ICT literacy of teachers is missing. The presented article focuses on identifying ICT knowledge of German teachers and teacher trainees, taken as a central aspect of media and ICT literacy, and in this respect especially addresses age-related and gender issues as well as different levels of ICT knowledge.

Keywords: ICT literacy, Media literacy, ICT knowledge, teaching profession, gender issues

Introduction

Schools worldwide are confronted with a variety of requirements related to digital media, for instance when looking at current developments such as mobile devices, cloud computing, collaborative working, or Game-based Learning [1]. Taking into account these developments, it is evident that the lacking integration of media literacy education in formal education has reached a new level of significance and will continue to gain importance [2]. Thus, for teacher professionals in the 21st century, the ability to handle digital media in different forms and scenarios is a central part of their every-day life [3].

Searching for studies focusing media or ICT literacy, it gets clear that this is an area of research which has not been extensively analyzed so far. There are at least some approaches discussing media use or media related attitudes of teacher professions [4], analyzing computer availability of teachers at home [5], or discussing the necessity of media literacy education on a theoretical level [6], but a minor amount of studies focuses ICT literacy of teacher professionals [7], especially accounting for different groups of teacher professionals: student teachers (initial training), teacher trainees (advanced training) as well as experienced teachers. Therefore, the presented article will analyze teachers' knowledge on ICT as predictor of ICT competence and ICT literacy, enabling conclusions on the readiness of teachers for the use of ICT in their profession. This article discusses ICT-related competencies of teachers in context of ICT integration in schools.

1. Integration of ICT in schools

In terms of school contexts, desktop or laptop computers still represent the most frequently used devices. The PISA studies showed that nowadays most students are quite well equipped with computers at home and that the school-related computer-per-student ratio has significantly improved comparing the situations between 2000 and 2009 [8]. Besides ICT availability at school, it is also important that teachers frequently use the available media, especially in classroom contexts. Thus, as important as data on the school-related availability of ICT is, it is not sufficient to allow statements on the implementation of ICT in schools. Studies have shown that the use of ICT in schools by teachers as well as by students differs a lot from the given possibilities. Based on these data, it can be shown that teachers in those countries where schools are equipped with computers are not necessarily using them in classroom contexts or other school-related activities. While in some ICT-equipped countries there is a relatively intensive use of computers in school contexts, the situation in other countries such as Germany differs: The level of computer availability is at least sufficient, but the use of ICT in school contexts differs strongly from the given possibilities. This is – amongst others – leading to a missing integration of ICT in learning scenarios as well as a lack of media literacy education of students [9].

In this context, discussions lately noticed that ICT-related competencies of teachers are quite important in terms of this gap and, therefore, in context of using ICT potentials in school [10]. As mentioned above, researchers have mostly focused on the availability and use of ICT in schools or on the curricular grounding of media literacy education in the last decade. Searching for literature on teachers' media and ICT competencies, it seems clear that this topic has not yet been an area of major research interest [11].

2. Discussing Media Literacy of teachers

Extensive data on media and especially ICT-related competencies in terms of teacher profession are rare. There is a variety of reasons for the lack of research on this topic, for instance the resistance of formal education against change and especially digital media or the task of finding teachers who permit studies on their media literacy. Even if data is provided, it often does not meet the requirements of objectivity, reliability and validity. In the past, studies have mostly concluded experience-based that teachers' lack media education and media-related competencies [12] or have focused on ICT availability and use. Hence, the most important challenge might be that the measurement of media competencies or media literacy has only found little attention in the past. As a consequence, there are – for the best of the author's knowledge – no instruments for adequately measuring media literacy in a quantitative manner, especially talking about the teacher profession.

2.1 Accessing ICT Competencies of Teachers

Speaking of competencies in general, there is quite an extensive discourse on how these can be measured. For instance, large scale studies such as PISA or TIMSS assume that knowledge is the most essential basis of competencies. In this respect, declarative as well as procedural knowledge can be seen as a predictor of competency. While the level of knowledge is quite important from a theoretical perspective, empirical approaches to media competencies of teachers in the European area have so far not focused on the level of knowledge [13]. Therefore, a decision was made to develop a new instrument targeting ICT knowledge, applicable in the given context. A first version consisted of nearly 400 multiple choice items, comprehending extensive knowledge on most fields of ICT. Because the

instrument was developed on the basis of the ICT standard work of [14], it can be seen as theoretically approved. After development, the questions were presented to experts (originating from the teacher profession as well as from the field of media research) rating the importance and the adequacy of the questions on a 5-point Likert scale. Finally, the experts agreed on the high importance and good adequacy of 39 items.

2.2 Description of the study

Based on this newly developed questionnaire, which is named ITK.basic in its German version, we conducted a study in the German federal state of Baden-Wuerttemberg, which focused on teachers and teacher trainees, in total including N=393 test persons from the different levels of teacher education. The smallest study group is the group of teachers (*T*) with exactly N=100 test persons. Teacher trainees are differentiated by student teachers (*ST*), who are studying teaching at university (initial training), and teacher trainees (*TT*) in the second phase of their vocational training, as is common in German teacher education. The study's results are by no means representative for the federal state of Baden-Wuerttemberg or the country of Germany. The study was paper-based as well as computer-based with an internet questionnaire, the assumption being that teachers as well as teacher students of the second phase would hardly participate in the survey if their questionnaires were not delivered paper-based. Thus, inquiry of *TS* was executed web-based, of *TT* both web- and paper-based, and of *T* just using a paper-based version of the ITK.basic. Since participation in the questionnaire (for the groups *TS* and partially *TT*) was voluntary, it is supposed that students with – at least by trend – higher ICT knowledge participated in the study. Thus, the empirical level of ICT knowledge is probably even overestimated in the presented results.

However, the overall reliability of the questionnaire resulted quite well with Cronbachs' $\alpha=0.914$. A good validity can be assumed because of the expert rating, and objectivity was achieved due to the study method which was based on a questionnaire. Overall, no test person was able to solve all the questions of the questionnaire. The one student with the lowest percentage of correct answers scored just about 5% correct answers, those with the highest knowledge levels around 95% correct answers. The most difficult items were solved by only 13 persons (3%), while the easiest question was solved by all of the probands.

2.3 Central findings from the study

One of the recently discussed aspects related to ICT competencies – not only speaking of the teacher profession – is age-dependence. It is mostly assumed that older persons do not know very well how to use computers and especially the latest ICT devices, which is a matter of concern because of the given age ratio in terms of the school systems in most developed countries. Thus, as first focal point of this study it is supposed in the presented data that older subjects score significantly less than younger ones. In addition, some authors argue that students are just partially media literate and that students choosing to become teachers mostly are not media literate. As teachers are expected to teach students ICT literacy as well as use ICT in their teaching activities, their own ICT knowledge becomes an essential predictor not only for their ICT literacy but also for their teaching competencies. Coming to the presented study: While there is no significant correlation of the subjects' age with their ICT knowledge ($r=-.099$, $p=.07$, $N=334$), the heterogeneity from 20 years to beyond 60 years is immense. There were students who solved over 95% of the questions as well as students solving below 20%. Therefore, data suggests that groups of teachers with significant gaps in media knowledge can be found at all ages. In terms of data analyses,

there are four groups that can be differentiated amongst the test persons. The following differentiation of groups should be understood as approximating in terms of practicable visualization of data – barriers between different groups do not represent fixed levels.

First, there is the group of **expert users** with profound ICT knowledge that solved more than 80% of the items in the questionnaire. The members of this group can be characterized by extensive knowledge in most areas of ICT. It therefore is assumed that subjects belonging to this group are well equipped with knowledge to use ICT in a self-determined way and are also able to use ICT in different pedagogical scenarios. It is also supposed that these test persons are somehow engaged and interested in ICT. 59 out of 393 test persons belong to this group, 56% of which are student teachers, 17% teacher trainees and 27% teachers.

Members of the second group, which is referred to as **standard users**, scoring between 50% and 80 %, are supposed to have some ICT-related knowledge in basic ICT topics necessary in every-day ICT use. Subjects belonging to this group are supposed to be mostly standard users, being equipped with a minimum of ICT-related knowledge. This group might be seen as target audience for on-the-job trainings in media education, because they have a good basis for further media-related skills and abilities. 171 test persons (43%) scored between 50% and 80% correct answers, 61 (35%) of which are student teachers, 59 (35%) teacher trainees, and 51 (30%) teachers.

Reaching between 25% and 50% of correct answers, the third group is labeled **low affinity users**: Members use ICT as a tool if necessary. They generally have little motivation to deal with ICT and minor expertise on standard tasks, but might be a good audience for basic professional training. 134 subjects (34%) – and therefore, the second largest group in this test – supposedly belong to the group of low affinity users. 56 (42%) of these are teacher students, 54 (40%) teacher trainees and 24 (18%) teachers.

Test persons of the fourth and last group solved below a quarter of items and, therefore, demonstrated a significant lack of substantial ICT knowledge in all areas of ICT. They should be strongly advised to attend extensive media-related training. Training on-the-job will mostly not suffice for these test persons, because they lack a basic understanding of ICT. 28 probands (9%) can be defined as **no affinity users**, 25% of whom are teacher students, 43% teacher trainees, and 32% teachers. The fact that this group does not only consist of older teachers but also of younger teachers aged 20 to 30 shows that today's students are not necessarily ICT literate.

Analyzing the group with quite low ICT knowledge it is clear that mostly female students are included here: While there are 19 (82%) female students in this group, just 4 (17%) male students possess minor ICT knowledge. Amongst the group of 59 students which scored above 80%, there are 70% males and 30% females. These aspects lead to the discussion of general gender-specific issues in terms of this article, which – in context of discussing media and ICT literacy – is an aspect of major importance. Gender issues are generally considered to be important in terms of the formal educational sector because of the given gender ratio in primary and secondary education. Thus, presented data showed highly significant differences between male and female probands in all of the groups: For student teachers ($r=.550$, $p=.000$, $N=157$), teacher trainees ($r=.382$, $p=.000$, $N=133$) as well as teachers ($r=.395$, $p=.000$, $N=98$). Gender differences are also significant in all included topics, the strongest differences are recognizable in the knowledge field of *data bases* ($M_m=.66$, $SD_m=.33$, $N_m=98$; $M_f=.36$, $SD_f=.28$, $N_f=240$) as well as *Software* ($M_m=.76$, $SD_m=.32$, $N_m=98$; $M_f=.48$, $SD_f=.29$, $N_f=240$). The least – but still highly significant differences – between males and females are extracted from the field of *basic knowledge* ($M_m=.79$, $SD_m=.20$, $N_m=98$; $M_f=.67$, $SD_f=.21$, $N_f=240$) as well as from *internet and web* ($M_m=.70$, $SD_m=.22$, $N_m=98$; $M_f=.52$, $SD_f=.21$, $N_f=240$).

3. Conclusion and Future Work

Bearing in mind that the ITK.basic was rated by experts to just ask for basic knowledge on ICT, the results mentioned here show that most teachers, teacher trainees as well as student teachers do not possess extensive knowledge in ICT. Considering the statement that presently there are major lacks in terms of measuring media literacy of teachers, the presented study adds to international educational research. It gives additional information on the addressed topics of gender issues. The focal point that older teachers generally are – at least compared to younger colleagues – not that media and ICT literate could not be proven in terms of this study. There are teachers older than 60 years who know lot more about ICT than some students in their early 20s. The instrument that was developed in terms of this study presents one step towards the development of an instrument which can empirically measure ICT competencies (not only in terms of teacher education) in a quantitative manner. Nevertheless, tasks such as the development of instruments focusing other areas of ICT literacy, remain.

References

- [1] Johnson, L.; Levine, A.; Smith, R. and Stone, S. (2011). The 2011 Horizon Report. Austin, Texas: The New Media Consortium
- [2] Frau-Meigs, D. & Torrent, J. (2009). Mapping Media Education Policies in the World. New York: United Nations.
- [3] Hague, C. & Payton, S. (2010). Digital Literacy across the Curriculum. A Futurelab Handbook. Bristol: Futurelab; Johnson, L.; Levine, A.; Smith, R. und Stone, S. (2011). *The 2011 Horizon Report*. Austin, Texas: The New Media Consortium;
- [4] Vrasidas, C.; Pattis, I.; Panaou, P.; Antonaki, M.; Aravi, C.; Avraamidou, L.; Theodoridou, K. & Zembylas, M. (2010). Teacher Use of ICT: Challenges and Opportunities. Proc. 7th International Conference on Networked Learning 2010.
- [5] MPFS (Medienpädagogischer Forschungsverbund Südwest)(2003). Lehrer/-innen und Medien 2003. Nutzung, Einstellungen, Perspektiven (*Teachers and Media 2003: Use, Attitudes and Perspectives*). Retrieved from <http://www.mpfs.de/fileadmin/Einzelstudien/Lehrerbefragung.pdf> on June 3rd, 2012.
- [6] Frau-Meigs, D. & Torrent, J. (2009). Mapping Media Education Policies in the World. New York: United Nations.
- [7] Petko, D. (2012). Hemmende und förderliche Faktoren des Einsatzes digitaler Medien [*Positive and negative aspects of the use of digital media*]. In: Schulz-Zander, R.; Eickelmann, B.; Moser, H.; Niesyto, H. and Grell, P. (Hrsg.). Jahrbuch Medienpädagogik 9. Wiesbaden: Springer VS. pp.38.
- [8] OECD (2011). PISA 2009 Results: Students On Line. Digital Technologies and Performance (Volume VI), p.146. Online: <http://dx.doi.org/10.1787/9789264112995-en>
- [9] Hague, C. & Payton, S. (2010). Digital Literacy across the Curriculum. A Futurelab Handbook. Bristol: Futurelab.
- [10] Buckingham, D. & Domaille, K. (2009). Making Media Education Happen: A Global View. In: Cheung, Ch.-K. (ed.). Media Education in Asia. Heidelberg u.a.: Springer. pp.19; Camps, V. (2009). Media Education beyond School. In: Frau-Meigs, Torrent (Hg.): Mapping media education policies in the world. Vision, Programmes and Challenges. New York: United Nations, pp.189;
- [11] Petko, D. (2012). Hemmende und förderliche Faktoren des Einsatzes digitaler Medien [*Positive and negative aspects of the use of digital media*]. In: Schulz-Zander, R.; Eickelmann, B.; Moser, H.; Niesyto, H. und Grell, P. (Hrsg.). Jahrbuch Medienpädagogik 9. Wiesbaden: Springer VS. pp.38.
- [12] Petko, D. (2012). Hemmende und förderliche Faktoren des Einsatzes digitaler Medien. [*Positive and negative aspects of the use of digital media*]. In: Schulz-Zander, R.; Eickelmann, B.; Moser, H.; Niesyto, H. und Grell, P. (Hrsg.). Jahrbuch Medienpädagogik 9. Wiesbaden: Springer VS. pp.38.
- [13] Zylka, J. (2012). Medienkompetenzen und Instrumente zu ihrer Messung. Entwicklung eines Wissenstests zu informationstechnischem Wissen von Lehrkräften, Lehramtsanwärtern und Lehramtsstudierenden. [*Media competencies and Instruments for their measurement: Development of a knowledge test on IT knowledge of student teachers, teacher trainees and teachers*] Unpublished PhD-Thesis: University of Education Weingarten.
- [14] Parsons, J.J. & Oja, D. (2010). New Perspectives on Computer Concepts 2011. Boston: Course Technology/Cengage Learning.