TOWARD MEDIA LITERACY OR MEDIA ADDICTION?

– CONTOURS OF GOOD GOVERNANCE FOR HEALTHY CHILDHOOD IN THE DIGITAL WORLD

ABSTRACT

Two separate discourses urgently need to be linked: How can we prevent digital risks, including clearly pathological forms of media use such as Internet Gaming Disorder? How can we support children in acquiring the skills which will allow them to make full use of the opportunities and potentials of digital media in the future? For good governance in bringing up healthy AND digitally literate children we need to master a number of challenges: 1) To find a common language, so that a fruitful transdisciplinary dialogue can take place between experts from different fields instead of them continuing to make contradictory recommendations. Such a problematic case is described in detail by contrasting the recommendations to follow an "Early High Touch – High Tech later" path, issued by experts studying digital risks (e.g. data security experts, as well as researchers studying long-term screen media effects on sleep, body mass index, empathy, executive brain functions and addictive symptoms) with the recommendations to follow an "Early High Tech" path, issued by experts studying digital chances (e.g. researchers developing digital learning environments for formal and informal educational settings). 2) To conduct sound and independent evaluation studies which assess the balance of long-term risks and benefits of different digital learning scenarios. 3) To base good governance in the field on the outcome of these studies. It is argued that far from mastering these challenges, favouring and hastily implementing the "Early High Tech" Path instead of the "Early High Touch – High Tech Later" Path has many characteristics of an (industry-driven) self-fulfilling prophecy and few of an informed political choice.

Key words: technology assessment; digitalization in education; child health; digital risks; digital potential

1 OUR COMMON GOAL – PREVENTING SCREEN RISKS AND REAPING SCREEN BENEFITS

A common goal of many, if not all, stakeholders involved in the debate on "education and well-being in the digital world" is that children should grow up to become healthy adults and mature and skilled users of technology. As adults, they should be able to assess and compare real-life and digital paths toward reaching a specific goal or satisfying a specific need. Last but not least, they should be able to decide and act in favour of the option that maximizes the long-term digital benefits and minimizes digital risks. These abilities were included in the construct of "Media Maturity" by Bleckmann (2012). A possible path toward reaching this goal is presented in Figure 1.

In the face of the massive controversy concerning the paths toward this goal ("Early High Tech" vs. "Early High Touch", see section 3.1), it is important to point out that there is a broad consensus with regards to the goal itself, i.e., on the idea that the human being should not become a "slave of technology" but rather learn to master technology and use it for his or her purposes in a limited, reflected, critical and technically skilled way. A second common goal is to reduce existing health and educational inequalities between privileged and disadvantaged social groups.
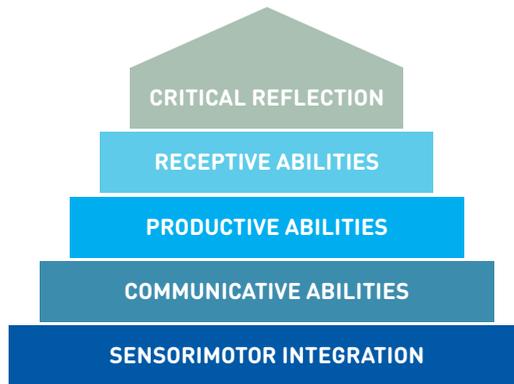
Figure 1: Media Maturity Tower (Bleckmann, 2012)

The two central principles of the Media Maturity Tower model are firstly, that analogue should come before digital (direct multisensory experiences in the real world as well as direct contact with other human beings constitute the best basis for subsequent mastery of digital media and prevention of media risks), and secondly, that active/creative media activities should come before passive/receptive consumption. So this sequential model of age-dependent media education by Bleckmann (2012) offers a theoretical framework which could be used to connect both sides, the prevention of (health) risks of digital media use and the fostering of digital literacy.

2 "DIGITAL MASTERY" – USEFUL SKILLS OR THE ROAD TO ADDICTION?

In the following section, readers are invited to follow a line of reasoning that stresses the ambiguous role of "digital mastery". Many policy papers suggest that a new goal of education in the digital age is to foster skills that allow students to master digital technologies. Experiencing "digital mastery" is often considered an entirely positive thing. So why call it ambiguous? An exercise in self-reflection, plus some results from research on video game addiction might come as a surprise and a challenge to reframe what one thinks about digital mastery:

The concept of "mastery" is an ambiguous one in the context of digital gaming experiences. On the one hand, the research tradition of Game Studies has often described an experience of control, an experience of "digital mastery", also named "effectance" or "control" as a central criterion for a positive gaming experience (Fritz, 2003; Klimmt, Hartmann, & Frey, 2007). Digital games are therefore designed to make the user feel in control. Success proves the designers right: games tend to succeed on the market if they make the user feel great (through giving commands, experiencing virtual self-efficacy/mastery/a sense of control) rather than small (following the programme's requirements and commands). The same would apply to the experience of using a digital device in general.

I would like to invite the reader to reflect on his or her own use of digital media. In this publication, I cannot, unfortunately, include two cartoons I used in the presentation on which this chapter is based, but I can describe them. In one of them, titled "in your mind", there is a huge person giving orders ("fetch my emails!", "show me the news!", "send a photo!") to a tiny smartphone replying "Y-y-yes, master". It is likely that many readers would claim that they are "masters" rather than "slaves" to technology in this way: They feel that they control the device, e.g. a Smartphone, rather than the device controlling them. But in the next cartoon, titled "in reality" a huge Smartphone is giving orders ("charge me!", "give me WIFI!", "new email! Read!", "answer this call!") to a much smaller person replying "Y-y-yes, master!". So the cartoons suggest that experiencing mastery would be a good thing, but that it happens too rarely.

On the other hand, and perhaps surprisingly, research on video game addiction shows that experiencing mastery can also be a bad thing, and that it happens all too often. The risk of becoming addicted is actually HIGHER for individuals experiencing full control of their virtual environment. Why? Because it is simply not attractive to spend hours and hours, and finally let your life and thoughts become dominated, by activities that make you feel small. The state of research on Internet Gaming Disorder, which was included in the international diagnostic manuals (in this case the DSM-V) as a research diagnosis in 2013 (American Psychiatric Association, 2013) and is being discussed as a likely candidate for ICD 13 (WHO, 2018), suggests that "digital mastery" can indeed be problematic. In our own socio-scientific model of Internet Gaming Disorder we have described how the online mock fulfilment of three real and understandable quests or desires can be reconstructed as central patterns from interviews with digital gaming addicts (Bleckmann & Jukschat, 2015):

1 the quest for belonging,
2 the quest for recognition of achievement
3 the quest for autonomy.

The case studies show that if there are temporary or permanent obstacles to the real-life fulfilment of these needs, gaming becomes rather attractive, in the sense of an attempt at self-medication. Some virtual environments are ideally suited to compensating for real-life problems, they are constructed in such a way that they offer to fulfil all three quests: 1) Many online games, especially MMORPGs (massively multiplayer online role-playing games) with virtual communities, convey a sense of belonging to their members. 2) Reaching one additional level after the other, experiencing "lucky or unlucky streaks" in games that use intermittent reinforcement schedules (also known as gambling elements) to give the human brain well-timed dopamine rewards convey an experience of success. 3) In a biography dominated by teachers, parents, employers who demand that that their commands be followed, gaming conveys a sense of autonomy. One of the young interviewees explained: "You know it just feels great to really do your own thing".

Subjectively, gamers get something from the game that they are missing in real life. The behaviour would not be called pathological, were it not for the long-term negative biographical consequences described in the study: While

one interviewee experienced "belonging" in his gaming community, his wife actually divorced him and he lost his family. While a young interviewee reached level 90 online, he had to repeat a year at school. While experiencing freedom and autonomy online, one of them became addicted to online gaming, tried to cut down but couldn't, and lied to friends and family. Virtual fulfilment in the case of our interviewees seriously interfered with the real-life fulfilment.

Another very interesting outcome of the study concerned the role of technical use skills in digital addictions. One of the interviewees described to the researcher how he would exchange hardware components, graphic cards and the like in the blink of an eye, how he would programme little macros to optimize the hit points of his avatar, a damage dealer in World of Warcraft. A number of other addicts displayed high to very high skills. Several of them even had university degrees in computing science.

Technical skills do not prevent people becoming addicted. This may seem a conclusion based on a small sample size, however, quantitative studies in the literature confirm this hypothesis. Two aspects of digital skills, namely high technical use skills and high emerging technology skills in a study with Asian adolescents showed a correlation to internet addiction and to a greater level of contact with problematic online content, such as violence and pornography (Leung & Lee, 2011). The third dimension, higher critical reflective skills were associated with a lower risk of addiction. Interestingly, in the report to the European Commission on testing and refining criteria to assess media literacy, the best predictors for high critical reflective skills were high general academic achievement and low screen time (Report to the European Commission, 2011). An analysis of the data from the "EU kids online" study confirmed these associations: Helsper (2014) found that high technical use skills were associated with a higher risk of addiction, especially among disadvantaged groups with low self-esteem and psychological problems.

The results from the first few studies on risk factors for media addiction are starting to be published (e.g. Mößle & Rehbein, 2013), although they cannot rely on longitudinal data of more than a few years' duration: Children who have a supportive family, good real-life friends, experience self-efficacy in real life and success at school are at low risk. Children with screen media in their bedrooms at an early age, with high screen time at an early age, with impulsivity as a character trait, children who use media products with a high addictive potential, children who are victims of bullying etc. are at high risk. The strongest predictor of subsequent addictive media use in the Berlin longitudinal study on children and the media was: "I like to play video games when I have experienced stress and disappointments in my life". In the light of the "quest for success, belonging and autonomy" model these findings can be interpreted as follows: Real-life fulfilment of the respective quest protects children from a desire for its mock online fulfilment. All of this supports the idea that for the prevention of digital addictions we do not need to re-invent the wheel: Many interventions to strengthen children's solid foundation in real life (e.g. life skills training, cf. Griffin and Botvin, 2004) are likely to be helpful in preventing the problematic use of screen media, whereas the acquisition of technical use skills can be helpful or counterproductive depending on the age and the circumstances of the child or young person. Premature use of

screen media is likely to prove counterproductive. Sheer time displacement makes screen media use act as "life skills reduction" (Bleckmann & Mößle, 2014). This leads to an extended common goal which is in line with the Media Maturity Tower model (Bleckmann, 2012): To prevent media risks and reap media benefits, the goal lies in an age-adequate balance of acquiring skills in real life and acquiring digital skills.

3 (UN)HEALTHY CHILDHOOD IN THE DIGITAL AGE

3.1 Children's screen media use – some facts and figures

Recent studies into European children's use of home and leisure time screen media show interesting and perhaps surprising results:

1   In a study comparing data from five countries (Belgium, Germany, Greece, Hungary and Norway) screen time in the home was higher if the parents believed that recommended maximum screen time was higher and if parental screen time was higher. Each country "excelled" in at least one of the variables measured. In Belgium, children's computer time was the lowest amongst the five countries (52 minutes per day in the sample of children of an average age of 11), in Germany television time was lowest at 87 minutes per day, whereas in Hungary computer time was highest at 77 minutes per day and in Greece television time was highest at 107 minutes per day (Verloigne, 2015).

2   The average daily screen time was around two hours for two-year-olds in the United States some years ago, with a tendency to increase (American Academy of Pediatrics, 2011) . Among the European countries, a 4-year-old's screen time is amongst the lowest in Germany at around thirty minutes per day (Feierabend, Plankenhorn & Rathgeb 2015). It increases by around another half hour every two years until the age of ten, then remains on a constant level. These are numbers for foreground media exposition, where the child is the primary consumer. In Germany, the average screen time is about double the recommended maximum for all age groups (Figure 2) (Bitzer, Bleckmann & Mößle, 2014).

AGE   **SCREEN TIME (HOURS PER DAY)**

■ Recommended maximum
■ Real average
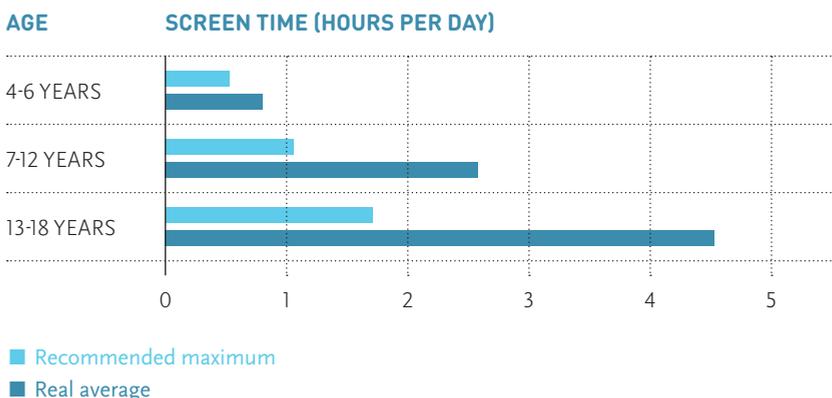
Figure 2: Screen time (hours per day)

3   The same is true for the home and leisure screen time of most children in Europe. Young children's screen time is considerably higher than the maximum screen time recommendations by health departments, practitioners and experts, who recommend that children under the age of three should not be using screen media at all (Strasburger, 2010; Vaala & Hornik, 2014). If background screen media exposition (i.e. the primary consumer is a parent, sibling, friend or other using screen media in the presence of a child) were added, the difference between the recommended times and the patterns of actual use would become even more marked.

4   It's a myth that computers replace television. That is not true on the screen time scale: In Germany, television times have remained constant for about 15 years, while computer, internet and smartphone time comes as additional screen time and is fast increasing (Feierabend, Karg & Rathgeb, 2014). On the scale of importance for the different ages this statement, however, is true: When children were asked which medium they could not go without, small children predominantly name the book, kindergartners name the television, followed by the computer, and for adolescents the smartphone is the most important medium. In Germany, smartphone ownership among 12-year-olds tripled from about a quarter to more than three quarters between 2012 and 2014. And last but not least: a hopeful observation from these German studies is that children "don't always do what they like best". The favourite activities of 6-12-year-olds are, meeting friends, playing outdoors and watching TV – in that order. The order of the activities that they actually take part in is: television first, meeting friends second, playing outdoors third. So children tend to use media more than they want to according to their self-reported leisure preferences (Feierabend, Karg & Rathgeb, 2013, 2014 and 2015). This sounds unfortunate, so why call it a "hopeful" observation? Because parents wanting to reduce their children's screen time might find it comforting in the face of conflict that in the long run they are supporting the child in having more time for his or her favourite activities.

5   For children who have their own devices in the bedroom longer screen time has been recorded than for children with screen-free bedrooms. For German 10-year-olds, screen time is almost twice as high for children who have their own devices. Children with their own bedroom screen equipment use age-inappropriatee content (rated 16 years old plus or adult only) six times as often as children without it (Mößle, 2012). The absence of screens in children's bedrooms is a better predictor for preventing problematic use than active parental media education efforts (Bleckmann & Mößle, 2015).

6   Children from disadvantaged backgrounds have on average more screen equipment in their bedrooms than children from more privileged backgrounds. In other words, the first digital divide, regarding access to digital media, has not only been bridged but in most European countries, it has been overcompensated for. In Germany, the population of 10-year-olds whose parents have a low educational background have three times as many televisions in their bedrooms as do 10-year-olds with higher educated parents. The risk of having their own gaming console in the

bedroom is four times higher for underprivileged children (Pfeiffer, Mößle, Kleimann & Rehbein, 2008). These children are more likely to have a computer in their bedroom, and to get their first smartphone earlier.

7   The average German adolescent checks his/her smartphone every seven minutes during waking time (Markowetz 2016).

3.2   Two positions with common claims and conflicting recommendations: Early High Touch vs. Early High Tech

The controversy regarding the different paths to reaching the initially mentioned "common goal" is characterized by two positions described as slightly overstated protypical versions. Section 3.2 will try to describe a synthesis of both. Both positions follow an internally consistent logic. The focus will be on the use of digital media for educational purposes during the early years, as this is where the recommendations are most controversial, while for older students there is a more consensual view.

· "Early High Touch – High Tech Later"

The health and other risks of digital media are considerable. Children from disadvantaged family backgrounds are affected more severely, as their screen media use patterns in the home are more problematic (more availability of screens in children's bedrooms, longer usage times among children and parents, more exposure to problematic content). Educational institutions should reduce their use of digital media for younger children or keep it at the current level, and aim towards compensating the excessive use of media in children's families by offering opportunities for real life social and sensory experiences (High Touch). Parents should be empowered to reduce the availability of screen devices, restrict their children's screen time and resist marketing pressure. Training for early childhood professionals is needed to enable them to follow these recommendations. This strategy will help to bridge the health divide. Fostering digital skills by using screen media in educational institutions should start towards the end of primary school.

In their study, Bitzer, Bleckman, and Mößle (2014) found a cluster of similar responses along the same lines from two groups of experts, namely 'child experts' (developmental psychologists, researchers into the effects of media, neuroscientists, …) and 'addiction experts' (public health professionals, prevention experts, media addiction researchers, …). In addition, experts (from the Early High Touch camp) highlight important exceptions to 'going digital' so comparatively late, such as the use of digital media for augmentative and alternative communication for children with special needs.

The theoretical grounding of the Early High Touch camp is based on reasoning from neuroscience and developmental psychology: too little stimulation of the large variety of senses (exteroceptive, interoceptive and proprioceptive) and too little sensorimotor integration are bad for the growth of the brain. Another concern linked to (early) screen media use is the dominance of bottom-up ("flight-and-fight-and-reward") brain activity as opposed to top-down (cognitive control, orbitofrontal cortex activity). Others call this bottom-up dominance a corruption of the reward system (Alter, 2017). The Early High Touch recommendations are also based on the results of media effects

studies: meta-analyses linking high screentime use by children to a higher risk of obesity, sleep problems, inattention, loss of empathy, low academic achievement, internet gaming disorder and other internet-associated addictive disorders (Mößle, 2012). Interestingly, Mößle's overview of the literature confirms that although these effects are small to medium, they are consistently more negative the younger the children are, the longer the usage times, the higher the use of age-inappropriate content, more negative when no adult is present, more negative when recording long-term rather than short-term effects on learning, far more negative when looking at patterns of actual use than in experimental studies with educational intent.

Whereas classical studies on the effects of media focus on foreground media exposition, recently the effects of caretakers' use of screen media (background media exposition) on very young children are beginning to be investigated. These studies consistently show a decrease in the quality of caretaker-child-interaction (Radesky et al., 2014, 2015; Christakis, Gilkerson, & Richards, 2009; Kirkorian et al., 2009). Preliminary results of the German BLIKK Study show a correlation between screen media use (background use by parents during childcare tasks) and one-year-old's sleep and feeding difficulties. The authors interpret this as a hint that the bonding between parent and child is impaired and urgently recommend further and longitudinal investigation (Mortler, 2017a).

· "Early High Tech"
"The benefits of digital media for children are considerable. Educational institutions should be equipped with more screen media, early childhood professionals should be trained to implement high tech projects with children in order to make children digitally literate at an early age. Parents in general and especially parents from disadvantaged backgrounds are not well qualified for this task. Educational institutions need to help disadvantaged children to use media well, in an active and creative way, because in the home, they only learn how to use the media in a passive and sometimes even in an addictive manner. So this strategy will lead to benefits for children's physical, psychosocial and cognitive development and help to bridge the digital divide. Parents and educational professionals should be made aware of how beneficial screen media can be for the young children in their care. The potential is very high because of
- *Individual learning*
- *Cheap education (teachers are expensive compared to computers)*
- *Gaming as playing*
- *Immediate motivation/reward*

This position is favoured by an expert group called "media experts" in the study, i.e. media education professionals and developers of software for children. It is also favoured by other digital education experts who tend to stress the benefits of screen media and favour an "Early High Tech Path". Digital education initiatives are mushrooming at regional, national and EU-wide levels.

Although each position is internally consistent (the assumptions of high positive media effects in young age groups and low negative effects are combined with a recommendation for a low entry age. In contrast, the assumptions of low positive media effects in young age groups and high

negative effects are combined with a recommendation for a high entry age), the differences are significant and somewhat worryingly large: Whereas the child and addiction experts recommend starting to use computers at age 9,5 years on average, the media experts recommend a starting age of 4,5 years. We suggest that this discrepancy is only in part due to socialisations and habitus in the different disciplines. In addition, it is likely that research funding by large multinational media corporations leads to a conflict of interest that impairs unbiased judgement with regards to the media experts. This is especially worrying as European governments tend to refer to experts from this on the subject of 'digital education'. They are either the only experts consulted or they tend to make up the majority of the experts in digital education advisory groups.

3.3 Screen media use in schools/kindergartens: the current state of research is more frequently suppressed or misquoted now than in the past

In contrast to what has happened up till now in the history of media education, the widespread introduction of today's high-tech tools is not preceded by extensive research. In the case of school radio, school television, language labs, programmed learning, to name a few examples, researchers used to conduct studies to investigate the risks and potential of new media for educational purposes BEFORE large-scale implementation. Large controlled trials with alternative-treatment control groups were carried out, mostly with neutral to negative results. In the history of media education, there was a repeated sequence of euphoria, stagnation and disillusionment. The historical hopes were (and present ICT-centred hopes are) that the new medium would help to teach children more individually, help the teachers to have more time for individual students, that students would be more motivated and learn more, and that weak students be better supported (Hübner, 2005). One example of "disillusionment" was when the language labs, in which weak students had been expected to improve their oral skills because they could each be instructed at an individually adapted level, lagged further behind than before. They lacked the will and skills to use the technology. Since the better students profited slightly compared to traditional teaching methods, the educational divide widened. In the end, for older students and adult learners language labs were found to be at best an addition to being taught by a good foreign language teacher (Hübner, 2005).

This supports the demand that today's "Early High Tech Hype" needs to be slowed down. There is a scarcity of high-quality independent evaluation studies for the pilot projects introducing ICT in classrooms. However, on the other hand, Spitzer (2017) has compiled a list of evaluation studies with neutral or negative outcomes. These include large-scale longitudinal trials with negative outcomes. Spitzer even goes so far as to state that the current political decisions concerning "digital learning" must be called "post-factual educational policy". In Denmark, Balslev (2017) makes the same point:

> *I'm concerned about the willingness to invest huge amounts of government money without any certainty of an effect. If you compare it to investments in healthcare or infrastructure, you have tightly regulated procedures for testing and specific indicators of success. I don't see decision-makers following such common rules when it comes to education technology.*

Concerning screen media in schools, there is now a new need to distinguish between the effects of pedagogically intended screen media use and the use of this for purposes for which it was not intended, i.e. distraction. This was not so much of an issue for overhead projectors, or instructional videos, etc. where the teacher usually controlled the devices. As opposed to this, the unintended use of modern digital technology such as smartphones or tablets in schools is widespread and has negative consequences for academic performance. In a recent study from the UK, Beland and Murphy (2016) found a significantly lower grade point average in schools without a mobile phone ban compared to schools with such a ban. Interestingly, the difference in academic achievement was very small among the good students, but large among the weaker students, which leads them to suggest smartphone bans in schools as an effective and inexpensive strategy for reducing educational inequalities.

Apart from demanding that more high-quality longitudinal evaluation studies be conducted, Spitzer also makes the point that many existing studies are misquoted: One example is the press reaction to the results of the ICILS study in Germany (STERN, 2014):

> *Deutschland ist digital nur im Mittelfeld? Kein Wunder! Schüler, Lehrer, Eltern, alle sind genervt: Die digitale Ausstattung an Schulen ist oft veraltet, Informatikunterricht fehlt oft völlig. Deutschland schnitt schlecht ab. (Germany is digitally average? No wonder! Students, teachers, parents are enraged: the digital infrastructure at schools is often outdated and there are no programming lessons. …bad results for Germany!)*

More than 100 newspapers followed this reasoning, though it is mostly untrue or unproven. The actual ICILS study measured eight-graders' CIL (Computer and Information Literacy) scores (Bos, 2014). The students had to perform simple, intermediate and advanced tasks on a computer. A drawback was that the study didn't record the ability to judge whether the computer is the best suited tool for a specific task or whether alternative (analogue?) tools would be better suited. So the study does not test for media maturity, but it does record CIL in a new performance-based measure which is in many ways superior to self-reported scales. The CIL scale is divided into five levels, among which the highest level, "critical reflective skills" can only be reached, for example, if students refuse to follow some instructions (e.g. not entering their private data when requested to do so in a situation where there is questionable data security).

In the results of the study, German eight-graders were in the upper-mid section of score point averages in an international comparison. Germany's scores are much better than those of many countries with a higher use of ICT in the classroom. The numbers which indicate low quality of equipment and low use in schools are however correct. But the scores of the German girls are higher on the CIL score than those of the boys. Girls start using computers at a later age and spend less time using them. Children from families with "more than 100 books" in their home scored the top level of five as much as four times more often than children with fewer books in the home. So in fact, the ICILS results strongly challenge the idea that you need to start early and use digital technology at school a lot to become digitally literate. This seems to be especially true when it comes to critical reflective skills.

In line with the actual (rather than the press reported) findings of the ICILS study, a recent OECD report presented the connection between ICT use in the classroom, countries' financial investments in this field, and decreases or increases in the PISA test scores. The researchers found a mixed to negative picture. A part of the executive summary reads as follows:

> In countries where it is more common for students to use the Internet at school for schoolwork, students' performance in reading declined between 2000 and 2012 on average. Differences between socio-economic groups in the ability to use ICT tools for learning are largely, if not entirely explained by the difference observed in more traditional academic abilities. So to reduce inequalities countries need to ensure that every child attains a baseline level in reading and maths. This will do more to create equal opportunities than can be achieved by expanding or subsidising access to high-tech devices. (OECD, 2015).

4 EXAMPLES OF SUSTAINABLE MEDIA MATURITY EDUCATION

An educational practice which integrates the perspectives of prevention of problematic screen media use and the fostering of media literacy for young children would do five things, and we can find the first of the two in many of the pedagogical approaches of progressive education, (Montessori, Steiner, Wild, Korczak etc.), but also in schools with other individual and well-conceived approaches. This educational practice should…

a …protect small children from foreground and background screen media use, from problematic use in terms of time, the content and the functional dimensions (cf. Bleckmann & Mößle, 2014).
b …create opportunities for real life sensorimotor experiences, for direct contact with other people, with nature, with the world around them.

The other three criteria which would constitute best practice are more rarely met in the educational practices of the progressive education institutions, so there is room for improvement:

a …support children in coping with, in the sense of digesting the unhealthy media experiences that they experience outside the educational setting (for good examples see Levin, 2013)
b …support parents in their struggle to do the first two things (i.e. reduce screen exposure so that it matches the increasing psychosocial maturity of the child, and support screen-free activities)
c …start a media education curriculum based on the two principles:
  • analogue comes before virtual and
  • active/productive comes before passive/receptive.

The last point is especially relevant for educational institutions and it means: books come before audio media, audio media come before audiovisual media, which come before the internet, and, that creative activities such as playing an instrument or drawing a picture are most suitable for younger children. Writing a computer program comes before acquiring "passive" skills in the

use of computer software , and also before mock-action (i.e. pressing buttons on a computer, not understanding what goes on inside, see below). Recording an audio tape comes before listening to the tape, making films comes before watching films.

For example, kindergartens are advised to do a "moving pictures project" by constructing and using a magic lantern. This consists of a torch, a cardboard box, a lens, a wall to project the pictures onto, slides or hand-made small transparent pictures. In contrast to this, when using a smartphone to do a video project, the smartphone acts as an unfathomable "black box" for the child. The small child can press a button to elicit a "reaction" but cannot understand the processes that are going on within the machine. We are surprised that the excellent ways of teaching IT relevant skills in the analogue world are not used more, such as board games that require you to program a little robot in advance to find the fastest path on a grid towards a certain goal (Ricochet Robots, Robo Rallye etc.) or acquiring analytic thinking skills by playing chess or using the CS Unplugged curriculum (csunplugged.org).

So it turns out that many kindergartens and schools that are being accused of being "backward" or "technophobic" are in fact pioneers of a sustainable digital education practice, sometimes without being aware of it. To meet the need for practical help in making this concept work in practice, we have started a prevention programme called "Really present – growing up healthy in the digital age" to support educational institutions (see programme website www.echt-dabei.de; Stiller et al., 2018). Within the programme, we have developed our own written materials as a manual for the participants, and also make use of an excellent resource for early care and education professionals created by the Campaign for a Commercial-Free Childhood (2013).

5 WHAT STEPS ARE REQUIRED TO ARRIVE AT SOUND GOVERNANCE? NON-BIASED CONTROLLED TRIALS ARE NEEDED

In the EU the precautionary principle allows a reversal of the burden of proof in cases of new technologies that have the potential to cause severe damage to the well-being of people, and/or the natural environment (EU, 2000). In this case, instead of the public having to prove that a product causes harm before banning or restricting its use by law, the corporation wanting to sell the product has to prove that it is not harmful before being allowed to sell it.

'In a child neurology review paper, Sigman (2017, p. 8) applies this to screen media and health and postulates that ..

> ...the time has come for health professionals to begin to scrutinize the motives of those attempting to obstruct the sensible adoption of the traditional principle of precaution. To be clear, the burden of 'proof' must now be on those who advocate the status quo to demonstrate that high and/or premature exposure to discretionary screen time poses no health and development risks to children. Until then, child health policy must adhere to the principle of precaution as a prudent approach to protecting child wellbeing and neurological integrity.

The German expert group on prevention of internet related disorders (Rumpf et al., 2017, p. 7) suggests accordingly:

> Major initiatives in educational policy that push more use of digital media at Kindergarten or elementary school level are strongly advised to take possible risks of media use into account. [...] Use of interactive digital learning technology is not a problem in itself, as long as it does not increase the risk of internet related disorders. A positive label for digital media which have been shown to be beneficial to learning and do not increase this risk is worth considering. For developing age- and context-specific criteria for such a label, more research is needed.

As more and more new technologies get introduced into educational institutions at an earlier age, today's research efforts indeed fail to meet a number of sound research criteria: long-term evaluation, assessment of benefits AND risks not only for academic success but also for health and well-being, and setting up alternative intervention control groups requiring a comparable financial investment. Non-intervention control groups are insufficient control groups (cf. Armstrong & Casement, 2000). Public funding for this research is essential to avoid the conflicts of interest that would occur – and are already occurring – when IT corporations fund the trials to test the effectiveness of the educational software that they themselves produce.

At the beginning of this article we defined a common goal: Media maturity means to decide, at an individual level, when to use screen media and when not to use them, based on knowledge of the long-term balance of risks and benefits. This goal is important not only for the adult individual, but also for policy-making, where technology assessment traditionally supplies the knowledge about the long-term balance of risks and benefits of different scenarios.

In order to make evidence-based decisions with regard to children's well-being, the speed of innovation in today's digital world is a problem: before the research results on the long-term effects could possibly be available, there is a pressure to introduce the latest new media into schools.

I have argued that the early high tech hype could have detrimental effects in three areas:
- widening the educational divide between children from privileged and disadvantaged family backgrounds
- increasing the risk of problematic and addictive media use
- causing a shortage of qualified IT workers.

I have quoted peer-reviewed publications that support these concerns. If the precautionary principle is applied, which I strongly recommend, international corporations would have to fund research to compare Early High Tech to equally well funded Early High Touch initiatives BEFORE widespread implementation. Or to put it very bluntly: If all schools and kindergartens are forced or bribed to use computers, how could future scientists even show that children might learn more in schools or kindergartens without computers? I strongly recommend making use of the existing Europe-wide diversity of

different educational traditions in different countries and in different public, private school and kindergarten traditions within the countries. This diversity is an ideal basis for the evaluation of high tech educational initiatives with a high touch "alternative-treatment" control group in comparison. I strongly recommend the funding of such evaluation studies on a European level.

Evaluating "digital education" in the good tradition of technology assessment is the biggest and most important consequence of the situation presented in this chapter. Here are some additional smaller recommendations:

• Regulate marketing of screen media products for children.
  e.g. pass a law that strictly regulates advertising aimed at the youngest children and their caretakers. To my knowledge, this was possible in banning unsubstantiated advertising claims for baby formula, so why shouldn't it be possible for screen products for babies?
• Include the addictive potential (King, Delfabro, & Griffiths, 2011; Rehbein et al., 2010) into criteria for age rating systems like PEGI: ban sales of digital products with a highly addictive potential to minors and ban their use in schools.
• Include courses on the theory and practice of prevention of media risks in all curricula for teacher training and further training, especially in subjects which focus on digital education.

At first glance, the suggestions in this chapter seem to be a good fit with the section on "Fostering digital, STEM and entrepreneurial skills" (STEM stands for Science, Technology, Engineering and Mathematics) within the new European Parliament Resolution "A new skills agenda for Europe" (European Parliament, 2017):

> 90. Insists on the need to incorporate new technologies in the teaching and learning process as well as to facilitate education through hands-on and real-life experiences, taking into account age-appropriate ICT and media curricula, that respect child development and wellbeing, and that provides early guidance in the responsible use of technology and fosters critical thinking in order to equip people with the right set of skills, competences and knowledge, and to ensure the development of the full range of digital skills that individuals and companies need in an increasingly digital economy; recalls the need to encourage girls and young women to pursue ICT studies.

This is indeed very encouraging. Unfortunately in Germany there is a more controversial situation which arises from the ministerial division of topics. In Germany the Federal Health Ministry and the Federal Education and Research Ministry are not yet managing to cooperate well with regards to digital education. At the Federal Education and Research Ministry the "Digital Kindergarten" is being discussed as an urgent requirement in order to prevent Germany from becoming less competitive in the global markets. With regards to the Federal Health Ministry the Federal Drug Commissioner herself recently issued the following statement:

> We have to take the health risks of digitalization very seriously! It is a matter of urgency to provide orientation for parents concerning media use. Small

children do not need smartphones. They first need to develop a solid stance in real life, they need "both feet to touch real ground", so to speak. The bottom line is that it is high time for more digital solicitude – by parents, by schools and other educational institutions, and by politics, too (Mortler, 2017b).

In this chapter I hope I have shown that if we have the health and well-being of children in Europe in mind, we need to take on board this last statement as an urgent recommendation for good governance in the field of digital education.

REFERENCES

Alter, A. (2017). Irresistible: *The rise of addictive technology and the business of keeping us hooked.* London: Penguin Books.

American Academy of Pediatrics (2011): Media Use by Children Younger Than 2 Years. Council on Communications and Media. *Pediatrics*, 128 (5). 6 pages.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders Fifth Edition DSM-5TM.* Arlington, VA: American Psychiatric Association.

Armstrong, A., & Casement, C. (2000). *The child and the machine. How computers put our children's education at risk.* Beltsville: Robins Lane Press.

Balslev, J. (2017). https://publishingperspectives.com/2017/04/danish-digitization-debate-educational-publishers/

Beland, L.-P., & Murphy, R. (2016). Communication: Technology, Distraction & Student Performance. *Labour Economics*, 41. 61-76.

Bitzer, E. M., Bleckmann, P., & Mößle, T. (2014). Prävention problematischer und suchtartiger Bildschirmmediennutzung: Eine deutschlandweite Befragung von Praxiseinrichtungen und Experten. *KFN-Forschungsbericht 125.* Niedersachsen, Kriminologisches Forschungsinstitut. Hannover.

Bleckmann, P. (2012). *Medienmündig - wie unsere Kinder selbstbestimmt mit dem Bildschirm umgehen lernen.* [Media Maturity - how our children can learn to master screens]. Stuttgart: Klett-Cotta.

Bleckmann, P. & Jukschat, N. (2015). The integrated model of (dys-) functionality: Reconstructing patterns of gaming as self-medication in biographical interviews with video game addicts. *Forum Qualitative Social Research*, 16(3), 48 paragraphs.

Bleckmann, P., & Mößle, T. (2015). *Talk or act? Effects of screen availability vs. effects of parental mediation style on children's problematic media use.* EUSPR Conference "Changing Behaviour without Talking: automatic processes and the regulation of behaviour". Ljubljana, 23.11.2015.

Bleckmann, P., & Mössle, T. (2014). Position zu Problemdimensionen und Präventionsstrategien der Bildschirmnutzung. [Position paper on screen media use: Problem dimensions and prevention strategies]. *Sucht 60 (4).* 235-247.

Bos, W. (2014): ICILS 2013 Computer- und informationsbezogene Kompetenzen von Schülerinnen und Schülern in der 8. Jahrgangsstufe im internationalen Vergleich. https://www.waxmann.com/f leadmin/media/zusatztexte/ICILS_2013_Berichtsband.pdf (last access 12.2. 2018)

Campaign for a Commercial-Free Childhood, Alliance for Childhood & Teachers Resisting Unhealthy Children's Entertainment (2013). *Facing the screen dilemma. Young children, technology and early education.* Boston, MA: Campaign for a Commercial-Free Childhood; New York, NY: Alliance for Childhood. Pdf available online

Christakis, D. A., Gilkerson, J., & Richards, J. A. (2009). Audible TV is associated with decreased adult words, infant vocalization, and conversational turns: A population based study. *Archives of Pediatrics and Adolescent Medicine*, 163 (6), 554-558.

EU (2000) http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2000:0001:FIN:EN:PDF (last access 12. 2. 2018)

European Parliament (2017). http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+REPORT+A8-2017-0276+0+DOC+XML+V0//EN

Feierabend, S., Karg, U., & Rathgeb, T. (2013). KIM-Studie 2012. Kinder + Medien, Computer + Internet. Basisuntersuchung zum Medienumgang 6- bis 13-Jähriger in Deutschland. [KIM-study 2012. Children + media, computer + internet. Basic study on the media behavior of 6- to 13-year-olds in Germany]. Stuttgart: Südwest, Medienpädagogischer Forschungsverbund.

Feierabend, S., Karg, U., & Rathgeb, T. (2014). 15 Jahre JIM-Studie. Jugend, Information, (Multi-) Media. Studienreihe zum Medienumgang 12- bis 19-Jähriger. 1998 - 2013. Südwest, Medienpädagogischer Forschungsverbund. Stuttgart.

Feierabend, S., Karg, U., & Rathgeb, T. (2015). miniKIM 2014 Kleinkinder und Medien Basisuntersuchung zum Medienumgang 2- bis 5-Jähriger in Deutschland . Stuttgart: Medienpädagogischer Forschungsverbund Südwest

Feierabend, S, Plankenhorn, T., & Rathgeb, T. (2015). KIM-Studie 2014 Kinder + Medien, Computer

+ Internet Basisuntersuchung zum Medienumgang 6- bis 13-Jähriger in Deutschland Stuttgart. Medienpädagogischer Forschungsverbund Südwest

Fritz, J. (2003). Warum eigentlich spielt jemand Computerspiele? Macht, Herrschaft und Kontrolle faszinieren und motivieren [Why do people play computer games? Power, mastery and control fascinate and motivate]. In J. Fritz and W. Fehr (Eds.) *Computerspiele. Virtuelle Spiel- und Lernwelten* (pp. 10-24) [Video Games: Virtual Worlds for Playing and Learning]. Bonn: Bundeszentrale für politische Bildung.

Griffin, K. W., & Botvin, G. J. (2004). Preventing addictive disorders. In R. H. Coombs (Ed.), Handbook of addictive disorders: A practical guide to diagnosis and treatment (pp. 535-570). New York: Wiley.

Helsper, E. (2014). Vulnerability and excessive internet use in adolescents. Lecture at the Symposium of the German Association for Media Addiction (Fachverband Medienabhängigkeit), 31. 10. 2014. Hannover.

Hübner, E. (2005). *Anthropologische Medienerziehung*. Frankfurt am Main: Peter Lang.

King, D. L., Delfabbro, P. H., & Griffiths, M. D. (2011). The Role of Structural Characteristics in Problematic Video Game Play: An Empirical Study. *Internation Journal of Mental Health and Addiction*, 9, 320-333.

Kirkorian, H. L., Pempek, T. A., Murphy, L. A., Schmidt, M. E., & Anderson, D. R. (2009). The impact of background television on parent-child interaction. *Child Development 80 (5)*, 1350-1359.

Klimmt, C., Hartmann, T. & Frey, A. (2007). *CyberPsychology & Behavior*, 10(6), 845-848.

Leung, L., & P. Lee (2011). The influences of information literacy, internet addiction and parenting styles on internet risks. *New Media and Society,* 14(1), 117-136.

Levin, D. E. (2013). *Beyond remote-controlled childhood: Teaching young children in the media age*. Washington, National Association for the Education of Young Children.

Markowetz, A. (2016). *Preliminary data from the unpublished Menthal Study on smartphone use*. http://www.n24.de/n24/Nachrichten/Netzwelt/d/4960536/so-oft-schauen-junge-leute-auf-ihr-handy.html , (last access 12. 2. 2018)

Mößle, T. (2012). *"dick, dumm, abhängig, gewalttätig?" Problematische Mediennutzungsmuster und ihre Folgen im Kindesalter: Ergebnisse des Berliner Längsschnitt Medien*. ["fat, stupid, addicted, violent?" Problematic media usage behavior and its consequences in childhood. Results of the Berlin longitudinal study media]. Baden Baden: Nomos Verlag.

Mößle, T., & Rehbein, F. (2013). Predictors of problematic video game usage in childhood and adolescence. *Sucht,* 59 (3), 153-164.

Mortler, M. (2017a). *Pressemitteilung zu ersten Ergebnissen der BLIKK Studie*. http://www.drogenbeauftragte.de/presse/pressekontakt-und-mitteilungen/2017/2017-2-quartal/ergebnisse-der-blikk-studie-2017-vorgestellt.html (last access 1. 7. 2017)

Mortler, M. (2017b). http://www.drogenbeauftragte.de/fileadmin/dateien-dba/Drogenbeauftragte/4_Presse/1_Pressemitteilungen/2017/2017_II_Quartal/Factsheet_BLIKK.pdf

OECD (2015). *Students, computers and learning – Making the connection*. http://www.oecd.org/publications/students-computers-and-learning-9789264239555-en.htm (last access 12. 2. 2018)

Pfeiffer, C., Mößle, T., Kleimann, M., & Rehbein, F. (2008). Die PISA-Verlierer und ihr Medienkonsum. Eine Analyse auf der Basis verschiedener empirischer Untersuchungen. [PISA losers and their media consumption. An analysis based on diverse empirical studies]. In U. Dittler and M. Hoyer (Eds.), *Aufwachsen in virtuellen Medienwelten. Chancen und Gefahren digitaler Medien aus medienpsychologischer und medienpädagogischer Perspektive* (pp. 275-306) [Growing up in virtual media worlds. Chances and risks of digital media from the perspective of media psychology and media education]. München: Kopaed.

Radesky, J., Miller, A. L., Rosenblum, K. L., Appugliese, D., Kaciroti, N. & Lumeng, J.C. (2015). Maternal mobile device use during a structured parent-child interaction task. *Academic Pediatrics*, 15 (2), 238-244. DOI: 10.1016/j.acap.2014.10.001.

Radesky, J. S., Kistin, C. J., Zuckerman, B., Nitzberg, K., Gross, J., Kaplan-Sanoff, M. et al. (2014). Patterns of mobile device use by caregivers and children during meals in fast food restaurants. *Pediatrics*, 133 (4), e843-9. DOI: 10.1542/peds.2013-3703.

Rehbein, F., Mößle, T., Zenses, E.-M., & Jukschat, N. (2010). Zum Suchtpotential von Computerspielen. Onlinerollenspiele wie „World of Warcraft" bergen ein erhöhtes Abhängigkeitsrisiko und erfordern Konsequenzen in den Bereichen Jugendmedienschutz und Prävention. [The addictive potential of video games. Online role-playing games such as World of Warcraft cause high addiction risk and this needs consequences in the areas of youth media protection and prevention]. *Jugendmedienschutz-Report*, 6, 8-12.

Report to the European Commission (2011). *Testing and refining criteria to assess media literacy levels in Europe*. Directorate-General for Information Society and Media. http://www.umic.pt/images/stories/publicacoes4/final-report-ML-study-2011_en.pdf

Rumpf, H. J., Batra, A., Bleckmann, P., Brand, M., Gohlke, A., Feindel, H. et al. (2017). Empfehlungen der Expertengruppe zur Prävention von Internetbezogenen Störungen. *Sucht,* 63 (4), 217–225.

Sigman, A. (2017). Screen dependency disorders: A new challenge for child neurology. *Journal of the International Child Neurology Association,* (17, 119), 1-13.

Spitzer, M. (2017). Editorial: Digital 0.0. Wider die postfaktische Bildungspolitik [Digital zero dot zero. Against post-factual educational policy]. *Nervenheilkunde,* 36 (4), 205-212.

STERN (2014). https://www.stern.de/familie/kinder/icils-ergebnisse-und-die-reaktionen-auf-twitter-und-facebook--deutschland-nur-mittelfeld--kein-wunder--3244322.html (accessed 12. 2. 2018.

Stiller, A., Schwendemann, H., Bleckmann, P., Bitzer, E.M., & Mößle, T. (2018). Involving teachers in reducing children's media risks. *Health Education*, 118 (1), 31–47.

Strasburger, V.C. (2010) Media education. *Pediatrics*, 126(5), 1012–1017.

Vaala, S.E., & Hornik, R.C. (2014) Predicting US infants' and toddlers' TV/video viewing rates: Mothers' cognitions and structural life circumstances. *Journal of Children and Media,* 8(2), 163–182.

Verloigne, M., van Lippevelde, W., Bere, E., Manios, Y., Kovacs, E., Grillenberger, M. et al. (2015). Individual and family environmental correlates of television and computer time in 10- to 12-year-old European children: The ENERGY-project. *BMC Public Health,* 15, 912. DOI: 10.1186/s12889-015-2276-2.

WHO (2018) http://www.who.int/features/qa/gaming-disorder/en/

BIOGRAPHY

Paula Bleckmann (born 1972) is a professor at the Alanus University in Alfter, Germany. Her research interest are: Prevention of media risks including addictive screen media use. Supporting families through target-group specific counseling. Socio-scientific studies on Internet Gaming Disorder. Benefits and Risks of ICT in educational institutions.

Paula studied Biology at the University of Constance. She completed a teacher training course and briefly worked as a teacher at an inclusive school, before she became a mother of three children. Her Ph.D thesis covers the topic of target-group specific parent counseling in the area of media education. In 2014 she completed her Habilitation thesis on prevention and coping mechanisms for Gaming Addiction at the faculty of Health Education at the Freiburg Educational University. She was appointed professor of media education at Alanus in 2015.