Powerlessness or Omnipotence – the Impact of Structuring Technologies in Learning Processes for Children with Attention and Developmental Deficits

Hanne Voldborg Andersen[(✉)] and Elsebeth Korsgaard Sorensen

Department of Learning and Philosophy, Aalborg University, Aalborg, Denmark
{Voldborg,Elsebeth}@learning.aau.dk

Abstract. Schoolwork of learners with developmental and attention deficits is often characterised by low productivity, many errors due to carelessness or inattention and poor organisational ability. Focus learners have difficulties performing at the same level as their peers. This paper addresses the challenges and investigates the potential of technologies for creating and facilitating environments, where learners are well-supported with respect to overviewing, structuring and planning tasks, evaluating and adjusting participation and management of time.

Keywords: Inclusion · Learning · Digital technology · Attention deficit · Structure and overview

1 Introduction

Individuals with Attention and Developmental Disorders (focus learners) as e.g. Attention Deficit Hyperactivity Disorder (ADHD) are challenged in life and learning, because of the core symptoms of their diagnosis [1]: The attention deficit reveals through poor memory, attention and persistence, while hyperactivity or impulsivity manifest itself in restlessness, behaviour problems, emotional vulnerability or social problems [1].

The schoolwork of learners with ADHD is often characterised by low productivity, many errors due to carelessness or inattention and poor organisational ability [2]. The focus learners have difficulties performing at the same level as their peers [3, 4]. Due to lacking memory and attention, it appears difficult for them independently to command and cope with what to do, how to do, when to do, where to do, with whom to do, for how long to do etc. They attain lower scores and poorer grades and are at a high risk for dropping out of school [5], the reason why teachers and researchers worldwide are searching for new methods to facilitate inclusion in the sense of increasing presence, participation and achievements for this particular group of learners.

Furthermore, the perspective of ADHD in adulthood shows continuing challenges for focus learners in relation to structuring and planning tasks, evaluating and adjusting their own behaviour, reactions, intuition and management of time etc. This affects them socially and in family, educational or working life [1]. It should be an overall concern for professionals to provide this group of learners with assistive tools and supportive

structures, to bring them overview and help them remain on track in changing this unfavourable future perspective. Research shows us that *"when students with ADHD are taught planning skills and strategies, and provided proper support and guidance, they can use a plan effectively and use strategies. This, in turn, can improve their academic performance"* [6].

Using technologies for *shielding and focusing* seems fruitful in helping focus learners join and participate more attended, smoothly and quietly in the classroom [7], but also technologies for *structuring and overviewing* has proved valuable tools for SEN learners to physically join and participate in educational activities in the classroom [8].

This paper addresses the challenges of creating and facilitating a learning environment, in which focus learners are supported in relation to overviewing, structuring and planning tasks, evaluating and adjusting participation and management of time and, finally, examining the digital potential for these processes. Section 2 of the paper outlines the theoretical perspective on which the research is resting. Section 3 gives an account of the research design behind the study, while Sect. 4 forms the forum for the actual analysis and insight into data. A more thorough discussion of the findings occur in Sect. 5 and, finally, Sect. 6 makes an attempt to assess the degree to which it is possible to make conclusions on the basis of these findings.

2   Theoretical Perspective

The learning process can be seen as a personal formation, where learners learn both to understand the world and them selves. Kohut [9] offers us in his object-relation theory an understanding of, what is at risk in these processes. Teachers appear emphatic reflecting and idealizing self-objects, who lead learners through a staged self-development process initiated by sufficient frustration. The self, in this process, will oscillate between two emotional conditions – powerlessness (to be nothing) and omnipotence (to be able to everything, grandiosity). Omnipotence increases learners' willingness to deal with things. Powerlessness causes learners to search for protection and confirmation.

If the stages are experienced positively, the learner will develop a robust/solid self, which make him/her able to assess opportunities in the world. If necessary frustration turns into invincible frustrations, narcissistic infringement occurs [9], which makes the self-developmental processes impossible. Invincible frustration leaves the self in a depressive emptiness and feeling of being abandoned – or chooses other environments for reflection – as e.g. gangs, religious sects, etc. [9].

Learning can be seen to happen in the ideal tension field between reflection and idealization [9]. To change the learning and life perspective for focus learners it will be necessary that they meet a reflecting and understanding environment at school, where the level of frustration is adjusted to the learners' zone of approximate development – and the learner experience more omnipotent and less powerless.

This resonance in the reflecting and understanding environment is only a necessary base; it is not on its own enough to increase self-development and learning [9]. The constructive frustration brings something new to light, while missing or destructive confrontation decreases or hinders the learner's development. The ideal learning

environment is one, in which the teacher has reduced the threat against the learner to a minimum and facilitated different views on the case [10].

Technology is widely recognised as valuable tools for people with special educational needs [11, 12]. Technology, however, may be used in many perspectives and with different functional roles. From a Persuasive Technology point of view [13], technology may function as a *tool* to increase capability, a *medium* to provide experience or a *social actor* to create relationships [13 p. 25]. Assistive Technologies (AT) may be used to train or rehearse something, or assist or enable learning [14]. When using Assistive Technologies the idea is not to fix or cure the disability [14], but to enhance quality of life, accentuate strength and enable expression of abilities [15].

For focus learners challenged when structuring and planning tasks, and when evaluating and adjusting own behaviour or reactions, intuition and management of time - it could be fruitful to utilise the persuasive potential in Technology as a Tool for "change attitudes or behaviours or both by making desired outcomes easier to achieve" [13]. But it is possible to bring the seven types of Persuasive Technology Tools [13]: reduction, tunnelling, tailoring, suggesting, self-monitoring, surveillance and conditioning into play in a real world school practice? And how might Persuasive Technology Tools in the hand of teachers and learners assist, motivate and enable the presence, participation and achievements of focus learners at school? Using this lens the authors examine, to what extent technology may assist teachers to create more ideal learning environments by reducing the threat of focus learners and enable them to participate in learning. In which ways may technology increase resonance and constructive confrontation, facilitate necessary frustration and optimise learning? How may technology help enhancing the learners' feeling of omnipotence, reduce powerlessness and minimize invincible frustration?

3   Research Design

This piece of research is one of the outcomes from a wider iterative and explorative qualitative research design, Ididakt, carried out 2013–2016 by the authors of this paper [16, 17]. Ididakt is a case study framed by Action Research (AR) [18, 19] and educational Design Research (EDR) [20] and data is collected in a real school context. EDR is a "*genre of research, in which the iterative development of solutions to practical and complex educational problems also provides the context for empirical investigations, which yields theoretical understanding that can inform the work of others*" [20 p. 7].

The authors/researchers were included as professional dialog partners and facilitators in the transformations processes at 11 schools, where 46 teachers have been inspired to experiment with and examine the impacts of using ICT facilitated interventions in their teaching practises in 26 classes. More than 500 learners aged 6 to 16 years are included in the project – among them 56 learners with extensive developmental or attention deficit disorders (focus learners). "*It is crucial for our data collection, that the unfolding research process goes hand in hand with the involved teachers' work and interventions into the field of study, so the process becomes a learning endeavour in terms of learning how to work with SEN learners and integrating ICT in the classroom*" [21]. The empirical data set consists of teachers'

statements at seminars, in interviews or at a research blog, from surveys, interviews with school leaders or students and from classroom observations. All in all a rich data set, which were analysed in a hermeneutical, phenomenological perspective.

4   Analysis and Findings

Technologies used for helping focus learners structuring and overviewing the day appear in Table 1. From various interventions the authors have identified the most valuable tools for structuring and overviewing the school day and task solving as constituted by Virtual Learning Environments (VLE), Timers, Calendars, Visualisations and Templates.

Table 1. Technology used for structuring and overviewing the learning processes.

Technology used in	Number of schools	Per cent of schools
Templates	10	91%
Skole-Intra	9	82%
Visualisation	8	73%
Google Apps for Education (GAfE)	7	64%
Timer	5	45%
MobilizeMe/Planet	2	18%
Office 365	1	9%
Meebook	1	9%

4.1   Virtual Learning Environments (VLEs)

The schools have used four different types of VLEs: Skole-Intra, Meebook, Google Apps for Education (GAfE) and Office 365. In the VLEs teachers compile and structure all materials for a subject, a course or a task in an online resource, which always appear accessible for the students. The VLE serves as a shared curriculum or portfolio reflecting what is processed and learned, and it contains information, instructions, guidance, links, assignments, calendar, checkboxes, shared files and folders etc. Learners and teachers communicate in multiple modes with each other, and it is easy for teachers to differentiate content, explanations and tasks. Use of VLEs seems to foster a visible and shared frame for the academic work, which reduces complexity for the learners in offering suggestions for what to do, and help them keep on track. The VLE enables self-monitoring and surveillance of the progression, and content can easily be tailored to the specific individual needs of focus learners.

The VLE is very helpful for learners with lacking memory and attention, as it helps them to cope more independently with what to do, how to do, when to do, where to do, with whom to do something, for how long to do something: "*It works well for all students. L.* (Focus learner, girl in 6th grade) *benefits from reading the writings of her peers. It helps her getting started and gives her ideas for her writing.*" (Teacher, School B).

Teachers describe how the VLE - specifically amongst the oldest group of focus learners - scaffolds the learning process and helps them participate and contribute more

autonomously in the classroom. In one young class, the teacher says that the VLE is more useful for peers. Nonetheless, it reduces the teacher tasks and leaves more time for focus learners.

Skole-Intra and Meebook are resources developed for education. They are easy to use and offer the teachers a fixed structure. GAfE and Office365 are generic tools, where the teachers must create a useful structure by themselves. It requires time, pedagogical visions and technological skills, but offers then a flexible and dynamic user interface, which easier can be adjusted different needs. The effect of VLEs seems dependent of the teachers' knowledge and competences for using the resource.

The VLEs seem to be valuable tools for classroom management. It is evident that a deliberated, structured use of VLEs enhances the learners' feeling of omnipotens. It might, though, be caused by the fact that use of VLEs also makes teachers' preparation and teaching more visible and structured. In contrast, if the VLEs not are well-structured and considered for the needs of focus learners, it would – similarly to a real world setting - still be difficult for them to navigate and overview what to do.

4.2   Timers

Five schools have used Time-timers in the classroom for structuring time, when focus learners participate in classroom activities and task solving. A time-timer is a visual watch, which in a simple, graphical way reflect the remaining time. The time-timer has proved a very strong tool for enhancing the focus learners' attention and persistence. The ability for self-monitoring time seems to be essential for most focus learners. The teachers notice more omnipotence and less stress and invincible frustration, when focus learners are able to measure the time left on a given task: "*The two persistent children (*focus learners*) worked autonomously in almost four hours, only because of the time managed and adjusted agenda. It was wonderful to se them work without constantly needing to be next to them – while at the same time they felt, that they had performed and contributed well. They went home happy, for sure, from school that day*" (Teacher, School D). Some of the schools tested online timers. They observed, that animated watches as e.g. bombs who blast, when time is up, are too disturbing for the focus learners' attention to tasks.

4.3   Calendars

Two schools tested assistive calendar applications (MobilizeMe and Planet) for planning and structuring the day for focus learners. The applications offered caregivers (parents, teachers, pedagogues, etc.) a shared calendar, in which they are able to collaborate, communicate and create a detailed day plan with text, pictograms and pictures. The focus learner finds the calendar at his iPad or mobile, where he follows the plan and with checkmarks illustrates, what is already done. The applications provide all types of persuasive technology tools (reduction, tunnelling, tailoring, suggestion, self-moni-toring, surveillance and conditioning), and are used successfully in many schools for Special Educational Needs. The focus learners find the applications: "*I use Planet every day… I have an alarm for getting up. I use a program for the day, so I can see, what I*

need to do. Find cloth, take my medicine, prepare my lunch, brush my teeth, be ready for and go to school… If I didn't get notifications I wouldn't do my homework…" (Focus learner, girl in 8th grade) Nevertheless, it seems to be difficult to implement specific assistive tools in a mainstream educational setting. "*We do not use MobilizeMe, because the daily investment of time will not measure up to the possible outcome.*" (Teacher, School C). It might be easier to provide such solutions to the focus learners, if the calendar tool was a part of the general VLE for all learners in the class.

4.4   Visualisations

As a supplement to digital structuring tools most schools have used various visualisations in the classroom to help the focus learners remember what was said and how to do. It might be day plan documents, posters with written expectations to learners' attitude and behaviour in the classroom, visible learning goals, collaboration groups or just notes at the board. We have observed, that quiet often focus learners seek information in these visualisations and use them to navigate in a school day. Even though learners have access to the same information online, it seems important to remember, that they might still need this "off-line" messages in the classroom.

4.5   Templates

Digital templates for structuring tasks have appeared successful tools in the project. At ten schools teachers observed that templates enhanced focus learners' capability for task solving and production. "*I have done experiences with writing templates, when my class was writing book reviews. I saw B. (*focus learner, boy in 4th grade*) autonomously make his assignment and within the deadline. I saw he worked systematically by means of the template. It is the very first time ever, I have witnessed him carry out a task in the school by himself."* (Teacher, School F). The templates can support learners with poor organisational ability to perform at the same level as their peers.

4.6   Other Interventions

Teachers in the project have made a variety of other interventions adjusted to the specific needs of their focus learners. From those, we found the following very fruitful:

1. Cancel morning hymn for focus learners and use this time to give him/her individual instructions about the day plan. Teachers observed a much more participating, calm and contributing learner for the rest of the day.
2. Adjust the homework to the focus learners' capability. Teachers observed less stress and invincible frustration.
3. Use of alarm and notifications at the iPad. Teachers observed that the focus learners remember their homework and arrive at school on time.
4. Use of video instructions. The teachers observed that the focus learners watch the video as many times as necessary to understand what to do.

5. Use of assessment and evaluation tools. The teachers observed enhanced awareness and understanding in focus learners about their own role in learning processes.

5   Discussion

There is little access to technology in the classroom of the younger learners. Not being a daily working tool, it spoils the teachers' possibilities for taking advantage of the potential in structuring and planning technologies.

It is evident that use of digital structuring tools has a positive impact when it comes to the focus learners participation and contribution in the learning processes. We have seen, how their memory, attention and persistence have been improved, as has the growing productivity of the focus learners. However, the technologies are not able to foster such changes on their own. They must be used in the hand of an intentional teacher, who uses his/her pedagogical imagination [22] to adjust the technologies and the structures according to the special needs of the focus learners. The technologies must be used as tools to increase capability, as mediums to provide experiences, and as social actors to foster the building of relationships. We might cite with [13] in stating that it is not enough with Persuasive Technologies. And then add: They must be used in a Persuasive Pedagogical setting.

In our earlier research we have promoted a five type intervention model for use of including technologies, where technologies for *structuring & overviewing* is one of the types among *shielding & focussing*, *differentiating & understanding*, *producing & disseminating* and *dialoguing & collaborating*. In an attempt to rank the five intervention types we have found that structuring and shielding tools are assistive technologies, which compensate for the focus learners' disabilities and enable them to become ready for – and join - the learning process, while the differentiating, producing and dialoguing tools are utilities directed towards the learning process.

6   Conclusion

This paper have examined and discussed the extent to which technology may assist teachers in creating a more ideal learning environment for learners with attention and developmental deficits. It seems evident, that digital tools, which provide possibilities for reduction, tunnelling, tailoring, suggestion, self-monitoring, surveillance and conditioning, are, in fact, able to assist, motivate and enable focus learners presence, participation and achievements at school.

We have identified well-structured Virtual Learning Environments (VLE), digital templates and timers as specific valuable tool for enhancing the focus learners' ability to become ready to learn, join and remain within the learning processes. We have further realised that visualisations in the classroom, notifications, video instructions, assessment and evaluations tools help focus learners to navigate, remember, become aware and understand their own role in the classroom.

Using structuring technologies in a reflecting and understanding environment in the school, it seems possible to reduce invincible frustration and increase resonance and

constructive confrontation in the zone for proximate development, in which the focus learners experience more omnipotence than powerlessness. Finally, we consider technologies for structuring and overviewing as basic assistive tool for equalizing the learning possibilities of the focus learners in an inclusive school setting.

References

1. Almer, G.M., Sneum, M.M.: ADHD - Fra barndom til voksenalder (1. udgave, 2. oplag). Frydenlund, København (2009)
2. Steiner, N.J., Sheldrick, R.C., Frenette, E.C., Rene, K.M., Perrin, E.C.: Classroom behavior of participants with ADHD compared with peers: influence of teaching format and grade level. J. Appl. Sch. Psychol. **30**(3), 209–222 (2014)
3. Barkley, R.A.: Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment, 2nd edn. Guilford, New York (1998)
4. DuPaul, G.J., Stoner, G.: ADHD in the Schools: Assessment and Intervention Strategies, 2nd edn. Guilford Press, New York (2003)
5. DuPaul, G.J., Weyandt, L.L., Janusis, G.M.: ADHD in the classroom: effective intervention strategies. Theory Into Pract. **50**(1), 35–42 (2011)
6. Johnson, J., Reid, R.: Overcoming executive function deficits with students with ADHD. Theory into Pract. **50**(1), 61–67 (2011)
7. Andersen, H.V.: Supporting inclusion of learners with attention-deficit/hyperactivity disorder in sound-field-amplification-systems. In: Proceedings of the 1st D4Learning International Conference Innovations in Digital Learning for Inclusion, pp. 1–8. Aalborg University Press, Aalborg (2015)
8. Sorensen, E.K., Andersen, H.V.: Amplifying the process of inclusion through a genuine marriage between pedagogy and technology. In: Proceedings of the EDEN International Conference held in Budapest, 15–17 June 2016
9. Kohut, H.: Selvets Psykologi. Hans Reitzel, Copenhagen (1990)
10. Rogers, C.R., Freiberg, H.J.: Freedom to Learn, 3rd edn. Merrill, Maxwell Macmillan Canada, Maxwell Macmillan International, New York, Toronto, New York (1994)
11. Waller, T., Watkins, A.: Information and Communication Technology for Inclusion. Research Literature Review. European Agency for Development in Special Needs Education, Brussels (2013)
12. McKnight, L., Davies, C.: Current perspectives on assistive learning technologies. University of Oxford, The Kellogg College Center for Research into Assistive Learning Technologies (2012)
13. Fogg, B.J.: Persuasive Technology: Using Computers to Change What We Think and Do. Morgan Kaufmann Publishers, Amsterdam, Boston (2003)
14. Abbott, C.: Defining assistive technologies - a discussion. J. Assistive Technol. **1**(1), 6–9 (2007)
15. Raskind, M.H.: Assistive technology for adults with learning disabilities: a rationale for use. In: Learning Disabilities in Adulthood: Persisting Problems and Evolving Issues, pp. 152–162. Andover Medical, Stoneham, MA (1994)
16. Andersen, H.V., Sorensen, E.K.: Empowering teachers and their practices of inclusion through digital dialogic negotiation of meaning in learning communities of practice. In: Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2016, Held in Vancouver. AACE, CA, 28–30 June 2016

17. Sorensen, E.K., Andersen, H.V., Grum, H.: Intercultural dialogic eLearning: a tool for fostering shared understanding and sustainable competence development in practices of inclusion. In: Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2013, pp. 389–397. AACE, Victoria, Vancouver Island (2013)
18. Duus, G., Husted, M., Kildedal, K., Laursen, E.: Aktionsforskning: en grundbog. In: Tofteng, D. (ed.). Samfundslitteratur, Frederiksberg (2012)
19. Jungk, R., Müllert, N.R.: Håndbog i fremtidsværksteder. Politisk revy, Kbh. (1989)
20. McKenney, S., Reeves, T.: Conducting Educational Design Research. Routledge, New York (2012)
21. Andersen, H.V., Sorensen, E.K.: Technology as a vehicle for inclusion of learners with attention deficits in mainstream schools. In: Proceedings of the European Distance and E-Learning Network 2015 Annual Conference Barcelona, 9–12 June 2015, pp. 720–730 (2015)
22. Skovsmose, O., Borba, B.: Research methodology and critical mathematics education. In: Valero, P., Zevenbergen R. (eds.) Researching the Social-Political Dimensions of Mathematical Education: Issues of Power in Theory and Methodology, pp. 207–226. Kluwer Academic Publishers (2004)