

Designing a Future Schoolbook for an Inclusive School System

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Abstract. The inclusive school system presents huge challenges for the educational system to be mastered, especially for school media. Every child has to be supported individually according to his or her needs and abilities. The digital schoolbook “Mate” is our approach to support students and teachers in an inclusive school system. The device provides differentiated learning access and school materials and enables students to learn individually and actively. In this article we describe the requirements and challenges for a schoolbook for an inclusive school system as well as our design process.

Keywords: Inclusion, Education, Digital Media, User Centered Design

1 Introduction

Every child, regardless of special educational needs or disabilities, has the right to attend a regular school. This idea of an inclusive school system has been required by law since 2008 when the Convention on the Rights of Persons with Disabilities (CRPD) set into motion. To make that concept work in school, every child has to be supported individually according to his or her needs and abilities. It requires differentiated access, goals and schedules within the learning process, as well as differentiated school materials adjusted to the individual needs of every student. Regarding today’s situation in German schools with class sizes of around thirty students supervised by one teacher and, at best, one assistant, the inclusive school system presents a huge challenge to be mastered.

The idea of this project was to support teachers and students to work towards an inclusive learning system. Since the schoolbook plays an important role in lesson design and comparable media provides a high potential for individualisation, we decided to focus on adaptable school media. “Mate” is the result of the conceptualization of a digital schoolbook that simplifies the adaption and individualisation of the learning content and involves students more deeply in the

learning process. It allows them be more self-employed, to develop a personal learning focus and to actively explore learning content according to their own learning speed and ability.

2 Inclusion

The inclusive system regards every human being as part of an inseparable heterogeneous group with different ethnics, languages or cultural backgrounds, different religions, ideologies, family structures, gender roles, social conditions as well as abilities and disabilities [1]. Heterogeneity becomes the norm and diversity is seen as enrichment. As every person is seen as ‘different’, there is no ‘being different’. This idea of heterogeneity is the main point that distinguished the inclusive system from the widespread integrative system. In an integrative system, a person or a group of persons attempt to be integrated into an existing group [2]. The difference between an inclusive and an integrative system is illustrated in figure 1.

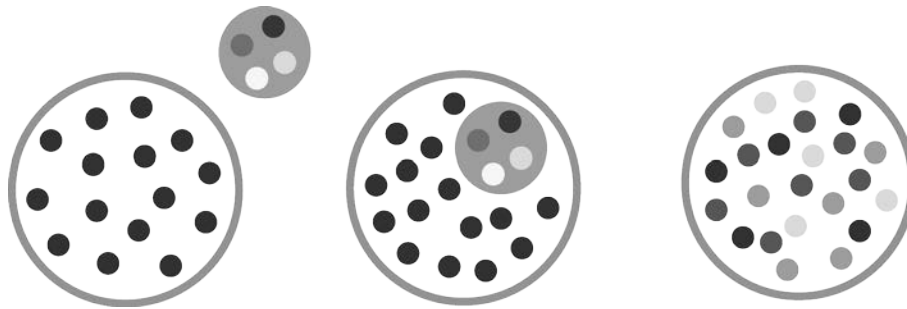


Fig. 1. From left to right: Exclusion, Integration and Inclusion

2.2 Integration versus Inclusion in the Educational System

Mostly, an integrative system in school works as follows: The degree of special support requirements is a crucial factor that decides to which kind of school a student is sent. Students with high support requirements are normally sent to special needs schools while students with low support requirements may attend regular schools in a special class or in a regular class with special individual support. This system clearly focuses the ‘normal’ students while students with special needs are tried to integrate into the regular model [2].

In an inclusive school system, all children with different abilities and disabilities are taught together. This brings with it the enormous challenge to adapt to individual needs of every child. It requires a broad range of education professionals such as regular school teachers, special school teachers, teaching assistants, or integration assistants. Schedules, learning methods, learning material, media and schoolbooks have to be individually adaptable to fit every student’s needs [3].

Since the printed text book is inherently a non-dynamic format with a life span of at least six years, it does not fit those requirements [4].

3 School Media and its evolution

The schoolbook plays an important role in lesson design, and some even call it the “secret curriculum” [5]. Nevertheless, the traditional schoolbook is criticized by experts. Wolfgang Neuhaus, for example, argues that the traditional schoolbook hardly offers incentives to learn or explore learning content actively [6]. Throughout the past few years, we’ve witnessed a high increase of digital school media, mobile learning apps and e-books [7]. But can we learn better by using digital media instead of the classic printed schoolbook? Are they the future of school media? Monika Planz gathered varying opinions of experts discussing this topic [8]. Critics argue that schools lack teachers with sufficient knowledge of digital tools and they would not get enough support to learn it. They also fear a “media caused isolation” and an anonymisation and de-personalization as a consequence of the use of digital media in school. Another important argument is the difficulty to maintain technical systems.

Supporters of leveraging digital media in schools argue that using new and interesting technologies motivates students because it mimics the digital tools and media they use in their everyday lives, and furthermore, digital media can provide more specific and up-to-date information. Digital media can support new ways of learning in more problem-oriented and self-organized ways, as well as learning in groups or projects. Moreover, digital media enables the differentiation of learning content within a heterogeneous group of students. Learning content can therefore be adapted to the students’ abilities and needs.

3.1 What is a good schoolbook?

To decide whether a digital or a printed book best serves the purpose of a schoolbook for an inclusive school system, we first set criteria for successful schoolmedia. Monika König and Martin Ebner set up a list of requirements [9] which outlines that a schoolbook should always be up-to-date, motivate students and offer adjustment options for the degree of difficulty, learning speed and etc. A good schoolbook should enable self-guided learning and offer a possibility to look up specific information.

The schoolbook should enable a quick scan of the content, provide the possibility to set bookmarks and show the content on a double page so two pages can be viewed alternately. Additionally, it should provide possibilities to highlight text and add comments or even content.

Wolfgang Neuhaus has stated that learning is much more effective if the knowledge is gained in an active way, so it’s very important that the schoolbook enables students to gain knowledge through this active learning [6].

3.2 Universal design for learning

The term “Universal Design for Learning” (UDL) was coined by members of the Center for Applied Special Technology (CAST) whose prime concern was to use new technologies to support students with disabilities. The UDL’s principles offer important information about the requirements school media should fulfill to address the concerns of an inclusive school system. The members of CAST compare their approach to a navigation system. A good learning system should enable every student to reach their goal but if course deviations occur, the route is recalculated. Different routes with different configurations are possible and they all get the students where they need to be [10], [11]. They are breaking down this comparison to the two main questions: What is the goal and how can you get there? [13] They developed a guideline for curriculum design that is based on three principles. According to those principles a good teaching framework should include and provide multiple means of engagement, representation and action and expression.

School media should provide different ways of access to one topic because the way children get engaged with learning content differs. It should as well provide different ways of representation such as audio information or visual information, adaption options for the representation of content (e.g. zoom functions, adaptive font size, adaptive volume and etc.) and supplementary explanations to be accessible for all children regardless of their abilities, disabilities or cultural or social backgrounds. The way of how students deal with learning topics, how they interact with their learning environment and how they are able to express their knowledge differs a lot, and this is especially true for students with motor impairments, organizational impairments or language issues where it is important to offer different communication channels. Content as well as results could be expressed through text, speech, painting, illustration, design, film, music, dance, movement or sculpture.

4 The Design Process

Education is a sensitive issue. To offer a widely accepted solution we created our concept in a user-centered design process to meet the needs of the involved groups of people. In the following, we explain our procedure.

4.1 User Involvement

Before we started the actual design process, it was very important to learn more about the needs and concerns of the main users: students and teachers. We conducted three expert interviews (in-depth interviews) with teachers and a short survey with thirteen students. The interviews focused on the teachers’ experiences with digital media in school, their expectations and concerns as well as the concerns of the parents towards digital media. Structural concerns (how to afford them, technical support, etc.) and the use of internet in school were discussed, as well. Two teachers already had good experiences with digital media in school and use them in their class regularly. One of them is a co-tutor in an inclusive class that is going to become an

iPad class, and she has a very positive attitude towards iPads in school and sees a lot of opportunities for the inclusive class. According to her, students with reading difficulties especially benefit from the possibility to listen to texts so they are able to follow the regular class with their classmates. Improving their reading skills should then take place in special classes.

To get inspired by students' opinions about the way they are taught in school and about how they work with the schoolbook, a small survey with a questionnaire was conducted. Five students in the twelfth grade, six students in the seventh and eighth grade and two students in the fifth and sixth grade participated. They were also asked to express own ideas or suggestions for a future schoolbook.

Most of the students (twelve of the thirteen) already use digital media (Internet or smartphone) for school, often for homework but in some cases in-class. All participants wish more interactivity and more active work in class: an eighth grade student would like to learn at different locations, e.g. outside. The same applies to the school materials: a student in the sixth grade wishes that "the text changes if one doesn't understand it. It might get more detailed or easier." Another student in the twelfth grade wishes that the learning content would be closer to their everyday life concerns: "I would prefer that the learning content is more adapted to what one really needs in everyday life, e.g. how to make a tax declaration." A sixth grade student wishes that the pictures in his book would "live", that they are videos, so he could understand things better while a fifth grade student wishes his book could read out things for him.

4.2 Creating Personas

To keep the user in focus throughout the whole design process, we created multiple personas-a description of an exemplary user and his or her characteristics. According to Cooper's definition, persona should be based on field research, but in practice the content may also come from the designer's assumption and experiences [12]. We built up three student personas: Paul, a twelve-year-old student in fifth grade, Hanna, a fourteen-year-old student in eighth grade and Julia, a seventeen-year-old student in twelfth grade. They are based on empirical information taken from the JIM-Study of 2013 (Youth, Information, (Multi-) Media) [13] as well as information collected in the expert interviews, the student survey and additional characteristics added by the designer.

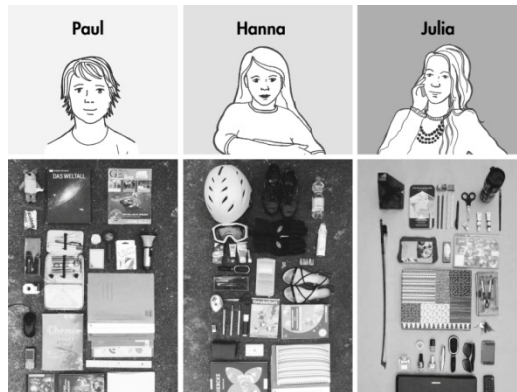


Fig. 2. Presentation of the persona

To get an idea of the persona, we will quickly introduce Paul and Hanna.

Paul is a twelve-year-old student in the fifth grade. His favourite subjects are physics and chemistry. He loves to explore things and dreams of being an explorer when he is grown up. He loves books about science and exploring his own environment. He got the old mobile phone from his father so he can call at home when he is in school. It's just a normal mobile phone, not a smartphone. He learns very quickly and gets bored when the rest of his class is still working on a topic he already knows.

Hanna is a fourteen-year-old student in the eighth grade. She loves sports and languages but hates mathematics and natural sciences. She just doesn't understand that stuff. Her reading difficulties make it even worse, and when the class starts discussing a text she is still stuck in the middle. She likes to work with her laptop to look up things for homework so she can watch videos that explain certain topics and doesn't have to read texts. She also found an app for her smartphone that helps her to learn vocabulary.

4.3 Creating Scenarios

One big question within the design process was, if the digital or the printed book suites best the affordances of an inclusive schoolbook. Since the digital book is inherently dynamic, offers differentiated access to the content, can be updated whenever needed to and joins all books for different topics in one device we decided to use a digital book as our platform. Based on the personas, we built scenarios for exemplary school lessons. We demonstrate which new possibilities of learning a digital future schoolbook offers and how students could work with it. In the following we will present the scenarios for Paul and Hanna.

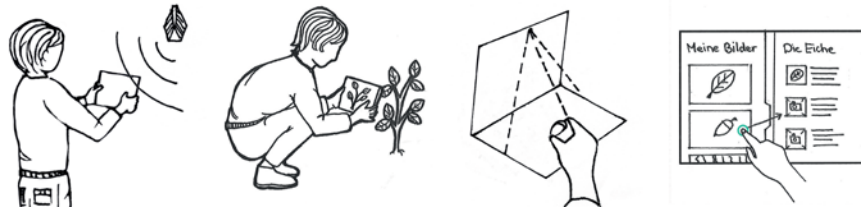


Fig. 3. Scenario I: A possible lesson for Paul

Scenario I: In today’s biology class, Paul and his classmates go out to the school’s garden. Folded backwards, the schoolbooks work as a mobile working station. As the students walk around to explore the different plants and trees, tasks are sent to their schoolbooks. Paul has to find a specific tree: an oak tree. He finds a tree he thinks that is an oak tree and takes a photo of the leaf. He also finds an acorn and takes a photo by using his book as a portable photo studio. When he is done he adds the pictures to the free spaces in his schoolbook. His book scans the pictures and gives him feedback: yes, that is an oak tree, well done, head on to the next task!



Fig. 4. Scenario II: A possible lesson for Hanna

Scenario II: In today’s English lesson, Hanna’s class starts a new unit about London. The students work individually with their books for a while. They can read texts, listen to audio text or even watch videos concerning the topic. A new part of grammar is introduced: if-clauses. Hanna doesn’t quite understand them at first, so she can display more detailed explanations to help. Her friend Anna found a video that explains if-clauses very well and she sends it to Hanna via the messenger. Hanna can now include the video directly into her schoolbook right next to the other explanations of if-clauses. Now she can watch it again if she needs to. Today’s homework has to be done orally, so Hanna records her answers to each question and sends it to her teacher just before 10 o’clock in the evening, the deadline her teacher set for it.

5 The Result: “Mate” – A smart schoolbook

Based on the research and the users’ needs, different concepts for the product and its interface were then developed in an iterative and comprehensive design process.

Fig. 5. "Mate", the digital schoolbook

The result, "Mate", is a digital schoolbook that redefines the learning process in schools and adapts to the individual needs of each student. The design of "Mate" is inspired by the traditional book. To offer more working space, it contains two touch displays and can be folded together to ensure save transportation. The layout of the content is inspired by magazines to address and motivate the students and the interaction elements derive from the real physical objects such as scissors or pens. A pen with plastic front allows writing on the screen and a camera in the right part of the book enables the students to take pictures of their work or other interesting things to integrate them into their book. "Mate" is extremely flexible and can be used folded backwards as a mobile working station for learning outside the classroom or with additional displays taken out for more working space or to easily discuss content in groups or with the teacher (Fig. 6).



Fig. 6. "Mate" with displays taken out for more working space (left) or folded backwards as a mobile working station (right)

Instead of rigidly structured contents the digital book provides students the adequate level of information and support they need. With interactive elements, concise texts and implemented videos or audio files, "Mate" motivates students to explore, work and learn independently and at their own pace. Working with paper, pencil and scissors trains important motor skills and creativity. That is why "Mate" combines digital with analog learning and working. Handwritten texts or sketches can

be transferred into the “digital world” by taking pictures of them which will then either be stored in digital folders or can be further edited.



Fig. 7. The "tree-quiz" (left) and the messenger (right)

Students are encouraged to actively influence the content of their books in order to set a personal learning focus. On the screen above (Fig. 7) you can see a quiz that students have to solve by taking pictures of the right trees in the school's garden. “Mate” also offers a communication platform for the whole class. The teacher can contact the students anytime and students can help each other. The chat can be supervised and deactivated by the teacher during class.

The schoolbook accompanies the students throughout their entire school career and grows with them. The book recognizes each student's educational needs and capabilities and adjusts its content continuously to support the learning process. To support active working and learning,

5 Conclusion

“Mate” is still a concept. We only covered some of the topics concerning inclusive learning that we researched. Further work has to be done to provide universal accessibility. With this concept study we hope to contribute to the field of inclusive learning and support the movement towards an inclusive school system. We want to motivate professionals of all related fields to think about the possibilities for learning in the future and to develop their own ideas and concepts.

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