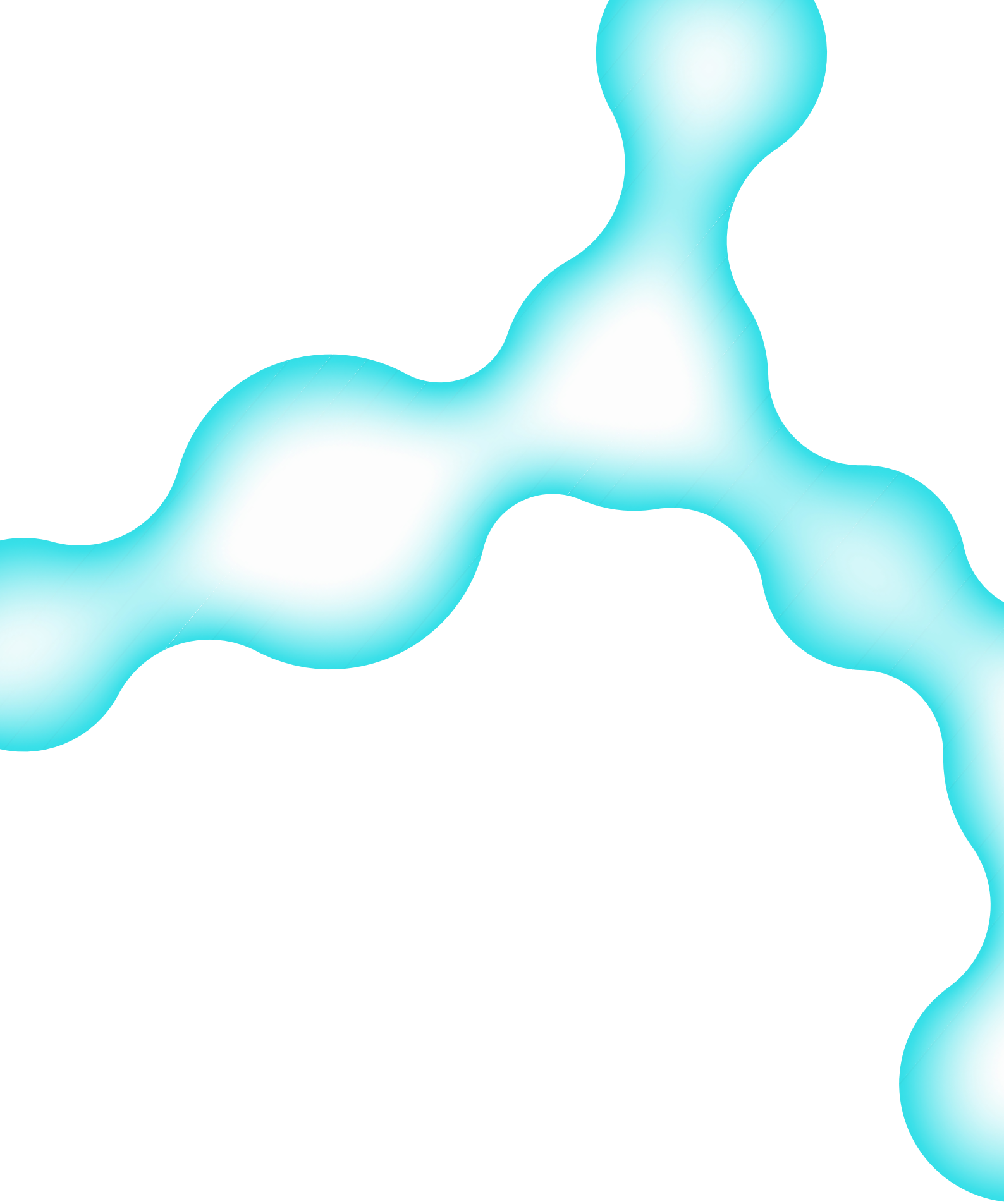

flink

Roman Engler & Zoë Urand

Flink

The app for intrinsic, creative, collaborative,
and interdisciplinary learning

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Abstract

The world is changing, and so too must education. To prepare students for the challenges they will face today and tomorrow, schools must develop individuals who are engaged and can adapt quickly and creatively to change. We believe successful students learn intrinsically, while developing interdisciplinary, creative, and collaborative skills.

Flink is an app that enables students to build learning paths by capturing the most interesting and important moments in their learning process, discover new and exciting creative methods, and see connections and patterns in their learning. With Flink, students develop themselves, learn with and from each other, and discover the world through creative and connected thinking.

Acknowledgements

Our bachelor thesis would not have been possible without the support, encouragement, and engagement of many people.

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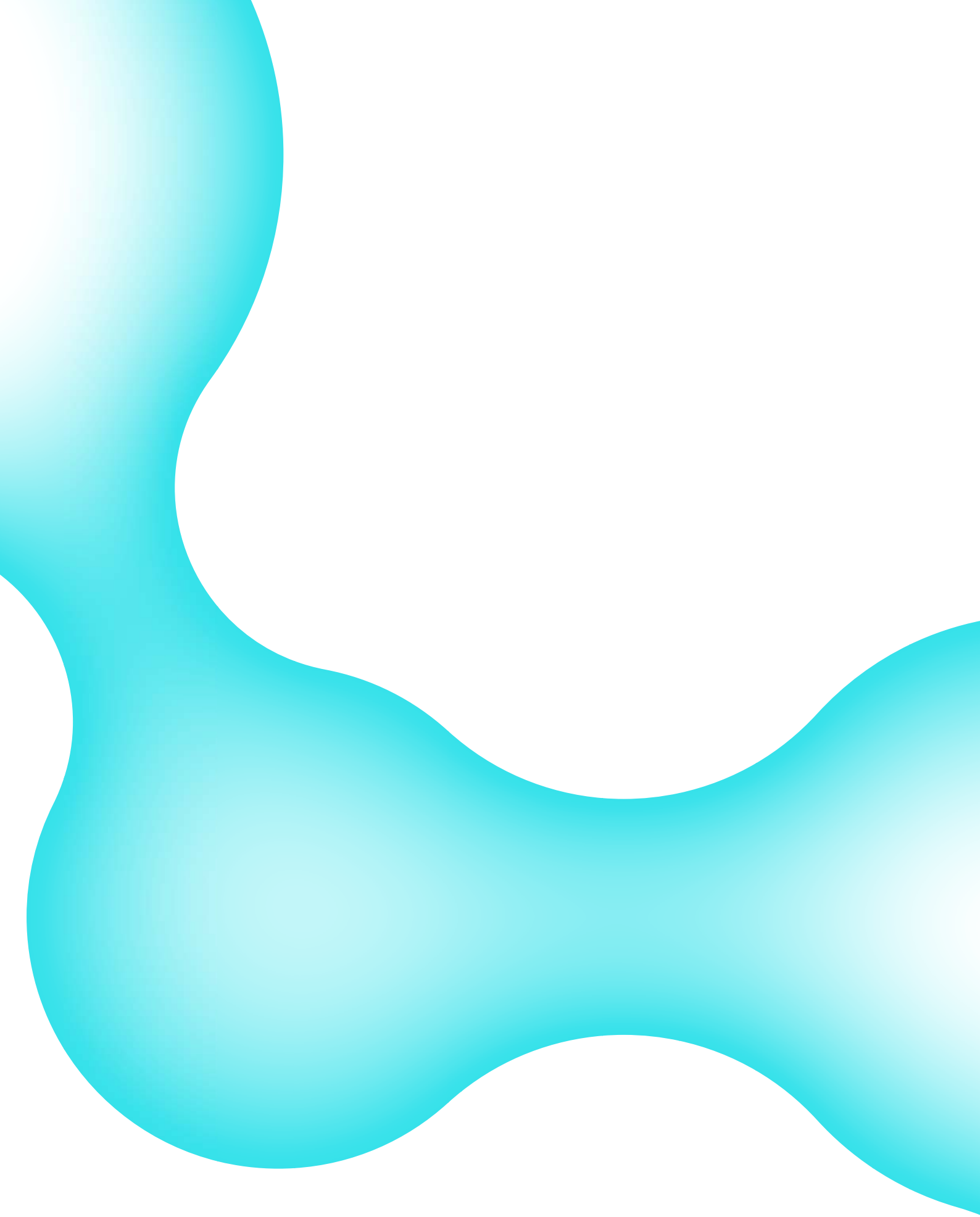
1 Introduction



Education has always played a crucial role in preparing students for the future.

As the world changes, however, education must also change. Students need to be able to adapt to the challenges we will face both today and tomorrow. Schools therefore must develop individuals who are engaged and can adapt quickly and creatively to change.

We are Zoe Urand and Roman Engler, two interaction design students with a common interest in education. We have teamed up for this bachelor project, to investigate the education system and address its potential for innovation. This thesis shows our journey from the analysis of what education means to humanity and how it manifests in the western world, to our research and experimentation on the pain points and potential within the educational system to our proposed contribution to the field.

Within this semester-long bachelor project, we have accumulated and studied the relevant academic research that has been done on our field of interest and learned that a global movement towards more individuality and empowerment of the students is happening in educational institutions.

We have worked together with both pedagogical experts and students themselves to experience first handed the reality in classrooms of Swiss schools. We have formed our vision for the future of education, seeing learning as an intrinsic process and for students to take ownership over their education.

We brought practice and theory together to build our argument towards the transformation that education can and should undergo and have developed our design proposition, a learning app which leverages technology and design throughout the education system, serving students and teachers alike.

2 Research

2.1 Background & Context

2.1.1 Education

Education can be defined as, “learning that is deliberate, intentional, purposeful and organized” (UNESCO, 2015, p. 17). It is something we have consciously constructed to channel learning and knowledge towards what kind of society we want to live in. Public education, however, remains largely unchanged since its inception. Sir Robinson (RSA, 2010) describes it as being, „modeled on the interests of industrialism, and in the image of it.” Schools function like factories that group students based on their age or manufacture date, separate subjects into categories, and focus on the delivery and instruction of information. But as our world and vision for the future changes, so too must education. Humans have an innate ability to learn, imagine, and be creative. We learn by interacting with and experiencing the world around us. We learn through play and collaboration. We learn in order to find solutions to problems and make meaning of the world. We learn to survive and thrive. The future of education needs to create conditions which support our natural tendencies towards learning.

2.1.2 Changing Education

As the world becomes increasingly complex, uncertain, and fragile there is a growing global consensus for radical change in education. Strategies and policies are being discussed and in the process of being implemented.

The UNESCO’s 2015 report, “Rethinking Education: Towards a global common good?” highlights that education plays a crucial role in promoting the knowledge we need to develop, in order to overcome the challenges of the future. Three main steps are mentioned: First, creating the sense of a shared destiny of all of humanity, within and throughout the environments we live in. Second, the awareness of the challenges this destiny poses to local and global, interdependent communities. Third, the collective commitment to engage in those challenges, based on an individual sense of responsibility towards one another (UNESCO, 2015). Acknowledging these steps as the goals of education-systems is a strong statement that clearly moves education out of the industrial age into a more responsible and sustainable future.

Mitchel Resnick writes in “Rethinking Learning in the Digital Age” about society’s shift from an industrial-, to an information- or knowledge-, and finally a creative society. He believes that success in the future will be based, not on how much we know, but on our ability to think and act creatively. Resnick refers to creativity not in the sense of artistic expression, but rather as a way of thinking which can be applied to all aspects of life to improve and reinvent ourselves. He mentions that the ultimate goal of education should be a society of creative individuals who are constantly inventing new possibilities for their communities (Resnick, pp. 36-37, 2002).

In our field research, we have experienced first-hand how these changes manifest in the public schools of Switzerland. For example, have we noticed that class structures are changing from a strictly age-related order towards classes organized by level of skill to help students develop more organically. The classes also become more interdisciplinary, and curriculums are being rewritten to bring education closer to the complex nature of reality. More autonomy is given to the students and new learning spaces are emerging in and outside the school buildings that allow students to explore their ideas in an open and freeing environment. Online and remote learning allow the schools to rethink the importance of spatial environments and to keep up with the development of the student’s social environments. Digital technologies are becoming a central part of education, helping students and teachers to engage with learning in new ways. Information is available at all times and just a click away. Rather than memorizing information and gaining knowledge, the skills and competencies become more important.

For the students, these new expectations and the possibilities introduce a revolutionary way of experiencing their

education. Their individual motivation and purpose become important parts in their personal development. Self-awareness, empathy and engagement become the focus of both education and the students.

2.1.3 A Future of Learning

In order to prepare students for the challenges they will face today and tomorrow, education must develop individuals who are engaged and can adapt quickly and creatively to change. We believe these qualities can be fostered by focusing on the following concepts: intrinsic learning, creative thinking, collaboration, and interdisciplinary learning.

2.1.4 Intrinsic Learning

When provided with the opportunity to learn intrinsically, that is, learning according to their own interests and motivations, students are more motivated and engaged in their work. Such a learning experience helps students explore and develop their interests, ideas, and voices. Kegan's concept of the self-authoring mind, as well as the research done by Baxter Magolda on self-authorship, also argue for the importance of giving students a voice in their education. The concept of the self-authoring mind is used by Kegan in his theory of constructive development, which proposes that human development extends past childhood and into adulthood (Eriksen, 2006, p. 290). Baxter Magolda references Kegan's description of self-authorship as, "the capacity to author, or invent, one's own beliefs, values, sense of self, and relationships with others" (Baxter Magolda, 2002, p. 3). Both Kegan and Baxter Magolda's research suggests that many adults do not reach a self-authoring mind, mainly due to universities not providing the right environment for them to develop in this way (Patton, 2016, p. 4; Baxter Magolda, 2002). Baxter Magolda argues for universities to do more, as "the early years of the journey into adult life are particularly difficult because they are marked by transformation from reliance on external authority to taking ownership and responsibility for one's life" (Baxter Magolda, 2002, p. 3). Students need to be allowed to become the author of their education to develop as individuals and prepare for a life post school.

Creative Thinking & Collaboration

Creative thinking and collaboration are also essential to the learning experience. Resnick (2018) explains how creative thinking helps students "learn to develop their own ideas, try them out, experiment with alternatives, get input from others, and generate new ideas based on their experiences" (p. 12-13). Such an approach helps students gain new perspectives and develop creative solutions to problems.

Creative thinking can also help students engage more deeply in their education. Seymour Papert's theory of constructionism argues that students learn best when they construct and build artifacts (Parmaxi & Zaphiris, 2014, p. 453). When a student constructs or creates something, they externalize their thoughts and ideas, and gain a better understanding of themselves. They are also then able to share these thoughts and ideas with others, mainly their peers. By sharing their work, students can inspire one another, teach each other new skills, collaborate, and provide valuable feedback.

Interdisciplinary Learning

An interdisciplinary approach to learning is important to help students gain a broader and more holistic understanding of the world. With such an approach, students explore the interactions between two or more disciplines and how they affect each other's perspective. Though this does not necessarily allow for the in-depth understanding of single-subject knowledge, Ivanitskaya et al. (2002) describes students as being able to "seek meaningful connections between and among disciplines" (p. 97). The ability to do this helps students to consider different perspectives and therefore adapt to the challenges they might face now and in the future.

Choice in the Classroom

One of the ways in which intrinsic learning, creative thinking, collaboration, and interdisciplinary learning can be integrated into the current classroom learning experience is through choice. Providing students with choice allows them to become actively involved in their education as they decide what they learn and with whom, what skills they develop as a result, and how they demonstrate what they have learned.

While several studies suggest a positive correlation between student choice and their intrinsic motivation and engagement, the research remains inconsistent and at times contradictory (Netcoh, 2017, pp. 384-385; Beymer & Thomson, 2015, p. 111). In general, the research demonstrates the complexity of choice, as well as the various factors which can impact how choice affects a student's motivation and engagement. For instance, there are some students who might be influenced by external motivations, and others that feel uncomfortable with the responsibility of decision making (Beymer & Thomson, 2015, pp. 108-114). The phenomenon of choice overload is also relevant and applicable in educational settings. With too much choice students can feel helpless and a lack of competence. Too many choices can lead to the feeling that the chosen option will be less satisfying. The reason for this is that to make a choice for one thing, means giving up another, which can lead to regret. More choice also makes it increasingly difficult to justify your choice (Netcoh, 2017, p. 385; Beymer & Thomson, 2015, pp. 112-113). Despite this and the many ways to increase student motivation and engagement in the classroom, such as goal setting or collaborative group work, choice shows the most promising results for intrinsic motivation (Beymer & Thomson, 2015, p. 110).

Though the idea of giving students choice in school is not novel, and many teachers view it as beneficial, few studies have investigated choice in a classroom environment. Research suggests that students are rarely given the opportunity to take ownership of their learning, and as a result may struggle when given such an opportunity. They have become accustomed to a system where the teacher decides everything, from what is learned to how the learning is demonstrated (Netcoh, 2017, pp. 384-385). Several studies which were able to investigate the effects of choice in a classroom found that students value choice in their learning but require some form of guidance or structure to support (Radenski, 2009). In other words, students need a framework—not a blank page—which is open enough that they can pursue their interests while still being supported.

2.1.5 Design in Education

From implementing change to reimagining the role of technology, design is able to support the field of education in several ways. First, it has the potential to support the field of education as it undergoes various changes. As these changes are complex and therefore difficult to implement, design thinking can offer its support. Where design is particularly useful is in its approach to problem solving. Design does not assume a right and wrong solution, but rather tries to ask the right questions. Furthermore, it places emphasis on the iteration, rapid prototyping, and involvement with users to test ideas and concepts. Design can therefore help schools to prototype and test the various aspects of a future learning experience they envision.

As changes are implemented, design can also help to redefine the roles of individuals, as well as relationships between certain groups of people. More specifically, we can help design for the interactions between people that best support these emerging roles and relationships. One area where roles are being redefined is between student and teacher. While teachers are taking on more of a coaching role by preparing weekly plans for their students, or placing more emphasis on group projects, students are being given more responsibility and freedom in their learning. For example, the Lehrplan 21 (LP21) in Switzerland has redefined the role of teacher as being responsible for creating a high-quality learning environment, as well as supporting students

individually in their development of skills and competencies (Deutschschweizer Erziehungsdirektoren-Konferenz (D-EDK), 2016, p. 28). Education is becoming a service to the students, rather than their obligation.

Design thinking is also valuable when integrated into the learning process of the students themselves. Panke (2019) argues for this by describing design thinking as being able to create a more empathetic, open-minded, playful, experimental, and collaborative learning experience (p. 290). To elaborate, the human-centered approach design often takes helps students to consider and include a wide range of perspectives that may differ from their own. They learn to not project their own world view onto others. The use of play and experimentation in design is also beneficial for students, as it encourages them to try out new things and learn from mistakes, as well as collaborate with others. Resnick (2018) describes the importance of experimentation as follows:

> *"If you follow instructions well, you'll be able to assemble IKEA furniture, you'll be able to cook a good meal, and you'll probably do well in school. On the other hand, if you always follow instructions—and if you only follow instructions—you'll never do anything very creative or innovative and you'll get stuck when you encounter a new situation in which the instructions no longer apply (p. 164)."*

Technology, specifically digital, is another area where designers can contribute to education. In the context of education, we understand technology as a tool, be it physical, digital, or both, that supports a student in their understanding of ideas, concepts, and knowledge. The focus, however, has shifted away from physical materials and towards digital tools. This is apparent from the surplus of educational apps and other digital technologies that are becoming increasingly integrated into a modern classroom setting. The periods of remote learning during the pandemic have also recently contributed to this shift. Resnick (2002) argued that while these digital technologies provide an opportunity for new forms of learning in education, more often than not they have been used to reinforce outdated approaches to learning (p. 32). In other words, the purpose of technology in education has been primarily concerned with the delivery of and access to information. This was and can still be observed today. Seymour Papert proposes an alternative use of technology in education. Papert applies his theory of constructionism to the use of technology in education, arguing that computers should be used as a tool to learn ideas, concepts, and knowledge by creating, instead of simply delivering information to students. In other words, moving forward design needs to carefully consider the role of digital technologies in the classroom.

2.1.6 Swiss Education

For our bachelor thesis we want to narrow down the scope of our research and investigate education on a local scale. As we are situated in Switzerland, our field research will be conducted with the schools here.

The Swiss system of education is organized both on a government and cantonal government level, resulting in local differences in education. Such a setup allows for the implementation of scalable educational policies that apply across many jurisdictions (Educa, 2016). In terms of teaching methods and materials, as well as infrastructure, Swiss schools are comparable to most western public schools. Perhaps where Swiss schools differ, however, is the length of compulsory education. Students in Switzerland are required to attend eleven years of education before they choose between a further academic or a professional career.

Lehrplan 21

Since its inception by Jean-Jacques Rousseau and Johann Heinrich Pestalozzi in the mid-18th century, Swiss education is undergoing its first major transformation. This transformation is known as Lehrplan 21 and reflects many of the

global trends on a national level in Switzerland. It is enforced by the Swiss Federal Constitution in Article 62 paragraph 4 (Federal Constitution of the Swiss Confederation, 2021).

The goals of Lehrplan 21 include the following: standardization of education across Switzerland between secondary levels I & II to benefit the mobility of teachers, families, and students; standardization of learning materials; a common curriculum for basic and advanced teacher training; a common curriculum to better measure academic performances; and a common curriculum to allow for more effective development and adaptations (Deutschschweizer Erziehungsdirektoren-Konferenz D-EDK, 2016).

Within Lehrplan 21, the most important change is the emphasis placed on the development and evaluation of students' skills and competencies, rather than pure knowledge acquisition. More specifically, the student should acquire competencies that can be evaluated by the aspects of skill, knowledge, willingness, attitude and mindsets, as well as self-driven learning, cooperation, motivation and engagement.

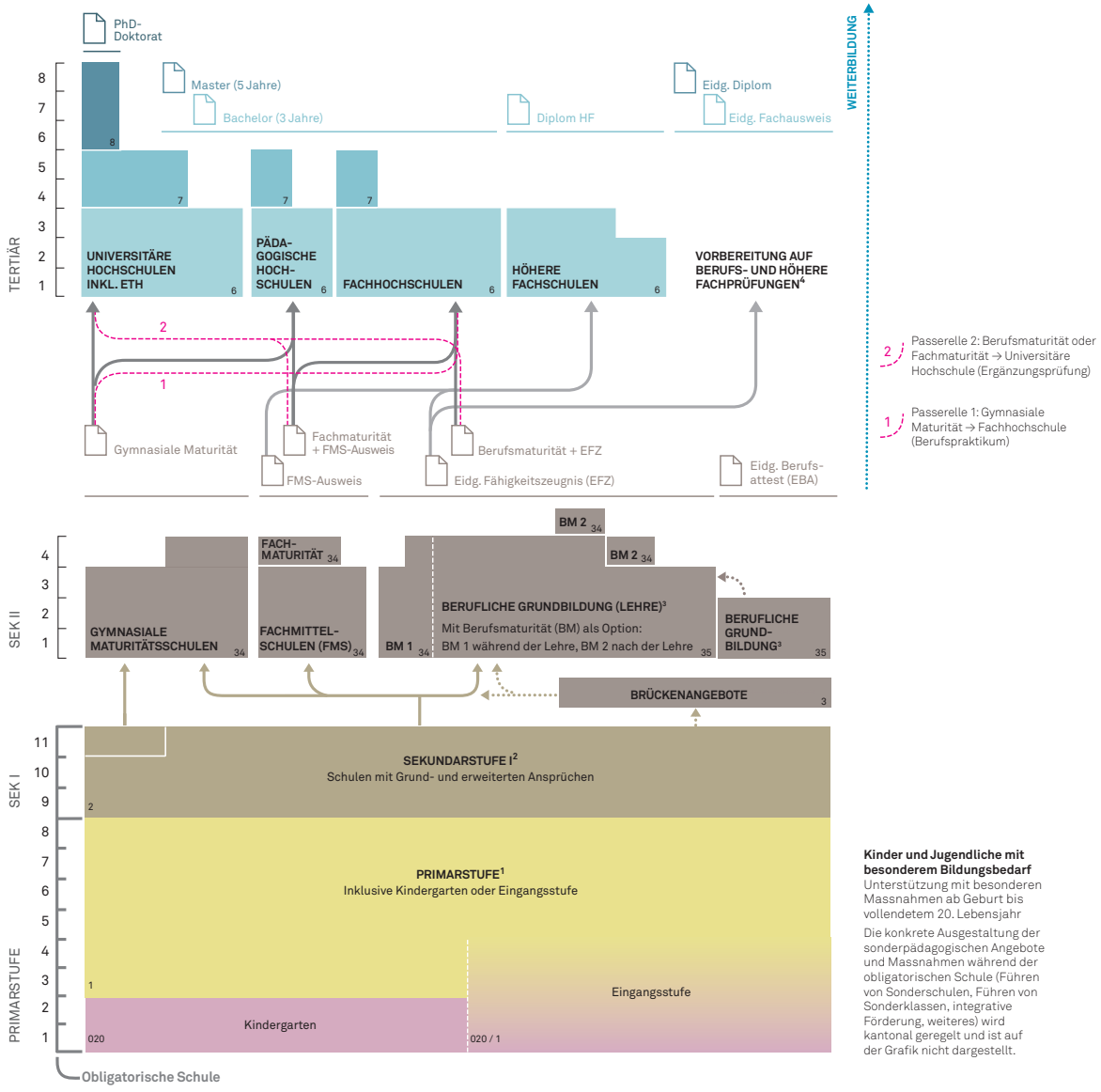
To assess the development of students' skills and competencies, Lehrplan 21 mentions, for example, the ability to access existing knowledge, to use a diverse set of skills for problem solving, to learn self-motivated and with the right methods, to make goal-oriented decision as well as to collaborate with others (Deutschschweizer Erziehungsdirektoren-Konferenz (D-EDK), 2016, p. 25). As we understand it, these competencies also reflect in design thinking methods and can as well be fostered with such.

Digitalization

Digitalization is also an important contributing factor to the changes happening in Swiss education. With the implementation of digital technologies, schools are changing the way they organize information, teach, and communicate. One example, "1:1 Tablets," is a local project from a school in Baden (CH, Aargau) where they equip every student with a tablet and a set of apps (Volksschule Baden, n.d.).

Under implementation of Lehrplan 21, the possibilities for such projects vary among different schools. This is mainly dependent upon their financial budget and how they decide to allocate their resources, because Lehrplan 21 leaves the execution of the plan to the schools. There are also concerns being raised regarding the negative impacts of digital technologies on social interactions in the classroom, physical learning experiences, and the accessibility of devices in general.

DAS BILDUNGSSYSTEM SCHWEIZ



Kinder und Jugendliche mit besonderem Bildungsbedarf
Unterstützung mit besonderen Massnahmen ab Geburt bis vollendetem 20. Lebensjahr

Die konkrete Ausgestaltung der sonderpädagogischen Angebote und Massnahmen während der obligatorischen Schule (Führen von Sonderschulen, Führen von Sonderklassen, integrative Förderung, weiteres) wird kantonal geregelt und ist auf der Grafik nicht dargestellt.

ISCED | International Standard Classification of Education 2011

- ISCED 8
- ISCED 7
- ISCED 6
- ISCED 4
- ISCED 34 + 35
- ISCED 2
- ISCED 1
- ISCED 020

[1] Zwei Jahre Kindergarten resp. die beiden ersten Jahre einer Eingangsstufe: in der Mehrheit der Kantone ins Obligatorium eingebunden

[2] Sekundarstufe I: Kanton Tessin mit vierjähriger scuola media (gemäss Ausnahmebestimmung in Art. 6 HarmoS-Konkordat). Übertritt in gymnasiale Maturitätsschulen nach 10. Schuljahr möglich

[3] Berufliche Grundbildung (Lehre): Ausbildung im Lehrbetrieb + Unterricht an Berufsfachschule + Besuch überbetrieblicher Kurse. Bei gewissen Berufen kann der Abschluss der beruflichen Grundbildung in einem schulischen Vollzeitangebot erworben werden (z.B. Lehrwerkstätte, Handels- oder Informatikschule).

[4] Eidg. Berufsprüfung / Eidg. Fachausweis = ISCED 6; Höhere Fachprüfung / Eidg. Diplom = ISCED 7

Fig. 1

2.2 Related Works

Our work finds a place in the field of educational innovations. A field that is explored by a wide range of research and builds a growing global market for products and services for students, teachers and parents. We have looked for projects that touch on our scope in different ways and wanted to see how they address the changes that are happening in education.

ClassDojo

ClassDojo is a communication platform which helps teachers, students and parents build a community by sharing memorable moments from the classroom with photos, videos and messages. The platform also allows students to make their own learning portfolios through photos and videos of their choice.

We view ClassDojo's implementation of a learning portfolio for students as an important step to supporting, encouraging, and celebrating the learning experience of each and every student. Giving students a place to share and save work they are proud of, and which they can reflect back on in the future, is important for self-development. In other words, students can begin to understand where they as individuals stand in their education and build on this understanding in the future development of the self.

Fig. 2

Intrinsic Campus

Intrinsic Campus is an independent „laboratory“ developing a prototype for the future of teacher training in Switzerland, with a specific focus on the intrinsic motivation of students. They believe that shifting the teaching focus to intrinsic motivations will better prepare students for a world in which they will need to be independent, responsible, able to think critically, creative, and most of all, able to believe in themselves.

Our tool and Intrinsic Campus both share an interest in the intrinsic motivation of students for learning. Education is changing, moving away from productivity and more towards the personal interests and passions of students. We want to target this area as well but work directly with and for students. How can we develop a tool which helps students begin to develop self-authorship by focusing on what intrinsically motivates each student?

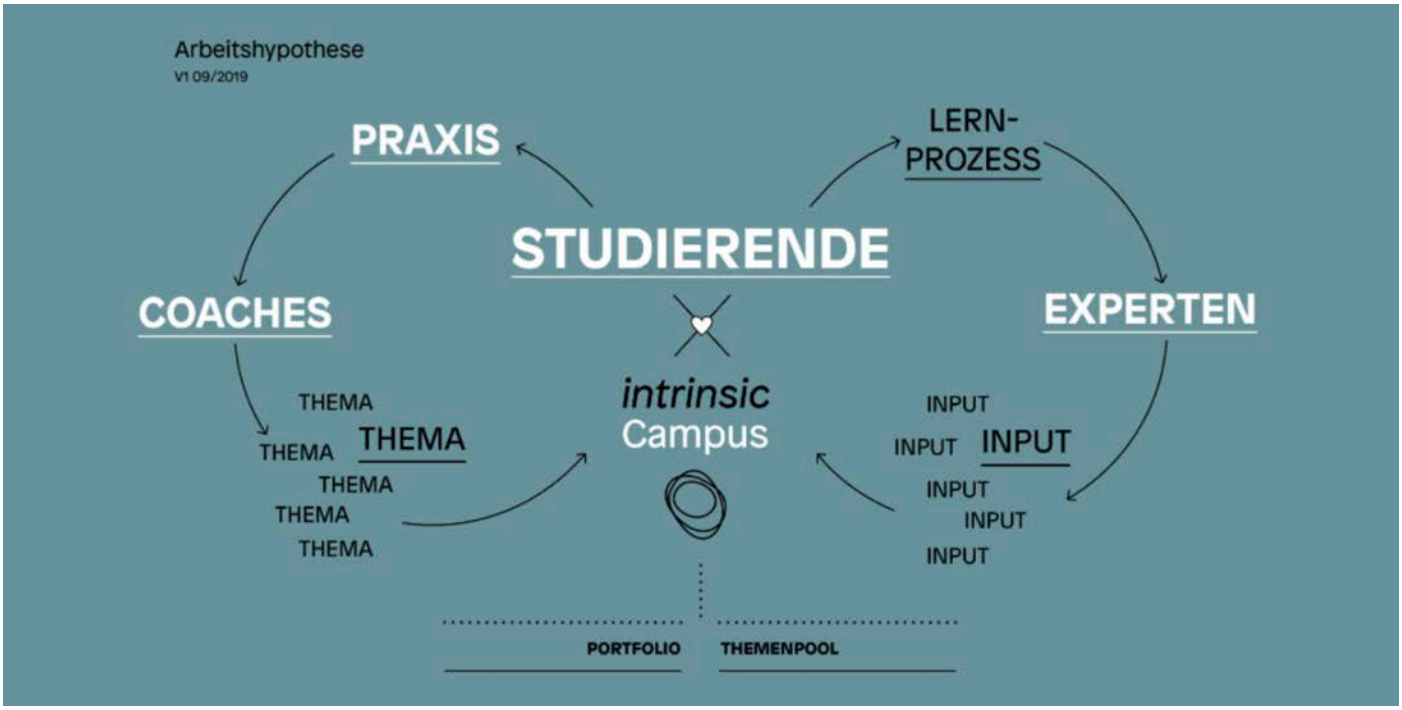


Fig. 3

Suggestion Box

The Suggestion Box from MIT Media Lab is a toolkit which allows for an inclusive approach to implementing change(s) in schools. In other words, teachers, students, and families can share their thoughts and provide input regarding decisions being made in the ultra-compact format of two simple sentences. While introducing change is no easy feat for educators, the current pandemic and its uncertainty offers an opportunity for schools to be innovative, thoughtful, and inclusive.

Similar to Suggestion Box, which makes suggestions for change in education a more democratic process, our work also looks to give a higher level of responsibility to the students in their own education.

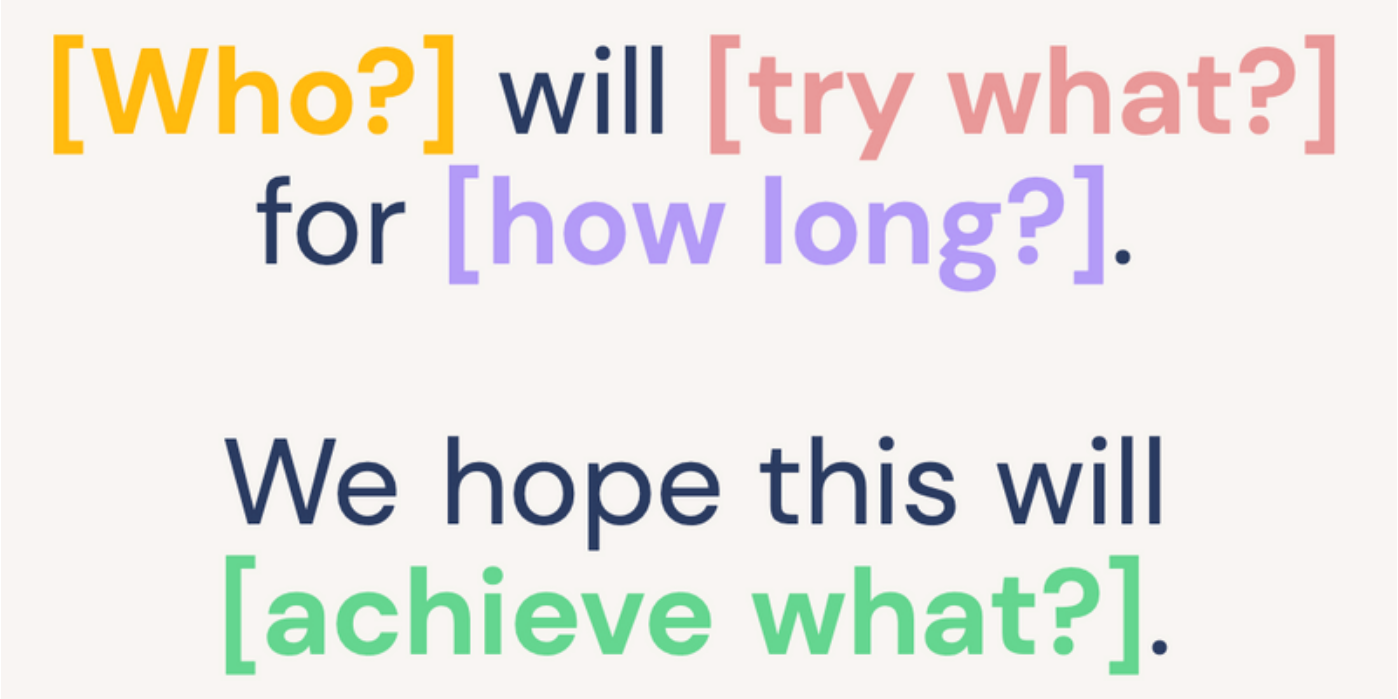


Fig. 4

SticStac Code Blocks

SticStac Code Blocks is a student project from Sharang Sharma at the Digital Media Bremen, Program for Technology, Theory, and Design. The project is a creative coding kit which uses augmented reality and physical materials to introduce children to and engage them in the basics of coding. Sharma was inspired by the overwhelming amount of augmented reality mobile apps that only allow for the consumption of media and wanted to design a tool for children to create in order to learn. Instead of touch screen-based interactions, children use an augmented reality headset, wooden blocks, and a controller to create.

This project reminds us of Papert's theory of Constructionism, and how Wstudents learn best by creating and making. We were also interested in applying the concepts of mixed media and constructionism to make the complex matter of our project more tangible.

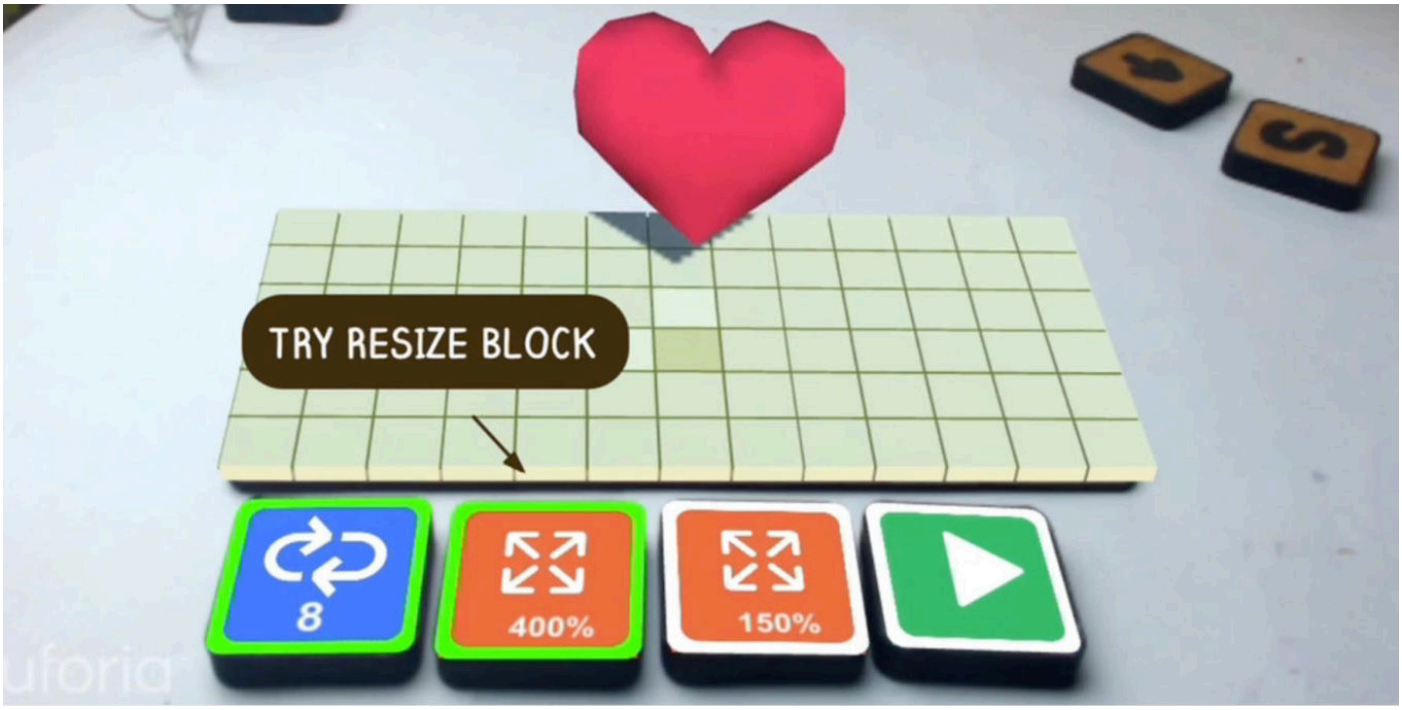


Fig. 5

Brilliant

Brilliant is an online platform which provides visual, hands-on, and interactive lessons for people of all ages.

While we view Brilliant as a prime example of how many tools for students are designed for the delivery of information and knowledge, its use of graphical user interfaces and digital interaction benefit and improve the overall learning experience.

We see an opportunity to design a tool with similar digital pedagogical aspects that is really in service of the student and focuses on their personal development.

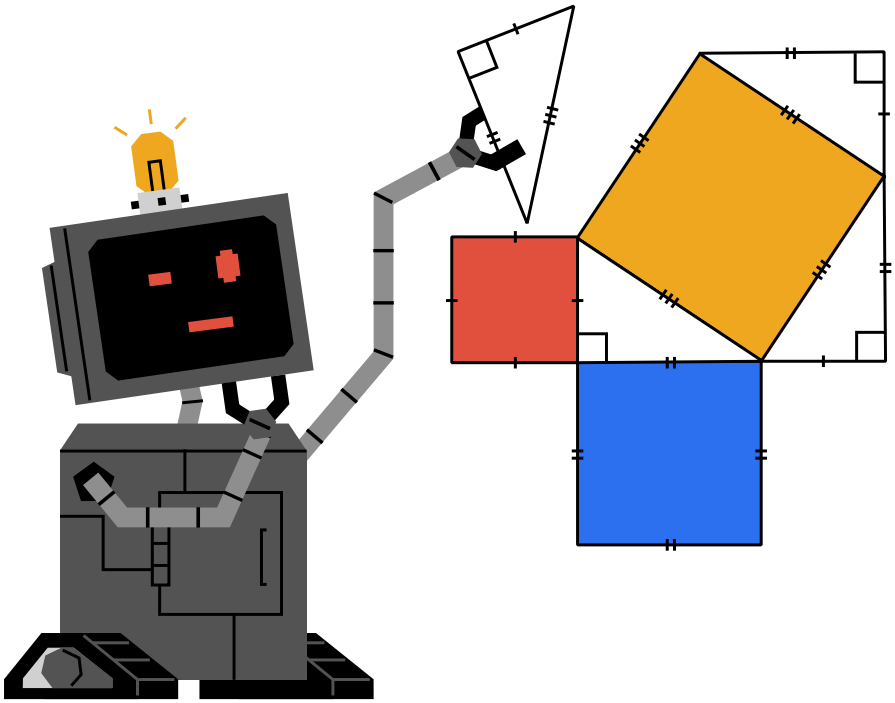


Fig. 6

2.3 Situating our Work

From our related works we realized that the tool we want to create for students does not seems to exist. The projects we selected, as well as many others, tended to focus on one, specific aspect of learning. For instance, ClassDojo allows students to document their work to share with others and build a sense of ownership in their learning but leaves the students‘ learning process aside. We also liked SticStac Code Blocks’ playful and tangible learning approach using a creative combination of different media but knew we did not want to limit our project to one topic. Then there was Brilliant’s learning community and use of digital technology which was indeed impressive, but failed to address how students learn collaboratively. Finally, Intrinsic Campus trains teachers and develops new pedagogic methods to implement intrinsic learning. Intrinsic Campus shares our vision but does not address the students directly.

We were able to observe that these projects and many more are improving learning in their own way. Nevertheless, we believe there is an opportunity to fill an important niche between them. We want to create a tool that emphasizes the importance of the learning process and provides a framework for a wide assortment of topics and projects. We also aim to create a tool that becomes an integral part of the students‘ education that grows and develops alongside them.

2.4 Our Contribution

We are interested in the many transformations happening in schools right now and believe that a student‘s learning experience could be more than sitting at a desk. We see the opportunity in new technologies and design methods to help both students and teachers. We want to design a tool which allows the teachers to restructure their classes towards the new goals of education and that at the same time creates an enjoyable, engaging and effective learning experience for the students.

In our design, we will be aware of the different needs, expectations, and fears of our stakeholders and take their unique skills and knowledge in account. We believe that our contribution will allow teachers and students alike to rethink the value of education, as well as their roles in it.

2.4.1 Research Question and Hypothesis

Our BA thesis will explore the possibilities of education in the development of students. We have therefore formulated the following research questions:

How might we create a learning experience that fosters students' intrinsic engagement and adaptability?

How might we create a tool that can be implemented into the existing education system, while also helping schools transition to a possible future of education?

Based on our research we hypothesize that by providing students with choice and guidance we can engage and intrinsically motivate students in their learning. Furthermore, we believe that by creating interdisciplinary, creative, and collaborative learning processes students become better able to adapt to the challenges of the future.

2.5 Methodology

Although we are also students, we are no longer elementary or high school students. Our idea of and feelings towards this particular area of the educational landscape is influenced by our own experience, which was over a decade ago in both Switzerland and Canada. For this reason, we selected a range of methodologies that would help us gain a better understanding of the modern student and their educational experience in the German-speaking part of Switzerland. More specifically, we wanted to know how different age groups of students understand education, as well as themselves in relation to their education.

As interaction designers we also believe it is important to involve others in the design process. We are not who we are designing for, and therefore want to give a voice to the students, teachers, and parents who know best what they need.

It is important to mention that the pandemic and the nationwide lockdown restricted the ways in which we implemented certain methods, as we were unable to physically be present in the classrooms with the students at certain times.

2.5.1 Exploratory Probes

Early on it became clear to us that we would need to better understand who the modern student is in order to design an experience for them. As we were specifically interested in how students understand themselves in relation to their education, and how this understanding develops over time, we wanted to work with students roughly between the ages of 8 and 15.

We originally imagined introducing ourselves and working with the students in their classroom environment, but this was not possible at the time with the restrictions set in place as a result of the pandemic. For this reason, we designed exercises for the students and shared them virtually over Zoom.

We refer to these exercises, not as cultural probes, but as exploratory probes. They share a similar, exploratory approach to cultural probes, but rather than have the user reflect on their everyday life they focus on a more specific topic or environment. In general, we also wanted to use these exploratory probes to see how students handle creative tasks and abstract concepts.

2.5.2 Fly on the Wall (FotW)

Lacking in recent experience of elementary and high school environments, we wanted to visit schools to gain a better understanding of the modern student learning experience for ourselves. We therefore looked to the 'Fly on the Wall' (FotW) method for inspiration.

Our intention with this method was to immerse ourselves in this environment and observe the behaviours and actions of students. Unlike FotW, however, we knew our presence would not go unnoticed by the students and were aware this could potentially affect how students behaved and acted.

2.5.3 Workshop

As interaction designers we believe that people should be involved more in the design process. In the case of our bachelor project, since we are not modern elementary or high school students, we wanted to give students the opportunity to share their thoughts and ideas in a workshop with us. Moreover, a workshop would allow us to interact with and observe students in real time, as well as ask questions or initiate discussions when needed. The method behind the workshop was inspired by Papert's constructionism, in that it allowed students to externalize and share their ideas, concepts, and knowledge through a constructed artifact.

2.5.4 Interviews & Conversations

To gain a more in-depth understanding of the field of education we spoke with experts from Swiss and Montessori education, as well as higher education. These conversations

happened at an early stage of our concept development phase and helped us to gain insight and hear various perspectives towards the current transformations education is experiencing. From these discussions, we were able to develop a rough vision for our concept and form our strategy.

2.5.5 Prototypes

We intend to use experiments and prototypes to quickly reflect and iterate upon our concept over the next four months. This methodology will help us to better understand which approach, whether it be digital, physical, or both, is better-suited to our idea. In addition, rough prototypes are useful to help communicate ideas to others in order to gather input and feedback. More specifically, we see the prototypes initially as helping us to work with students and gain a better understanding of their experience in school and what their needs might be. Towards the end of our project, we will use prototypes to refine our work.

2.6 Chapter Overview

From our literary research and related works, we have been able to gain a more nuanced perspective on the field of education. We understand the importance of education for society and see the main forces that have shaped the education systems we know. Education is society‘s reaction to the environment of the past as well as its’ forecast for the environment of the future. We understand that new economical, ecological and social challenges have to be addressed by society and that therefore education is undergoing a global transformation towards teaching skills of adaptability and sustainability.

We have learned that the transformations we see happening in education tend to manifest themselves in the form of new teaching methods, class structures, and learning technologies, and that these changes can be challenging for students and teachers. We have decided to focus our efforts on Swiss education and look at how we can use student choice to create a learning experience which is intrinsic, interdisciplinary, creative, and collaborative. Such a learning experience would help develop engaged students who are able to adapt to the challenges they will face. We will use these initial findings from our research to develop our concept and contribute to the field of education.

3 Concept Development

3.1 Angle

Our shared interest in education is one of the main reasons why we teamed up for the bachelor project. As we neared the end of our three years at the Zurich University of the Arts and began to look forward, we also found ourselves reflecting on our time spent in education in general. From an early age until now, we have both experienced and been shaped by different, yet similar, educational systems in Canada and Switzerland. We would not be who we are today without such experiences. Having said that, we wish our time spent in school could have been a more personalized one. One in which our intrinsic motivations helped to motivate and engage us in the learning process. We feel that this kind of system would have better prepared us for the challenges we face today and will face in the future. As current students and products of our education, we still see a lack of choice and therefore personalization in the educational system. As designers we see an opportunity to help students gain a sense of ownership over their education.

The importance of having and developing a sense of ownership goes beyond the classroom. Kegan's constructive developmental theory argues that people need to be able to demonstrate self-authorship in order to meet the demands of modern society. In other words, they need to become the authors of their own life. Individuals who have reached what Kegan refers to as the self-authoring mind, have been able to establish a set of values and beliefs for themselves. They have come to understand they are not their relationships and are independent and self-regulating.

Unfortunately, however, many individuals do not reach this (and other) later stages of development outlined by Kegan (Patton et al., 2016). Much of the research regarding the development of self-authorship is concerned with the reimagining of higher education. The reason for this being that many students leave university without having developed self-authorship, which is in part due to universities failing to provide the necessary conditions for this development to occur (Patton et al., 2016). While this work is extremely important, we also believe that providing students with more options for choice in their education from an early age onwards will help them to develop their intrinsic motivation, sense of competence, autonomy, and relatedness—all key components of Kegan's self-authorship. Doing so, could in turn, better prepare them for the transition to a self-authoring mind later in life.

During our literary research we were able to confirm the lack of studies which look at the effects of student choice on motivation and engagement in the classroom. Most research on choice provision has been conducted in fields such as marketing and economics (Beymer & Thomson, 2015; Netcoh, 2017). Moreover, the empirical research that does exist within education is limited, inconsistent, and at times contradictory (Netcoh, 2017, p. 385). For this reason, we found it important to gain a better understanding of how the modern student perceives themselves within their education and explore how choice provision affects this perception or understanding.

3.2 Field Research & Findings

3.2.1 Exploratory Probes

As we have not been in an elementary or high school setting for over 10 years, and one of us experienced education in another country, we knew it would be important to work with students as soon as possible. With a better understanding of what it is like to be an elementary and high school student today, as well as how these students engage with our topic, we would be better equipped to contribute as designers in this field.

From the beginning, we were fortunate to have the opportunity to work with students, both from primary and secondary classes at a school in Zofingen. Our first contact with the students was the two secondary classes (40 students in total), ages 14-16. The teachers of the classes, Stefan Pauli and Luca Marti, both suggested we prepare an exercise or task, which could then be included in the weekly work plan of the students. They were extremely accommodating and supportive, even presenting us with the option to provide exercises or tasks for the students every week if necessary. It is important to note that while we would have preferred to work with the students in the classroom environment, the pandemic and its restrictions did not allow us to do so at this time.

In the end we prepared two different tasks or 'exploratory' probes for each class of students. Each probe was provided with a set of instructions and the necessary material to complete the task, as well as a brief survey. Our intention was to gain insight into how the students understand themselves within the context of their education, what opportunities they see for themselves, and what it means for them to act on these opportunities. We were working on the hypothesis that if the students externalize their thoughts and ideas by doing and making, not just thinking, or speaking, they would be able to better understand themselves and communicate this.

Exploratory Probe 1

Paper Self-Reflection

This first exploratory probe was designed with the intention to gather a first and broad impression of the reflective skills of students in this specific age group. We asked them to create a figure of themselves based on their interests, while also considering the subjects of their week plan and how they relate to them. This probe was included at the end of the students' week plan, which the teachers then printed and handed out to them. As we could not physically be present in the classroom, we introduced ourselves and our work as interaction design students, as well as the task instructions (Fig. 7-8) and our own examples (Fig. 9) over Zoom.

Wir sind alle Studierende

Hallo, wir sind Roman und Zoë.
Wir studieren Interaction Design an der Zürcher Hochschule der Künste. In unserem Bachelor-Projekt wollen wir eine App für euch Studierende designen. Dazu brauchen wir eure Hilfe.

01 Gestalte deine Figur so, dass diese deine persönlichen Interessen zeigt. Male, zeichne oder collagiere, wie es dir gefällt.

02 Schneide deine fertige Figur und den Faltständer in einem Stück aus. Falte die Laschen zur Rückseite deiner Figur und befestige sie mit einem Klebestreifen.

03 Schneide die Abzeichen aus und klebe sie an den Stellen auf deine Figur, welche für dich Sinn machen.

04 Sende uns ein Foto deiner fertig aufgestellten Figur auf roman.engler@zhdk.ch

05 Scanne den QR-Code und beantworte die vier Fragen. Danke!

Fig. 7

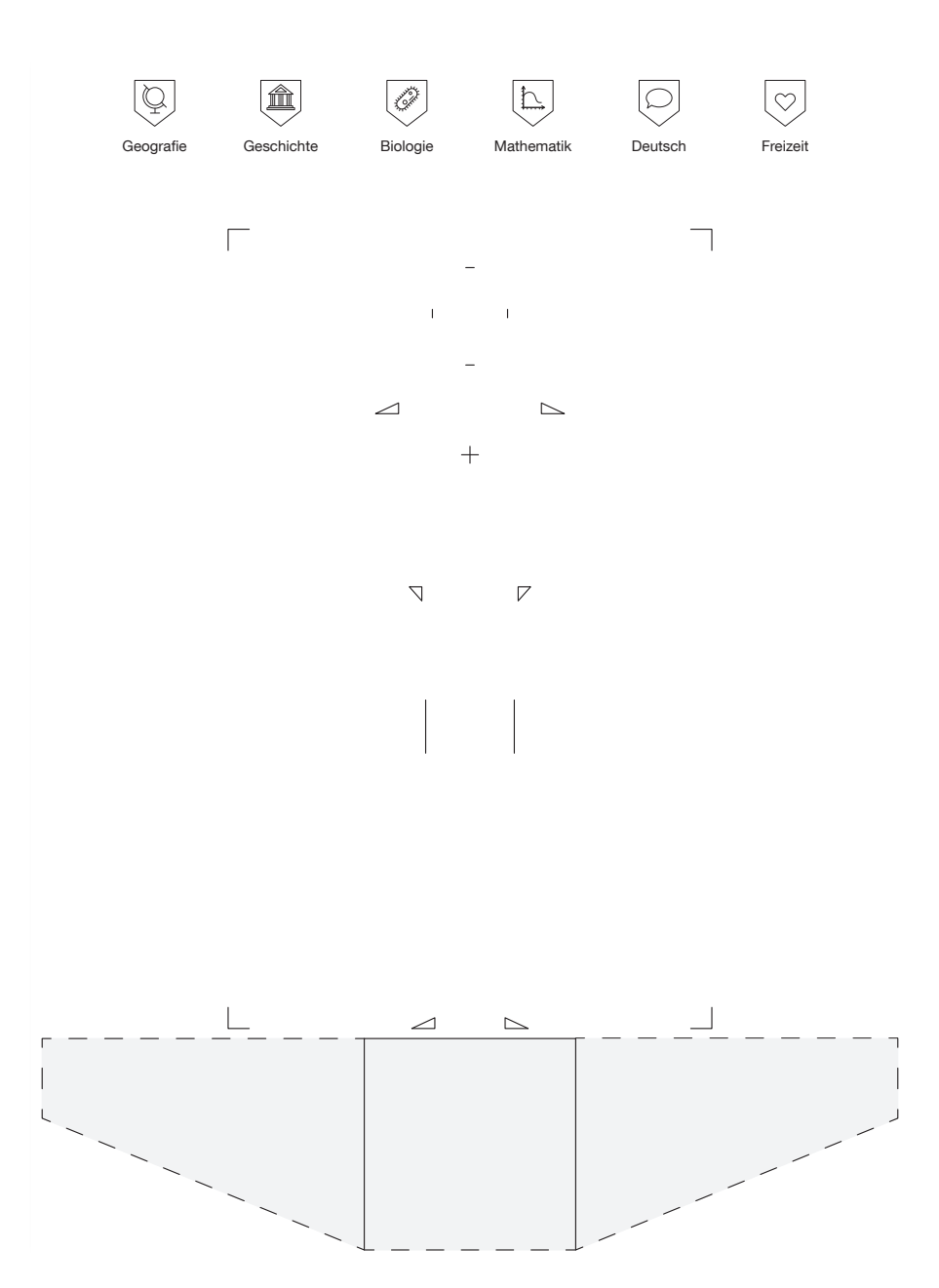

Geografie
Geschichte
Biologie
Mathematik
Deutsch
Freizeit

Fig. 8

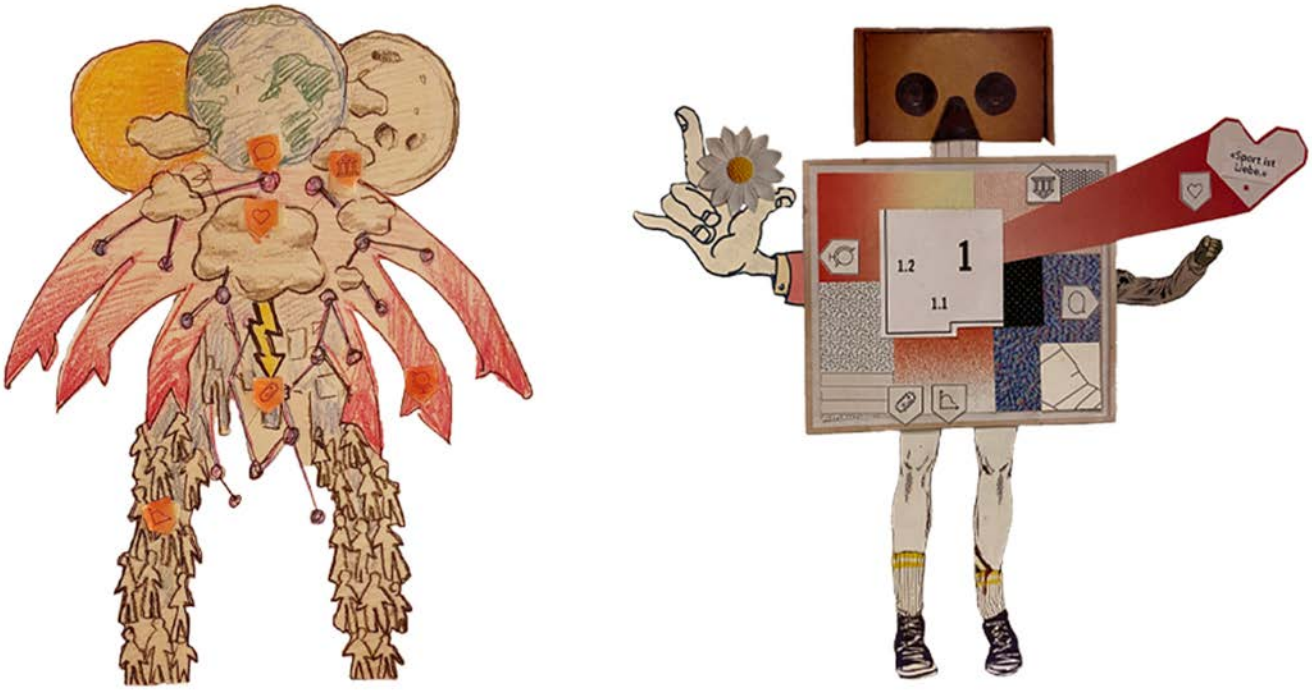


Fig. 9

Results

Out of the 40 students we worked with, 25 sent us photos of their figure (Fig. 10-34). These figures are meant to be composed of student general interests. With a task that requires an abstraction of the self, we noticed some students were very influenced by the examples we provided. Some figures showed a sense of humour, others were based on current interests, and a few may or may not have been influenced by their peers. Even the figures that are very abstract seem to be built from bits and pieces of the student‘s interests, not necessarily an abstract representation of themselves. It is important to state that our understanding or interpretation of these figures is exactly that—an interpretation. Nonetheless, it was a very insightful exercise to see how students ages 14-16 engage with such exercises.

As we could not physically be present in the classroom with the students, and therefore could not observe the environment, how the students interact with one another, how they work, etc., we created a survey about the exercise to try and better understand how they engaged with and understood the task. The survey was anonymous and short, with only four questions. Out of the 40 students, 28 responded. Here is what we could gather from each of the questions:

‘Was sind die ersten drei Eigenschaften, welche dir für deine Figur in den Sinn kommen?’

«Diese Figur zeichnet, liest gerne und liebt Eishockey.»

In this first question, most of the responses were either activity and/or interest related, or adjectives describing what kind of person the students perceived themselves to be. We believe the responses were simple and to the point, mainly because we asked the students to describe their figure in only three words. When we tried to do the same for our own figures, we also found it difficult to describe our abstract level of thinking in three words. However, when looking at the student figures and survey answers together, it did seem as if they were using words to describe themselves on a level different than ours.

'Was wünschst du deiner Figur für die Zukunft?'

«Das ich das mal erlebe.»

It was common with the responses to these questions to see students wishing their avatar a good and happy life, and that they will achieve their dreams.

'Was ist dir an dieser Übung schwergefallen?'

«Aus meinen Interessen schlussendlich die Figur zu gestalten.»

For the students, either there was no issue at all with this exercise, or it was difficult to form an idea of what their avatar should look like, and therefore draw it.

'Wann leistest du in der Schule mehr als von dir gefordert wird?'

«Wenn ich ein Fach machen kann, das ich mag.»

What was interesting with this question, was how students give their best efforts when a) they like the subject, b) they are good at the subject, and c) they are being evaluated in some way.

Findings & Insights

Although we offered students the choice to express themselves with their preferred medium or material, the task afforded most of the students to respond by drawing. This produced quite varied results, with some of the figures drawn carefully and in detail, and others being clearly rushed with not much effort given. While we understand that drawing as a method to express oneself is not preferred by everyone, we believe it helped the students to externalize their thoughts and therefore understand themselves in a more nuanced way. We observed this in each of the conversations we had with three of the students who had participated in the exercise. During these conversations, the students referenced back to their paper figure to help explain their thoughts to us.

In conclusion, this first probe showed us the diversity of interests that exist among students, and how students identify more with these interests than their education. This was visible in most of the figures we received back, but also during the individual conversations we had with the three students. Students were proud of their interests and beliefs and showed a clear sense of ownership over them. Moreover, the act of creating and materializing thoughts and ideas helped students to better understand themselves and therefore communicate this with others.

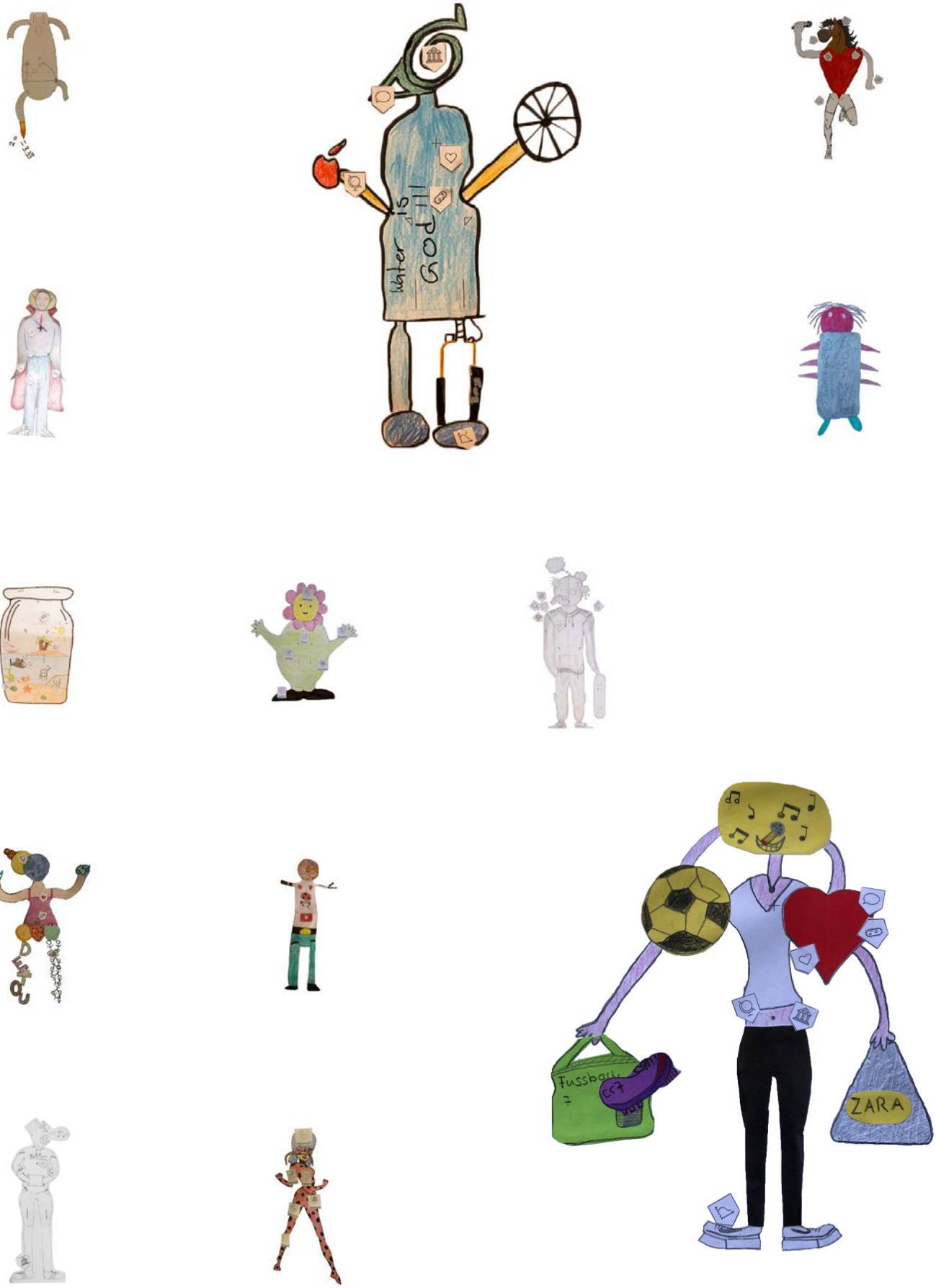
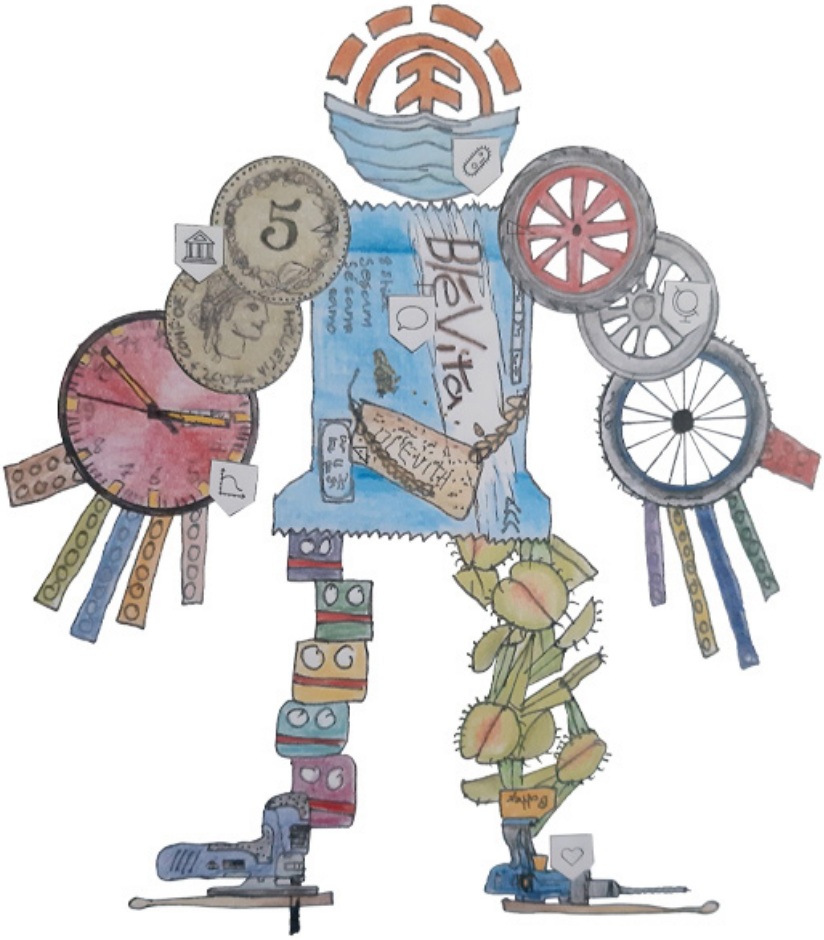


Fig. 10-34


Save the earth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BleVita

Exploratory Probe 2

Sculpture Kit

In the second exploratory probe we created building block kits and a set of instructions (Fig. 35-41) for students to spatially construct their week plan. The kit consisted of 12 building block pieces painted with 6 assorted colours (i.e. pink, red, orange, yellow, blue, and white). These colours represent the 5 subjects of the week plan, as well as 'Freizeit' (i.e., each subject has 2 dedicated building blocks). Our aim here was to have students consciously and actively engage in the planning of their week, while also reflecting on their role as individuals in their education. We hoped that by providing students with an easy-to-use, creative method, they would be able to better express themselves and engage in the task.

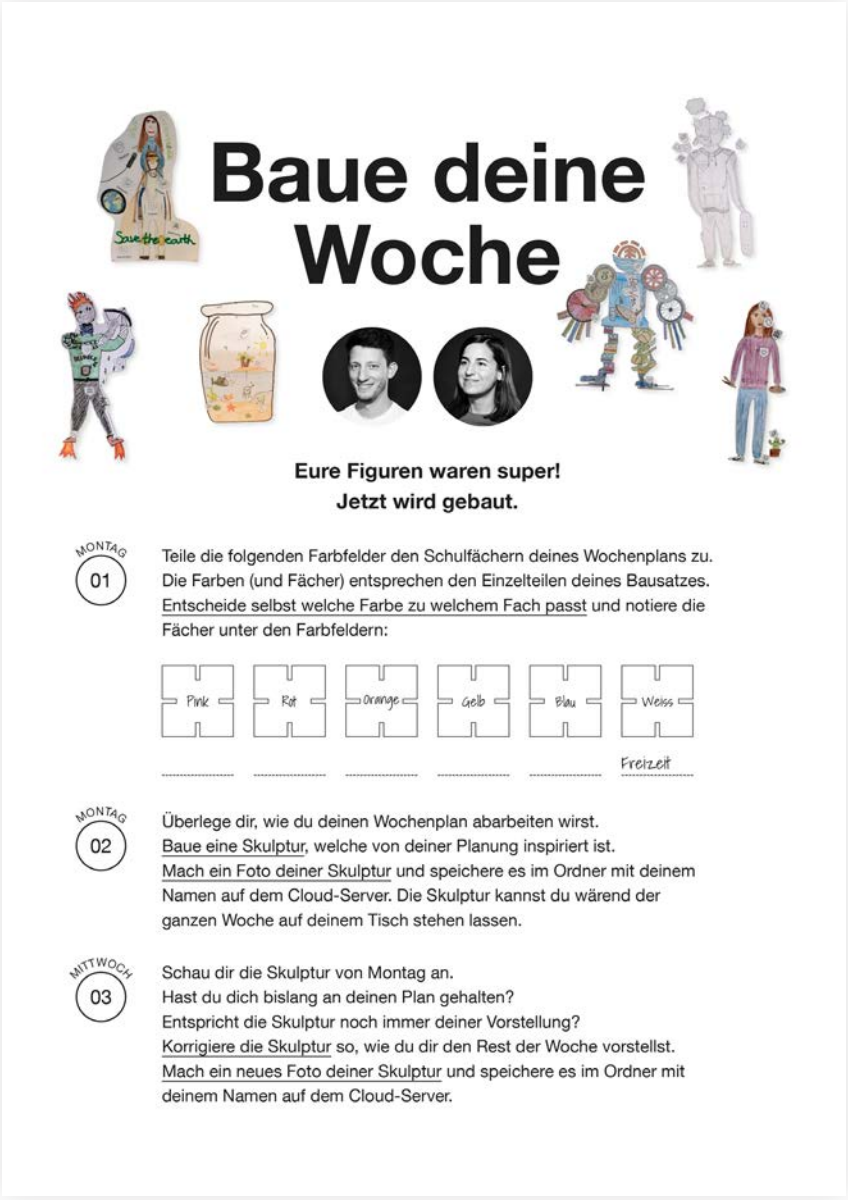


Fig. 35

FREITAG
04

Schau dir die Skulptur von Mittowch an.
Hast du dich an deinen Plan gehalten?
Entspricht die Skulptur noch immer deiner Vorstellung?
Korrigiere die Skulptur so, dass sie deiner Arbeitsweise seit Mittwoch enspricht. Mache ein letztes Foto deiner Skulptur und speichere es im Ordner mit deinem Namen auf dem Cloud-Server.

FREITAG
05

Scanne den QR-Code und beantworte die Fragen. Danke!

Fig. 36

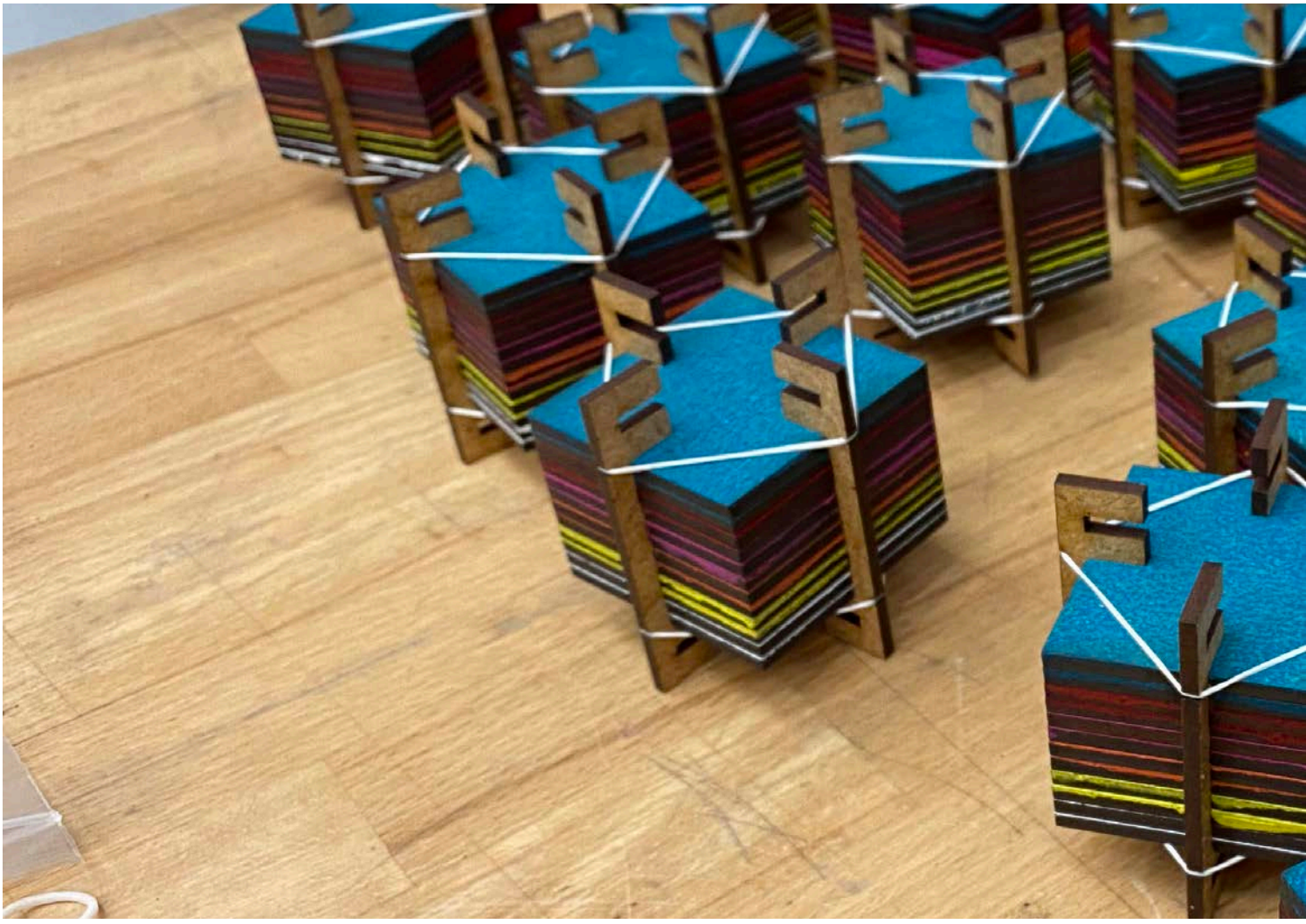


Fig. 37-41

Results

Out of the 40 students we worked with, 33 sent us photos of their constructions over the week. Below are a series of photos representing the diversity of constructions made by the students (Fig. 42-53).

Similar to our first exploratory probe, we were not able to be physically present for the second probe, because of the pandemic. For this reason, we created another survey to better understand how the students engaged with this next task. We divided the survey into two separate sections. While the questions in the first section referred to the previous probe, the second section asked students about the new probe. This survey was also anonymous, and out of the 40 students, 17 responded. Here is what we could gather from each of the questions:

'Wo befindet sich deine Figur im Moment und weshalb ist sie dort?'

«Müll, weil ich sie nicht brauche.»

«Sie steht nun bei mir zuhause auf dem Regal wo all meine anderen Zeichnungen ihren Platz finden.»

Most responses to this question demonstrate that students did not give much thought to where they placed their figure after the exercise, and that usually the figure was not on display for others to see. Some students also threw out their figure. Despite this, there were a few students who kept their figure and placed it somewhere consciously.

'In welchen Momenten hast du in der Zwischenzeit nochmals an deine Figur gedacht? Was ist dir durch den Kopf gegangen?'

«Es gab keine Momente.»

«Als ich Basketball gespielt habe.»

While most students had not thought of their figure since making it, others did when they happened upon it by chance. There was also the odd student who thought about the figure when they were engaged in an activity that they included in/on the figure.

'Was würdest du heute anders machen, wenn du die Figur überarbeiten müsstest?'

«Ich würde nichts dran ändern.»

- *«Kreativer gestalten.»*

Similar to the previous questions, the responses were more or less be split between doing nothing at all with the figure, to wanting to put more effort in and be more creative. It is important to note that we did not equate a lack of willingness to engage in our task with laziness, but instead believed we had not offered a suitable medium or method for these students to engage.

'Was war deine Strategie, als du die Skulptur gebaut hast? Was hat deine Entscheidungen beeinflusst?'

«Ich habe die Fächer welche mir wichtig sind nach oben getan.»

«Immer das zuunterst was ich zuerst mache.»

«Ich habe es so gebaut, wie ich Lust hatte.»

In the second probe, students tended to use similar ideas or logic to build their sculptures, often organizing their subjects in a vertical manner to represent the order in which they would complete or had already completed them. Other students in comparison built their sculpture based on what subjects they liked and disliked, or they went with more of a gut feeling or intuition, building the sculpture however they felt it was right for them.

'Mit welchen Ideen hast du die Skulptur am Mittwoch und Freitag verändert?'

«Ich habe sie so umgestellt, dass ich sah welche Aufgaben ich noch machen musste.»

«Meiner Motivation.»

«Ich wollte das sie nicht gleich aussehen.»

There were a wonderful variety of responses here, with students changing their sculptures according to how they had already worked, or what still needed to be done, which we had expected. We also received some more surprising answers. Several students considered how the pieces were only coloured on one side and used this to their disposal by facing them either towards or away from themselves to represent what still needed to be worked on. Others used motivation as a strategy or logic to adjust their sculptures.

'Was hat dir bei dieser Übung am meisten Spass gemacht? Was hat dich überrascht?'

«Das Bauen der Figur. Das man sie behalten darf.»

«Am meisten Spass hat mir das Bauen gemacht.»

«Ich fand es cool das ich kreativ sein konnte.»

Most responses were positive. Students enjoyed having the opportunity to build and create something. Moreover, those who do not consider themselves as creative appreciated being provided with a tool to express themselves. These responses support Resnick's argument that students who are not in kindergarten lack the appropriate tools and materials to be creative.

'Was ist dir an dieser Übung schwergefallen?'

«Eine sinnvolle Skulptur zu bauen.»

«Nichts, war eigentlich sehr witzig und abwechslungsreich.»

Most students did not seem to have a challenging time with this task. If there were any difficulties, often they were related to applying individual logic to the structure of the sculpture.

'Was würde deine Figur von Aufgabe 1 über deine Wochenplan-Skulptur denken?'

«Nicht schlecht, aber es fehlt mehr Freizeit.»

«Ich glaube, dass ich viel Zeit investiere.»

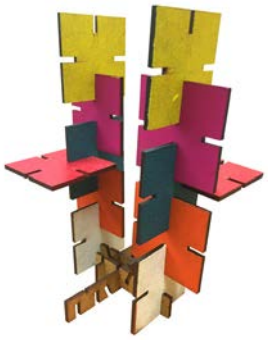
«Keine Ahnung.»

Our intention with this question was to invite students to reflect on their work through the eyes of their figure. While several responses to this question were left blank, many students answered as if they really were looking from another perspective, one which focused less on the actual building of the sculpture and more on what it meant for them. In two of the responses provided above, students were able to recognize that they invest a lot of—even too much—time doing schoolwork.

Findings & Insights

Based on both the results and survey responses we received, as well as the individual conversations we had with students, our second probe was able to engage students playfully and creatively in the task. In general, students were pleasantly surprised and appreciative of the creative method we provided for them. The approach allowed all students, especially those who may not view themselves as creative, to express themselves in several ways. While some students arranged the building block pieces according to the week and their school schedule, others made a clear distinction between their Freizeit and school work. What became obvious was that the Freizeit pieces tended to be more carefully considered, and that students associated their free time with their interests—not within their week plan.

The spatial (and visual) constructions allowed by the building blocks also provided students with new perspectives. Students were able to use their constructions to reflect on how they worked, where they spent their most time, and how they wished for more free time. When we asked them to explain their thought process with their construction, students benefited from having a tangible artifact in front of them for reference and to discuss.



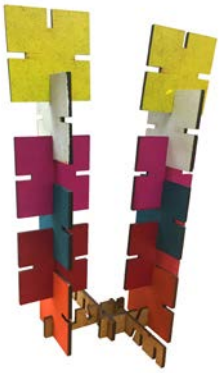
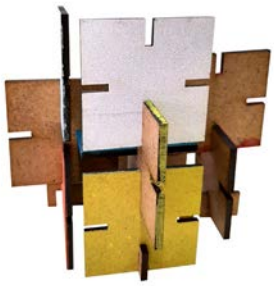
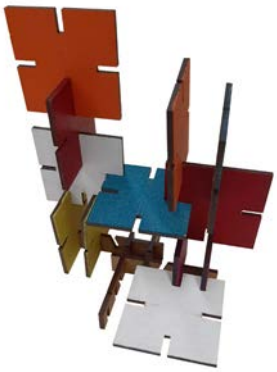


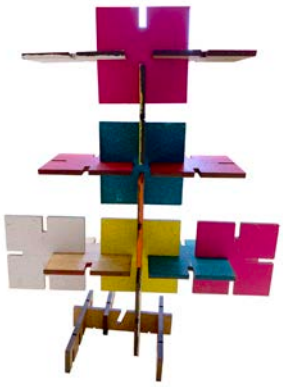
Fig. 42-45

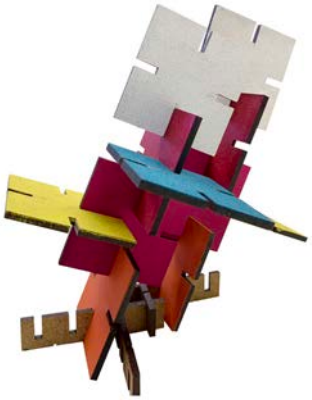
Fig. 46

Fig. 47-53









3.2.2 Fly on the Wall (FotW)

With the easing of certain pandemic restrictions we were allowed to visit and meet the students and teachers we had been working with, as well as those we would work with in the workshop. In preparation for our workshop, we wanted to gain a better understanding of the modern student and the classroom in general. We therefore used the Fly on the Wall (FotW) technique to observe both 9th grade classes, as well as the 6th grade class. During this time we were able to observe student behaviour across different age groups.

6th Class (11-12 Years Old)

Visiting Tamara Bösch's classroom was like jumping back in time. The walls were covered in colourful learning materials and posters, an assortment of books and games lined the shelves, and the blackboard was full of chalk writing. One of the main differences, however, were the various digital technologies lying about the classroom. The iPad had clearly become a valuable tool for these students to access information and complete their work—even document what they have accomplished and are proud of (Fig. 54-55). There was also quite a bit of energy in the classroom, so students were allowed and encouraged to skip or move in the hallways between tasks.

We were also fortunate to witness student choice in the classroom. In their English class the students had been given the topic or theme of "inventions and discoveries" and were required to work in pairs and create a presentation on a piece of A3 paper. In this instance, the students were provided the topic but could choose what invention interested them the most. The students worked together on their iPads, exploring different inventions and inventors. One student even made a mind map to help organize all the information she had found on the Internet (Fig. 56). While some students started with a shared initial interest and quickly became absorbed in their research, others chose the first thing they found in order to complete the assignment as quickly as possible. This observation suggests that providing students with choice does not automatically guarantee motivation and engagement in learning.

Fig. 54-55

Fig. 56-57

9th Class (14-16 Years Old)

Our visit with Stefan's class was a very different experience. The students outwardly directed more of their energy towards how they perceived themselves and were perceived by others. This could be seen in the variety of personal styles developing, the range of personalities on display (or not on display), as well as the interactions between students. This became increasingly apparent during their presentations regarding possible jobs and apprenticeships. Immediately after a presentation ended the students would be discussing the quality of each other's work aloud for everyone to hear.

We also had the chance to see the students working on their individual projects for their geography class. They had been given the topic of the rainforest and could then choose whatever they wanted research if it related to the topic. Furthermore, they were allowed to choose what form their deliverable would take. Most of the students were working on iPads, which made it easier to see what they were researching. One student was looking at images of Lemurs for reference as he drew a comic strip about the animal. Another student was watching what looked like a documentary about the deforestation of the rainforest. There was even a student searching for chocolate cake recipes (we assume this was connected to the production of cocoa). When we asked Stefan further about how students handle choice, he had mostly positive things to say. In general, students appreciate being able to make their own choices with regards to what and how they learn. Of course there are always students who do not show much of an interest in learning, and choice is not going to increase their motivation and engagement in school. He also shared with us a deck of method cards called "Lernerfolg ist lernbar," which help students throughout their learning process (Fig. 57).

3.2.3 Workshop

Preparation

Our initial work with the 40 students (ages 14-16) in Zofingen was primarily concerned with how they perceived themselves on an individual level, as well as in relation to their education. Were they able to identify with their education? And in what ways, if any, were they able to take ownership of their learning experience? Our findings and insights led us to question the current level of personalization in the learning experience, and how we could better motivate and engage students through choice. What if students were provided with more opportunities for choice, from what they investigate to how they share their findings? How could a tool use various dimensions of choice to guide students through a personalized learning experience, which would support and develop their intrinsic motivation, autonomy, competence, and relatedness? Additionally, how could education be enriched by learning through doing? These were questions we wanted to try and answer in a workshop with students.

As a result of our initial work with the school in Zofingen, as well as the easing of certain pandemic restrictions, we were offered the opportunity to pitch an idea for a workshop to teachers during one of their weekly meetings. One of the teachers, Tamara, showed interest and was willing to have her 6th class students participate in a 1.5hr workshop with us. Although we had read about Piaget's stages of child and adolescent development, as well as spoken to various individuals in the field of education, we still believed it was important for us to gain firsthand experience with students in a workshop. We wanted to understand for ourselves how different age groups engage with and understand our topic.

The goal of our workshop was twofold: first, to understand how students might imagine the future of education; and secondly, to gain insight on how students at this age handle the freedom of choice with minimal structure. We therefore split the workshop into two tasks. For the first task we planned to ask students how they imagined the future of schools and learning while simultaneously live drawing their ideas and thoughts on the blackboard. We were interested in knowing the students' hidden wishes or thoughts with regards to learning. The planning of the second task required more care and consideration due to the complex nature of choice, particularly student choice in a classroom setting. Our idea here was to create a guided learning experience for the students that would allow them complete freedom of choice in several dimensions, such as choice of topic and choice of 'deliverable'. As we had seen during our usage of the FotW method, the students were not completely foreign to having choice in the classroom. For this reason, we wanted to test out complete freedom of choice within a framework of questions and statements. The task was broken down into the following five steps:

1. *'Was möchtest du erforschen?'*
2. *Informationen Sammeln*
3. *Experimentieren*
4. *Zeigen*
5. *Wie weiter?*

These steps and any additional information, as well as space to document work, would be included on a worksheet for the students (Fig. 58-59). In the first step we would ask students individually to choose a topic or interest to explore and write it down on the dotted line. Once decided, they would then use their iPads to research and find information on the topic. The worksheet would also provide space for students to write down or sketch any interesting information they found during this time. From here, the next steps would be to experiment with how they could share their topic and what they found with their peers. Whether they created a poster, a comic, or an actual prototype, our goal here was to have students learn by doing and sharing with others. The last step was to have students think about where they could go next from here. To make our task clearer to students, we also planned to provide the students with an example of the task so they could better understand what

was expected of them in each of the sections (Fig. 60-61).

As previously mentioned, there are few studies on the effects of choice provision in the classroom. For this reason, we viewed our workshop as an opportunity to contribute to the understanding of how choice affects the motivation and engagement of students in an educational setting.

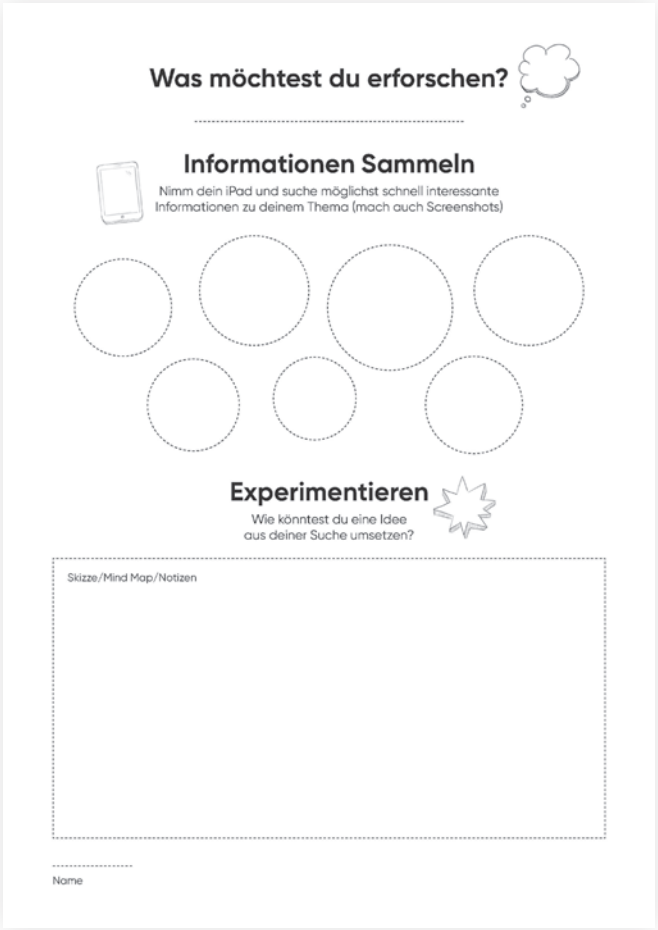


Fig. 58-59

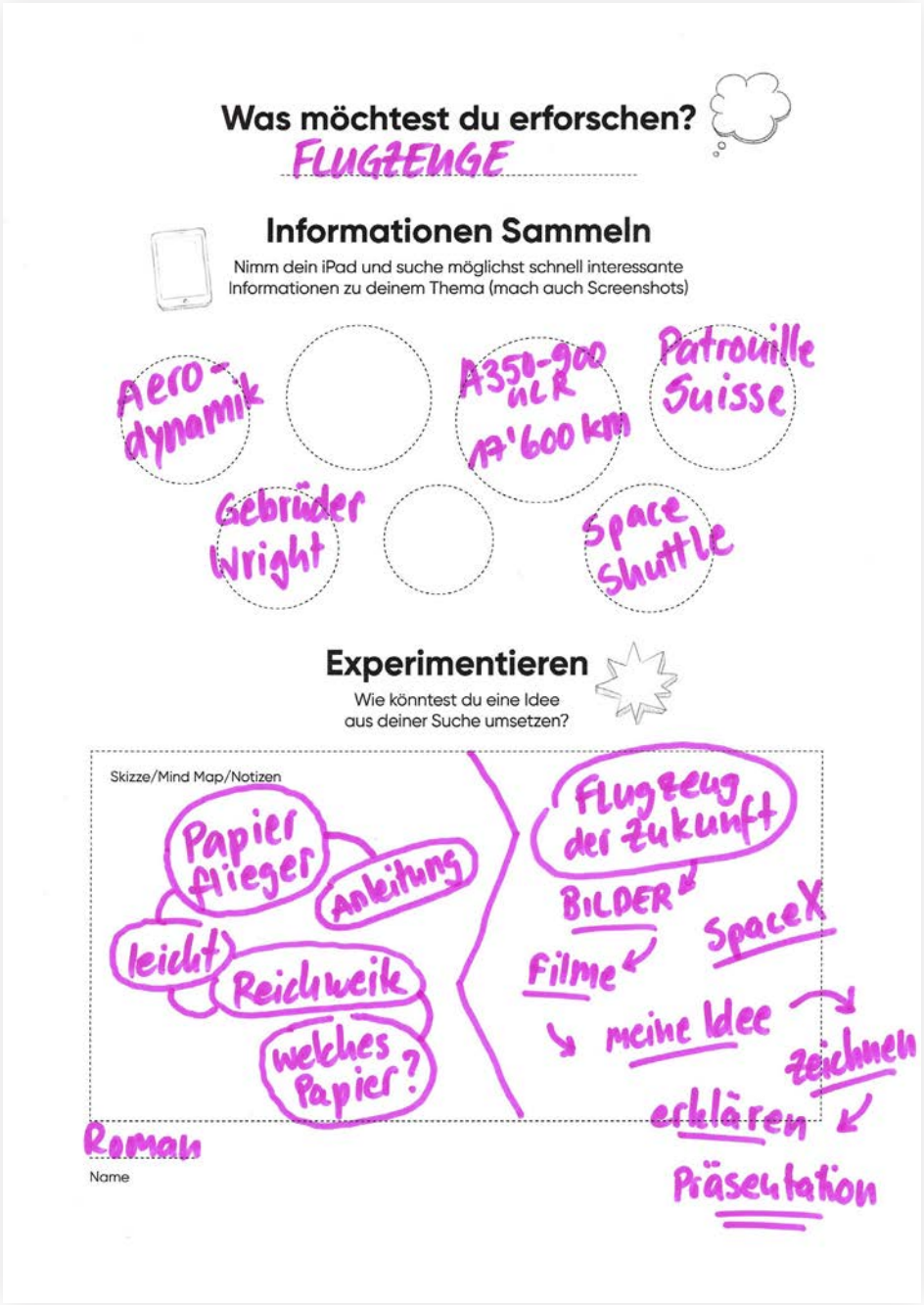

Was möchtest du erforschen?
FLUGZEUGE
Informationen Sammeln
Nimm dein iPad und suche möglichst schnell interessante Informationen zu deinem Thema (mach auch Screenshots)
Aero-dynamik
A350-900 neo
17'600 km
Patrouille Suisse
Gebrüder Wright
Space Shuttle
Experimentieren
Wie könntest du eine Idee aus deiner Suche umsetzen?
Skizze/Mind Map/Notizen
Papier flieger
Anleitung
leicht
Reichweite
welches Papier?
Flugzeug der Zukunft
BILDER
Filme
SpaceX
meine Idee
zeichnen
erklären
Präsentation
Roman
Name

Fig. 60


Zeigen
Was hast du herausgefunden?
Wie kannst du es anderen zeigen?
Das möchte ich zeigen...
1. Anleitung
1.
2.
3
4.
5.
6.
7. . . . .
2. Vorführung
Wie weiter?
Wie könntest du fortfahren?
Wie funktionieren flügel ?
Roman
Name

Fig. 61

School of the Future

Our workshop with Tamara's 6th class (ages 11-12) consisted of 22 students.

We began with an ice breaker game, where the students passed a ball around and said their name and one thing they enjoy doing or are interested in. We had seen Tamara use a similar approach with her students during our previous visit and thought it would be a fun way to introduce ourselves and ease them into the workshop.

We then moved directly into the first task, where we asked the students to imagine how the school of the future would look like (Fig. 62-63). As they shared their thoughts and ideas, we sketched them on the blackboard while also inviting students with ideas to do the same. The responses to this task began with funny and imaginary things, such as flying chairs and tables, robots for teachers, and iPad carrying drones. As the task progressed, however, the responses moved closer towards the personal interests of the students (e.g., gaming and boxing), future technologies, the learning of new languages, and a transition to homeschooling. At this point a few things became clear. The first being that technology already plays a key role in their education, and they expect it to become increasingly prevalent and prominent. Second, they have an idea of things they are interested in and would rather spend their time on

Fig. 62

these things than school. They might see their interests as separate from school. And lastly, that the pandemic has shifted their idea of where school can take place.

There were also some extremely insightful responses, such as ‘Schüler die sich selbst benoten’, ‘Vielleicht so ein Lern-programm wo man sagen kann welche Fächer man wann machen kann aber bis am Ende der Woche muss man alle Fächer gemacht haben’, ‘Viermal in der Woche Schule, und einmal hast du frei’, and ‘Minecraft spielen zum bauen oder Mathematik lernen’. These responses began to hint at their desire for a more personalized and creative learning approach. They want to have more choice in their class, with regards to what, how, and when they learn.

An Intrinsic Learning Experience

In the second half of the workshop we began our next task, where students worked through a personalized learning experience. We began by explaining the task with an example we had created ourselves. In our example we chose to explore planes and decided our deliverable would either be a paper airplane, or a sketch of what planes might look like in the future. Once we had run through the example, we allowed students to start.

In general, students required quite a bit of guidance to complete the task. Some steps required more help than others, and this seemed dependent upon the students' abilities, whether they were aware of their interests already, and if they had already been exposed to related questions or tasks in the classroom.

With regards to the first step, 'Was möchtest du erforschen?', some students knew immediately what they were interested in. For instance, one student wrote down gaming and explained that he had a variety of different gaming consoles at home and enjoyed playing all sorts of games, including Minecraft. He was extremely passionate about the topic. In contrast, there were students who were not sure what they wanted to explore or had too many options and could not decide what to choose. There was one student who originally wrote down Tik Tok, but then changed his answer to one of his favourite American rappers. When we asked him why he had done this he explained that he liked many things and was not sure what to choose. One could argue this was a case of choice overload. He clearly had interests but struggled choosing one interest over another and did not seem satisfied with his final choice of topic. We also had one student copy our example. Perhaps he was really interested in planes, he did not know what else to choose, or he did not feel motivated to find his own topic to explore. Despite this, he became incredibly enthusiastic and determined to find a superior airplane design. He also showed immense pride when sharing his result and explaining his findings.

Another interesting observation we made was the ease at which students were able to provide an example of what they like doing during the ice breaker game but struggled to find a topic of interest for this first step. This could have been due to a lack of clarity in our instructions, or the relaxed and fun atmosphere created by the ice breaker game allowed students to respond naturally off the top of their heads, instead of overthinking things. This shows us the importance in how the students perceive the act of learning from the very beginning of a task.

The second step, 'Informationen Sammeln', was easy for the students. In school they are already given tasks where they are required to search for information on the Internet. We observed that most students either found information on the topic by looking at images or reading Wikipedia articles. The students found this section of the task the easiest and only asked if they had enough information, or what they could then do with this information in the next step. It is important to highlight here that student research tended to remain on the surface. In other words, they did not spend much time exploring their topic. This could have been the result of a lack of time to complete the exercise, that the task was not engaging enough, or that they do not have knowledge of methods which could help them to explore.

This brings us to the third and fourth steps, which were 'Experimentieren' and 'Zeigen'. In these steps we observed several students not knowing exactly how they could share their work with others. While a few of them decided to work from the example we provided (a paper plane and the instructions to show others how to make one themselves), others just required a bit of guidance to find an idea. Once they had this idea, they were extremely motivated and engaged in their work, and excited to share it with others. There were also students who were really inspired and wanted to show others how they could make their own air balloon experiment, draw a whale, or even make a perfect basketball shot.

Based on our observations in this part of the task, we believe some of the problems students faced was a result of simply not having enough time. Furthermore, some of the topics chosen by students were quite abstract and therefore difficult to share with peers. It could therefore be beneficial for students at this age to be shown a handful of methods for how to share their work, as well as what types of information they could show (e.g. how to do or make something, information they have learned, etc.).

Fig. 63

Findings & Insights

During the second part of the workshop we had several important findings, both from our observations as well as the work produced by the students (Fig. 64-73).

Intrinsic Learning & Guidance

Throughout the task students required our guidance to support their intrinsic learning. For starters, many of the students became anxious or uncertain when choosing a topic at the beginning the task. With complete freedom of choice some students felt like they had to choose between their interests and were therefore unfulfilled with their decision in the end. Other students were unsure of what they were interested in or what we expected of them. When we had one-on-one conversations with these students, however, we were able to help them find a topic they were interested in and could engage in enthusiastically. In fact, most of the time students knew something they were interested in, but these interests were not considered as educational.

While we want to support students with more opportunities to pursue their individual interests in their education, we also see the value in guiding them into the learning process. This could be as simple as providing the topic for a project or assignment and allowing the student to choose more specifically what interests them in the topic. We understand that students at this age are still exploring what there is to learn in the world and believe they should do so with an intrinsic approach. When students experience a wide range of topics in an individual way, they may discover new interests and begin to draw connections between different fields.

Methods to Encourage Creative Thinking

We also observed most students using their iPads to research information on the Internet. While digital devices are useful for some things, we would argue that students would also benefit from learning and using creative methods such as sketching or paper prototyping, which encourage them to work with their hands and engage with their learning on another level.

A palette of methods to work from could also help students to work their way through barriers they face when they are learning. For instance, if a student is unsure where to start an assignment, they might use a design matrix to make decisions in a more playful way. Perhaps they even discover a method they enjoy and that inspires their work, such as the building of physical objects or the re-enactment of a scenario. To have such methods would help students overcome barriers, become more independent, and gain a stronger sense of ownership over their education.

Sharing for Yourself & Others

Every student who volunteered to show their work had been visibly engaged and motivated during the entire task and was excited to share their interests with the others. One student had been curious about the history and future of cars. His research led him from the first automobiles produced by Carl Benz to the CES (Consumer Electronics Show), where modern technologies are presented every year. He used sketching as a method to explain and show a future car system that allows cars to fly through magnetic fields built into the streets. By sketching the hovering car in an environment, his focus widened from the car to the environment and specific technology that would be needed for such a future. He even considered how the cars drive sideways on walls and asked what would happen if the WLAN connection of such a car would break down. What was also interesting to observe during this time was the support provided by the student's peers. For example, when we were selecting students to share their work, many of the students were pointing at one student and telling us we should let him present. When this student presented his design idea for a gaming console, he was visibly excited and proud of his work. Overall, this final part of the task revealed to us the importance of sharing in the learning

experience in general. Students can benefit from each other when they share their ideas and knowledge. This is especially the case when students can share their interests, as well as the work they are proud of.

Fig. 64-65

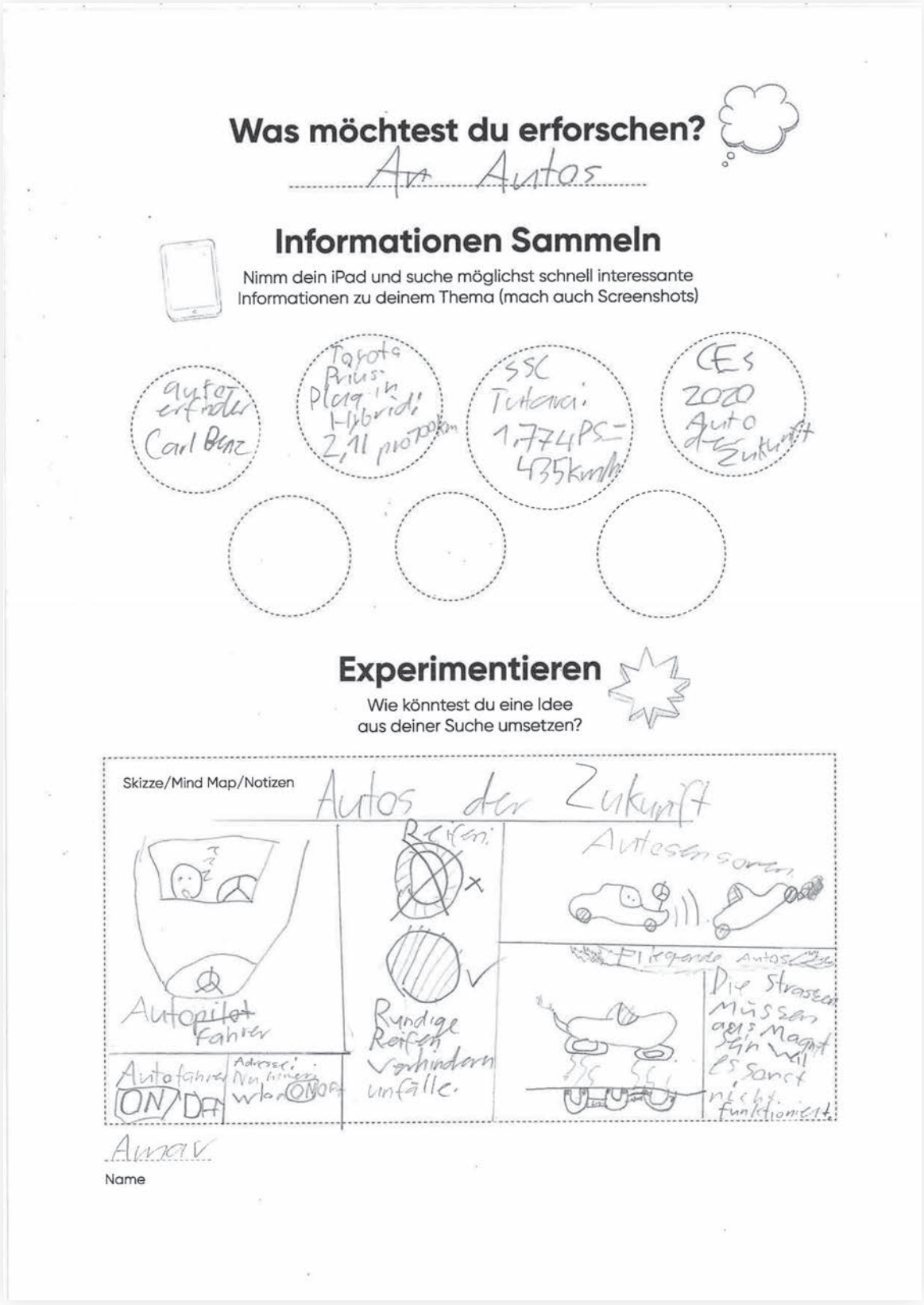

Was möchtest du erforschen?
Informationen Sammeln
Nimm dein iPad und suche möglichst schnell interessante Informationen zu deinem Thema (mach auch Screenshots)
Experimentieren
Wie könntest du eine Idee aus deiner Suche umsetzen?
Skizze/Mind Map/Notizen
Autos der Zukunft
Autopilot
Name

Fig. 66

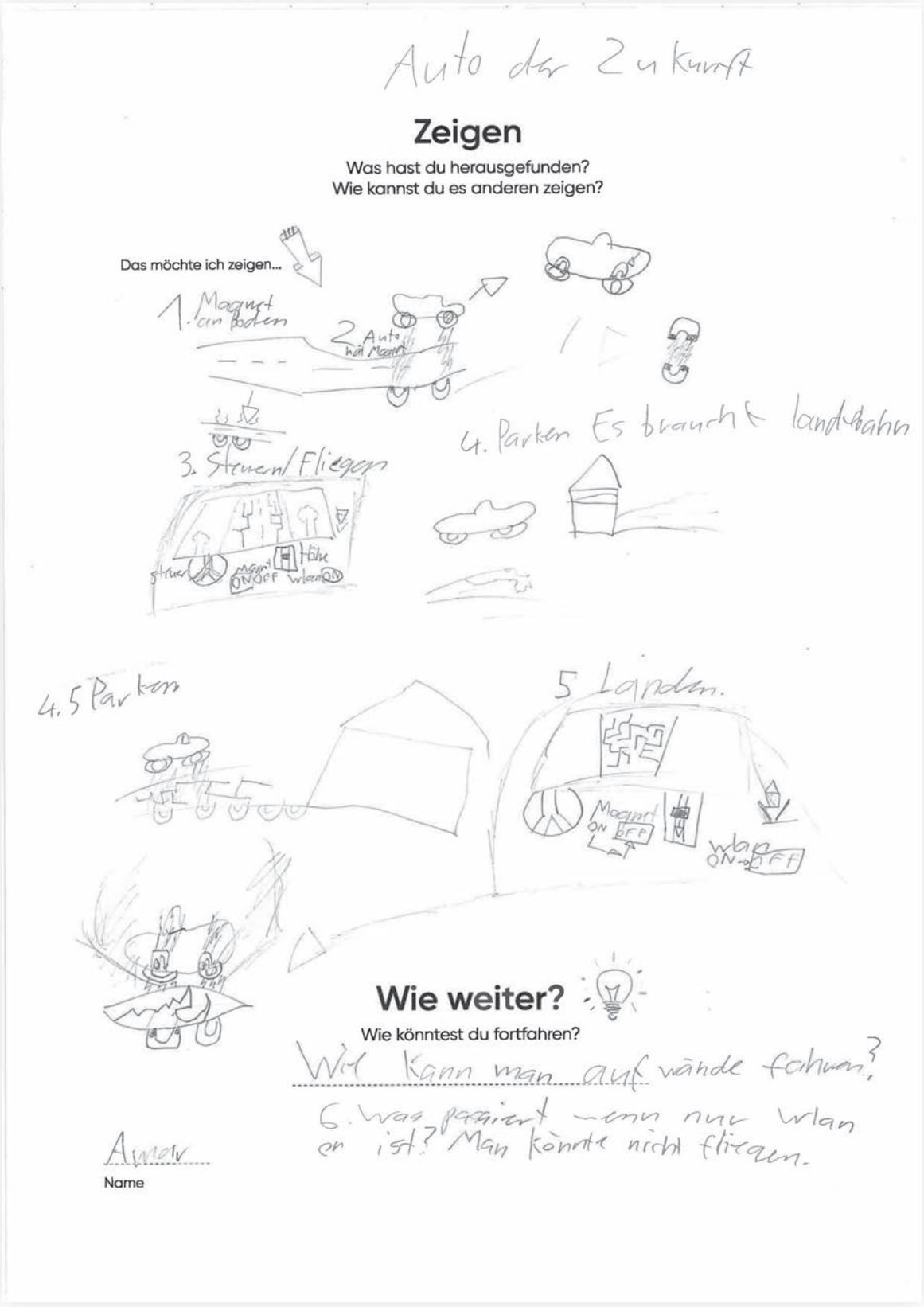
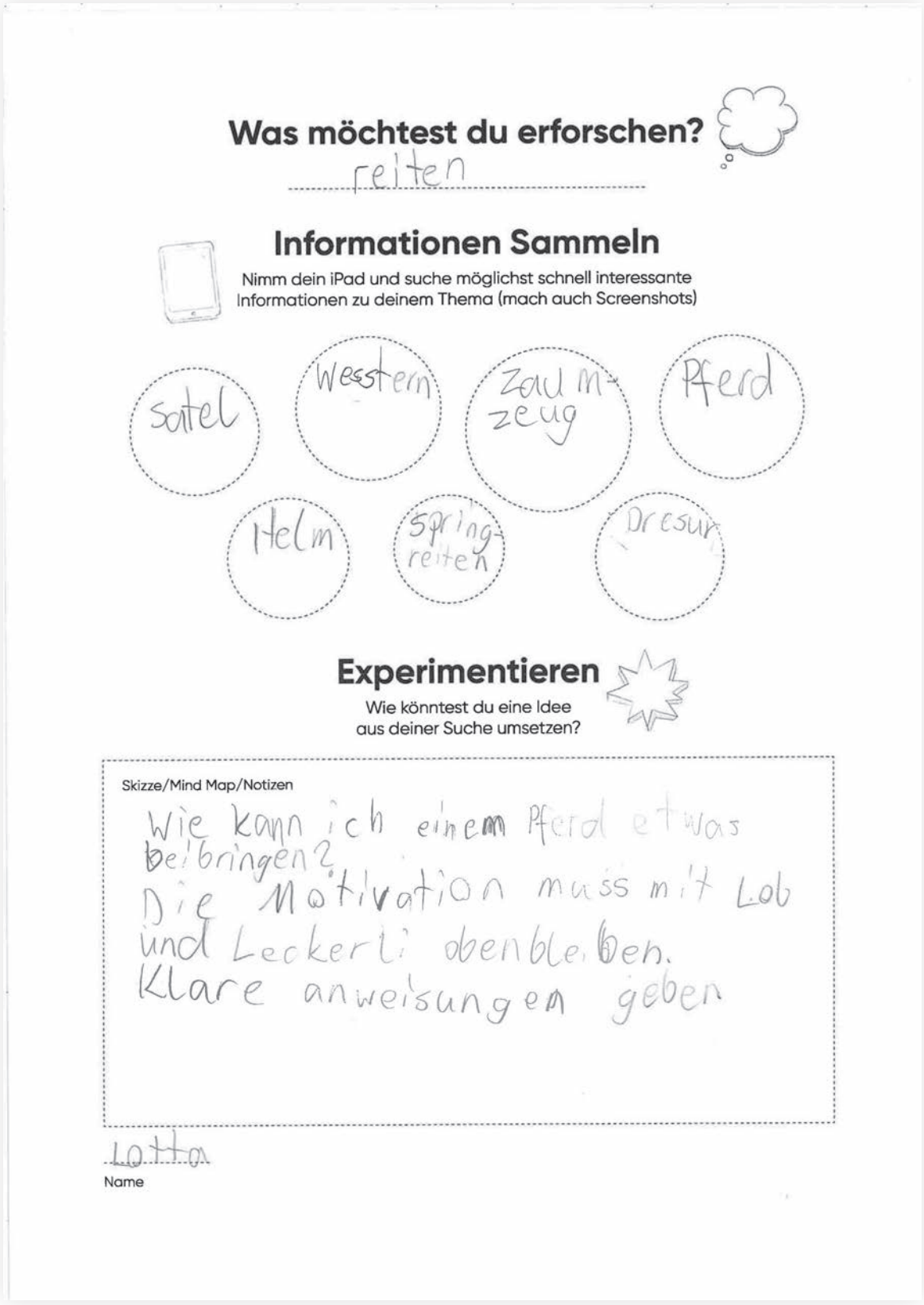

Auto der Zukunft
Zeigen
Was hast du herausgefunden?
Wie kannst du es anderen zeigen?
Das möchte ich zeigen...
1. Magnet am Boden
2 Auto hat Magnet
3. Steuern/Fliegen
4. Parken Es braucht Landebahn
4.5 Parken
5 Landen.
Wie weiter?
Wie könntest du fortfahren?
Wie kann man auf wände fahren?
6. Was passiert wenn nur Wlan an ist? Man könnte nicht fliegen.
Name

Fig. 67



Was möchtest du erforschen?

reiten

Informationen Sammeln

Nimm dein iPad und suche möglichst schnell interessante Informationen zu deinem Thema (mach auch Screenshots)

Sattel
Western
Zaumzeug
Pferd
Helm
Springreiten
Dressur

Experimentieren

Wie könntest du eine Idee aus deiner Suche umsetzen?

Skizze/Mind Map/Notizen

Wie kann ich einem Pferd etwas beibringen?
Die Motivation muss mit Lob und Leckerli oben bleiben.
Klare anweisungen geben

Lotta

Name

Fig. 68

Zeigen

Was hast du herausgefunden?
Wie kannst du es anderen zeigen?

Das möchte ich zeigen...

Das beliebteste Lekerli ist Leinbitz.

Wie weiter?

Wie könntest du fortfahren?

Wie schmecken die Leinbitz Leckerli?

Lotta

Name

Fig. 69

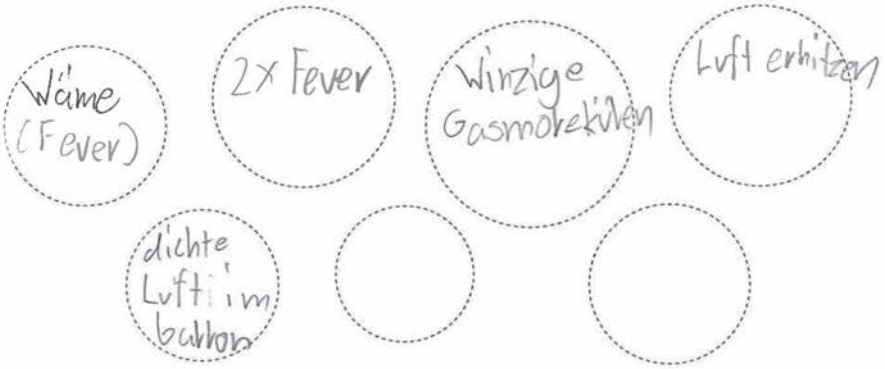
Sandro

Was möchtest du erforschen?

Heißluftballon

Informationen Sammeln

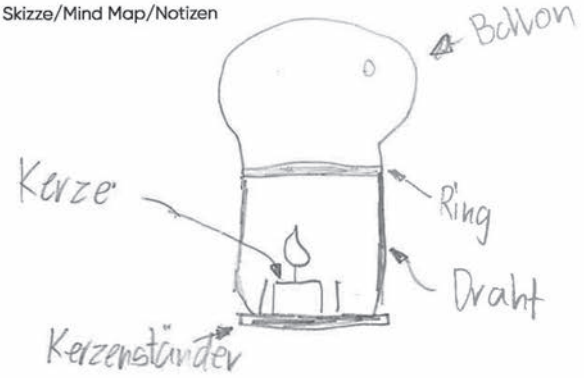
Nimm dein iPad und suche möglichst schnell interessante Informationen zu deinem Thema (mach auch Screenshots)



Experimentieren

Wie könntest du eine Idee aus deiner Suche umsetzen?

Skizze/Mind Map/Notizen



1x Ballon
1x Feuerzeug
1x Metal ring
1x Kerze
1x kerzenständer
2x draht ca 5cm
1x Freier raum

Sandro

Name

Fig. 70

Sandro

Zeigen

Was hast du herausgefunden?
Wie kannst du es anderen zeigen?

Das möchte ich zeigen...

1. 5cm Draht abschneiden

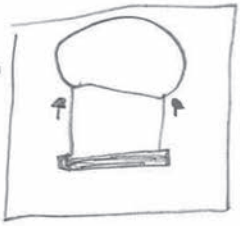
2. Draht an den Kerzenständer

3.

den ring an die öffnung von den ballon

das die Wärmer luft besser reinkommt

4.



Alles zusamen machen und die Kerze anzünden und fliegen lasse

VIEL SPASS !!

Wie weiter?

Wie könntest du fortfahren?

Was passirt wenn das helium auf die stimmbänder landet?

Sandro
Name

Fig. 71

Was möchtest du erforschen?

Gaming

Informationen Sammeln

Nimm dein iPad und suche möglichst schnell interessante Informationen zu deinem Thema (mach auch Screenshots)

erfunden am 1958

William Higinbotham

es gibt Wett bewerbe

Preis 500,000€

Tennis for Two

Micro soft X box series X

PS 5 X box series X

Experimentieren

Wie könntest du eine Idee aus deiner Suche umsetzen?

Skizze/Mind Map/Notizen

Alessio

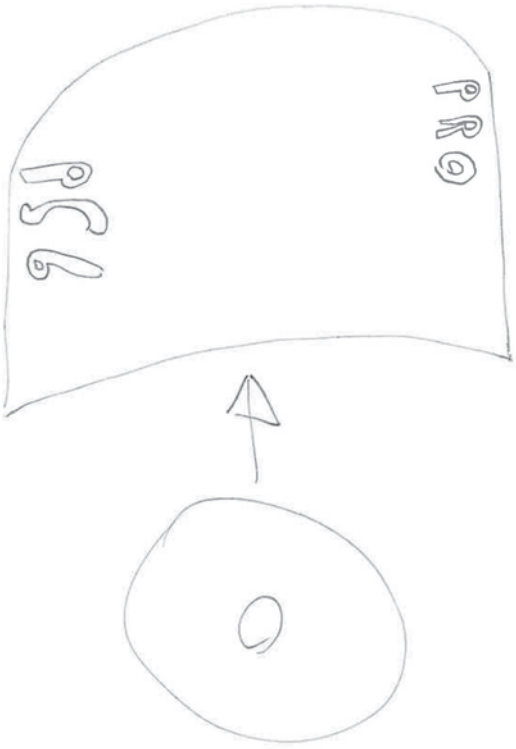
Name

Fig. 72

Zeigen

Was hast du herausgefunden?
Wie kannst du es anderen zeigen?

Das möchte ich zeigen...



Wie weiter?

Wie könntest du fortfahren?

neues Using für PS

Alessia

Name

Fig. 73

Teacher Feedback

Our initial feeling towards the workshop was that it was a bit chaotic. When we shared this with Tamara, she painted a completely different scene for us. She described how surprised she had been with her students' level of focus and engagement throughout the entire 90 minutes. It was in this moment that we realized things had only felt chaotic because we had been constantly moving from one student to the next. We had been too busy to see that students were working diligently at their desks.

Tamara also mentioned how a few of the students had surprised her. She observed that the students who are usually disinterested and unmotivated were engaged and motivated. These students were extremely proud of the work they produced during this time and excited to share it with others. In contrast, a few of the students who typically excel in the classroom had a more challenging time with the task. For us, this is yet another indication of a system which favours certain kinds of information and learning styles over others. We are not arguing that the system works for one student and not the other; the situation is more complex than it is black and white. For this reason, we believe that placing more emphasis on intrinsic learning and creative thinking will help support the development of all students.

Student Feedback

At the end of our workshop we had the students evaluate our exercise by placing a sticker on a matrix depending on how fun and interesting they found the exercise (Fig. 74). As each student placed their sticker, we also invited them to describe in one or two sentences how the exercise was for them. We found that most students placed their sticker in the top right corner of the matrix—very fun and interesting. Though they were likely influenced by their peers, many of the individual descriptions or comments from the students caught our interest. We translated and paraphrased the following statements of the kids:

«It was fun, because at first I did not know what I should do, but then I was very inspired»

«It was fun, but the topic that I picked turned out less interesting than I had expected»

«I found it very fun and interesting… Can I please show you afterwards what I have created?»

«For me it was fun, because I could do the exercise about Minecraft, and I play Minecraft myself. I also learned something new about it today.»

«It was very interesting to me because I was able to look at something new that I did not know anything about before and was now able to learn something about it.»

«I found it very interesting and fun, because I already did something similar in another school, but there we only had to write down what we already knew about a topic, and here we had the possibility to actually do research about something we like.»

These comments from the students demonstrated that the students were excited to learn about something they like, and that they earned new things about their interest or themselves. Moreover, some of the students were proud of their work.

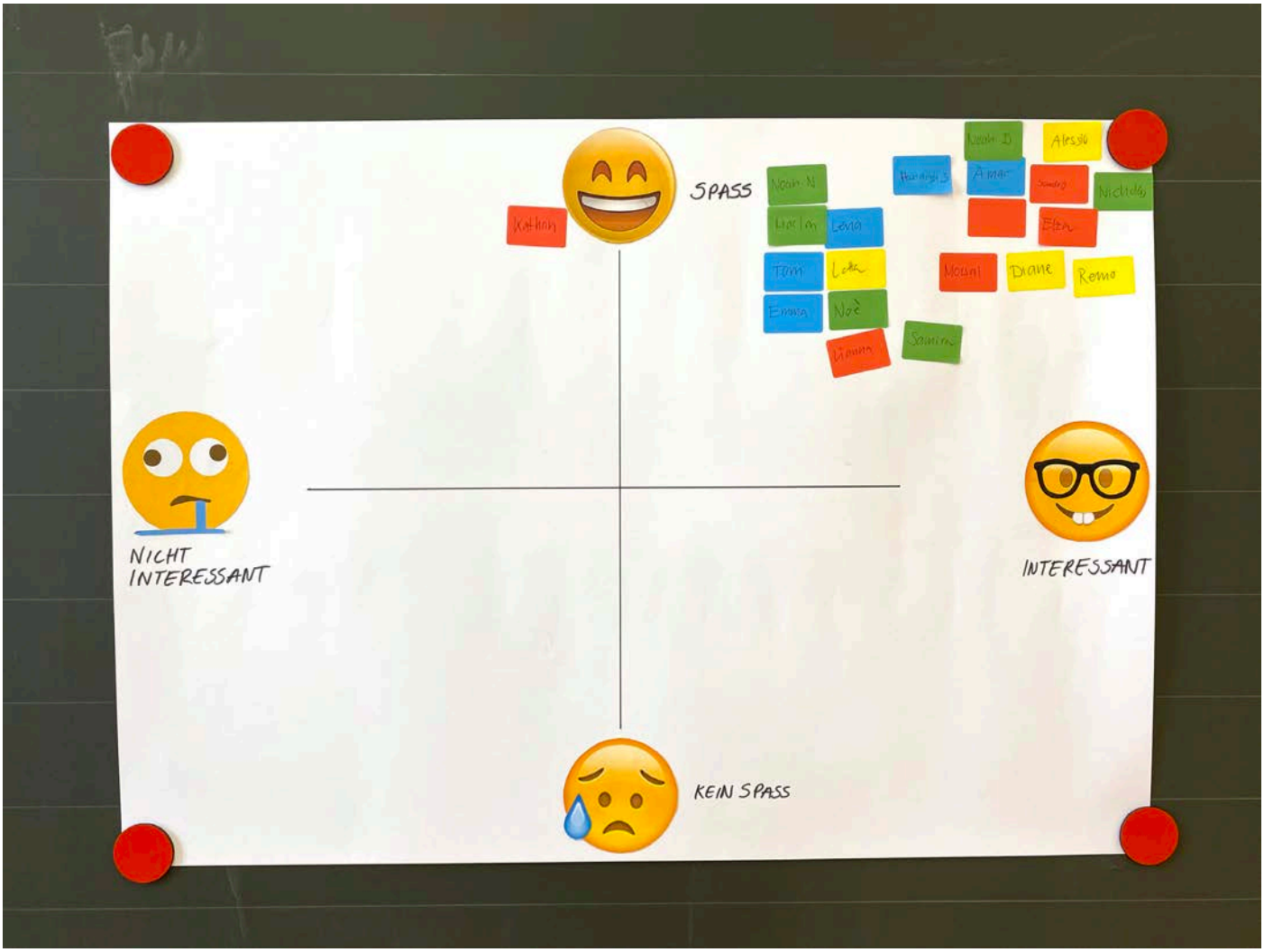


Fig. 74

3.2.4 Conversations & Interviews

Before our work with the school in Zofingen we began our research by having conversations with various people in the field of education. As we were unsure of what information to look for, we kept it informal and allowed the conversation to carry itself.

In our conversations we introduced ourselves, the field of interaction design, and our interest in education for our BA thesis. Depending on the flow of the conversation we sometimes shared initial ideas or concepts, but we really wanted to focus the individual's relationship to education, as each person had a unique perspective to share.

Judith Studer

Principal of Schule Wallbach

Our first conversation was with Judith Studer, the principal of Schule Wallbach in the canton of Aargau. She explained to us that, although Aargau was the last canton to have the Lehrplan21 (LP21) implemented, her school and its teachers had already been working with the notion of skills and competencies for quite some time. Their biggest unanswered questions up until now were 'How can competency be defined and measured?', 'How do students value themselves?', and 'How can teachers communicate to students where they stand in their learning process?' Judith described LP21 and the shift in focus towards skills and competencies as a process: 'Lernen ist immer ein Prozess. Kompetenz Lernen ist auch ein Prozess'. Every year the school is discussing where they can further develop and make changes, and many ideas are already being shared among teachers. From our talk with Judith we were able to gather that schools are ready for change and are constantly reflecting on how they can create a more valuable education for their students.

Christine Urand

Principal of Rietberg Montessori

Our next conversation was with Christine Urand, the principal of Montessori Rietberg Schule in Zürich. During this conversation we primarily discussed human development from a Montessori perspective. Our aim here was to gain a better understanding of how children develop so that we as designers could best support their needs. We also touched on the main teachings and principles of Montessori. We had two main takeaways from this discussion. First, that a child's curiosity needs to be supported and nurtured from an early age. Second, that children benefit immensely from learning through physical materials they can interact with.

Ryan Derby-Talbot

Founder, Principal Consultant of Reimagining Higher Ed

The third conversation we had was with Ryan Derby-Talbot, a consultant in supporting higher educational change initiatives. Previously a professor turned vice president and chief academic officer at Quest University Canada, he has since then been the founding chief academic officer at Fulbright University Vietnam, and has now set up an organization called Reimagining Higher Ed. During our conversation Ryan introduced us to the concept of self-authorship from Robert Kegan and explained how much of higher education is failing to provide students with the necessary conditions to make choices, reflect, and put together their own learning approach. We agree, and also believe students can begin to develop a sense of authorship over their education from an early age on.

Severin Hofer

Graduate of PH Zug and Kindergarten Teacher

Severin Hofer is a Kindergarten teacher in Rotkreuz, but we initially read about him in an article sent to us by Marcial regarding his BA work at the University of Teacher Education in Zug. He originally wanted to criticize the teacher training and its lack of consideration for student interests but had to change topics in order to finish school. He did, however, manage to publish his first thesis, 'Punkten Durch Bildung.' Though we touched on several topics during our conversation, we were most interested in his thoughts on the importance of student interests and intrinsic motivations in the overall learning experience.

Christian Müller & Christine König

Co-founder and Strategic Designer & Communicator from Intrinsic Campus

During our research we discovered Intrinsic Campus, an independent laboratory developing the prototype for future teacher training in Zürich. As they also imagine a future of teaching which focuses on the intrinsic motivations and interests of students, we arranged a meeting with the co-founder Christian Müller. Up until this point we had only worked with the public school in Zofingen and were curious to hear more about Intrinsic Campus' approach as an independent lab.

While speaking with Christian we learned more about their project "Intrinsic City". They are developing this tool in order to provide a solution and framework for an education without the curriculum or structure we know today, as they could not find an existing tool. With Intrinsic City they are looking to address the following areas of concern:

1. Lernumgebungsdarstellung: what does the learning environment of the student look like? Which resources are available and how can they be made tangible and accessible to the student?

2. Portfolio Management: how is a student's progress and overall learning experience manifested or visualized throughout their education?

3. Bewertung / Begutachtungsthematik: how are students graded or assessed? And how does this assessment connect them a life post school?

Based on our literary research and work with the students in Zofingen we could see the value of such a tool. We had also considered addressing some of these aspects in our own project with a particular focus on the second.

After this meeting with Christian we decided to submit a rough concept to Intrinsic Challenge—a method developed by Intrinsic Campus that invites others to submit ideas or concerns regarding education, specifically in the contexts of remote learning and digitalization. Once an idea or concern is submitted, a group of students from pedagogic universities attempt to develop innovative solutions or insightful responses in the time span of a week.

As a result of this challenge we received some valuable feedback from Christina König and one of the students who had looked at our concept. Our biggest takeaways were to focus more on student collaboration, as well as their ability to create their own methods to learn

3.3 Concept

Based on our literary and field research we see the value in providing a more personalized learning experience for the student. Doing so can enhance motivation and engagement in learning and help students to gain a sense of ownership and competency in their education. One approach discussed in the literature is to provide students with more opportunities for choice. There are several dimensions of choice, but some examples include choice of topic and format. During our field research we were fortunate enough to observe these kinds of choices being given to students and the positive effects they had. These kinds of choices will support students' development of their intrinsic motivation, autonomy, sense of competence, and relatedness—all key components of Kegan's self-authorship. For this reason, we want to develop a tool that will allow more opportunity for personalized learning, specifically through choice provision.

As the iPad is becoming increasingly integrated into the classroom learning environment and student learning experience, we believe a tool in the form of an app for this specific device is best-suited. Having said that, we also recognize the general concern around digital technology being used primarily to deliver and consume information. We want to use technology as a way for students to feel a sense of ownership over their education, to document their individual learning processes, and to learn by doing through the use of creative methods—not by simply regurgitating information. We believe the design process and its methods can help students begin to see learning as a non-linear and creative process.

The app will also help the teacher to support students' individual learning experiences while still following the curriculum. Whether teachers provide a topic in which students can choose something that interests them, or leave the choice completely up to the student, the app allows for the curriculum to be fulfilled and for students to develop skills and competences. In this regard, our app supports education now and into the future.

Being able to adapt to both the current school system, as well as possible futures of education which focus on the student, allows our app to be implemented by schools now. By helping teachers and students experience the benefits of an intrinsically motivated learning approach today, we can support the transition to an education for tomorrow.

3.4 Next Steps

When designing our app we need to ensure that it is contributing to an intrinsic, creative, and collaborative learning experience. To do this, we will explore, iterate, and refine the main features and functions of the app, as well as its architecture. In addition, we will further develop our app as a service as we consider the interests and touchpoints of the involved stakeholders.

Though it was our initial intention to prototype certain aspects of the app with the students, we found this to be near impossible without a fully developed app. For this reason, we relied mainly on click-dummies and feedback from our mentors and peers to iterate further.

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4 Project Development

4.1 From Concept to App

From the very beginning of our BA project we wanted to contribute to a future of education which places more emphasis on the intrinsic motivations and interests of students. In general, students who can pursue that which excites and inspires them, or sparks their curiosity, are more motivated and engaged throughout their learning experience. Moreover, providing students with the opportunity and responsibility to create their own approach to learning gives them a sense of ownership over their education, teaches them to work in a self-organized manner, and leads to a more enjoyable and fun learning experience overall.

We experienced similar sentiments while working with the school in Zofingen. Many of the teachers were already testing out new ideas and approaches in their classrooms to provide their students with more opportunities for intrinsic learning. These ideas and approaches were visibly popular among the students, who appreciated the chance to learn what they wanted and how they wanted.

What our workshop revealed to us, however, was that students need guidance and support throughout an intrinsic learning process. As designers, we were able to offer this support by suggesting a variety of different creative methods, such as mind maps, sketching, and paper prototyping. These methods helped the students in moments where they felt unable to continue their work flow.

It was only after the workshop that we realized we had inadvertently become the tool we wanted to design, and that the design process and its methods are well-suited for an intrinsic learning process. Our work process and palette of methods help us as designers to learn by exploring and experimenting, as well as to work with our hands.

We therefore want to support students and teachers with this transition by designing an app which guides the student through such a learning process, like a designer would. We cannot be sure of which direction the future of education will take, but we want to support and encourage an intrinsic learning process now, as well as into the future.

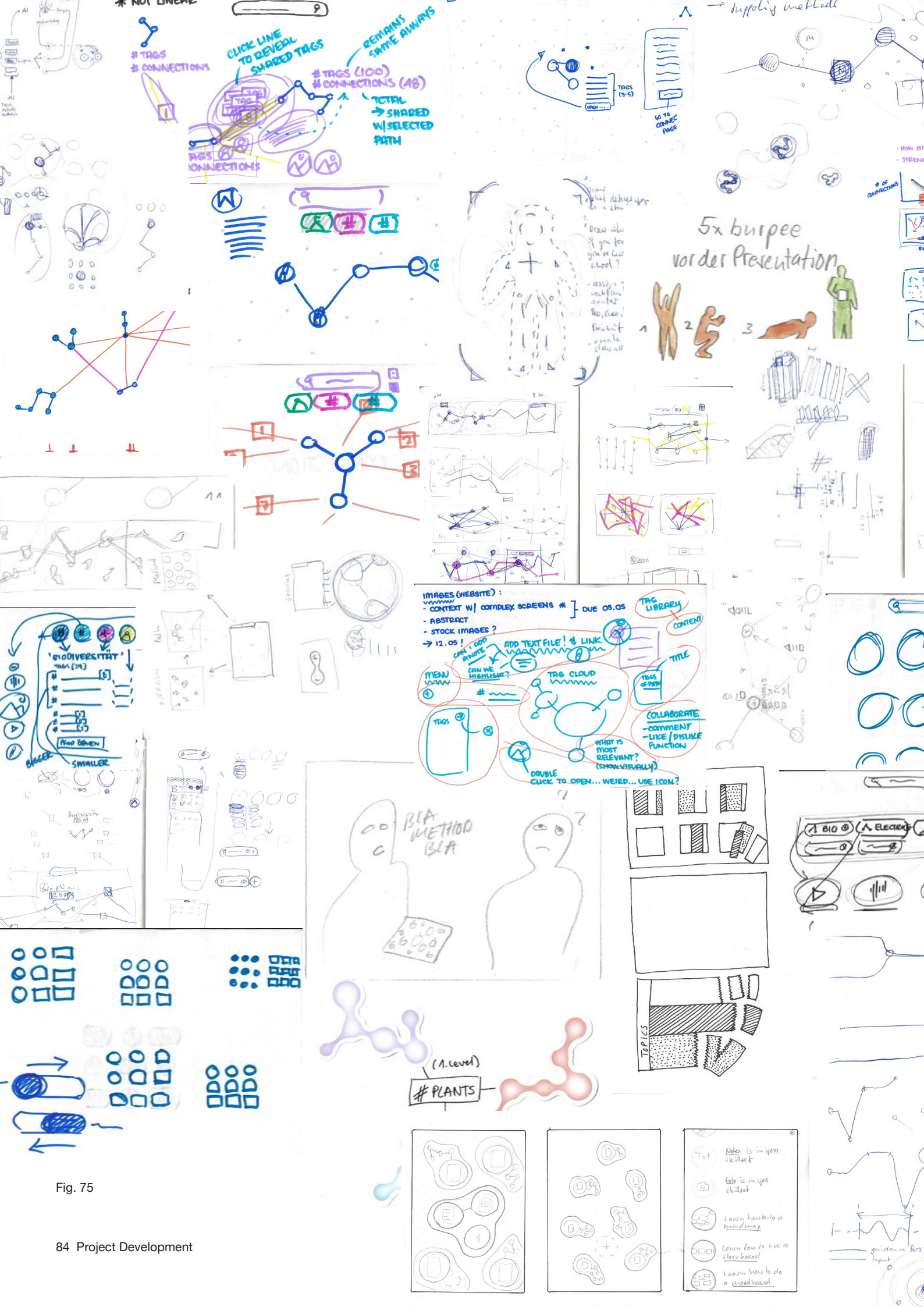
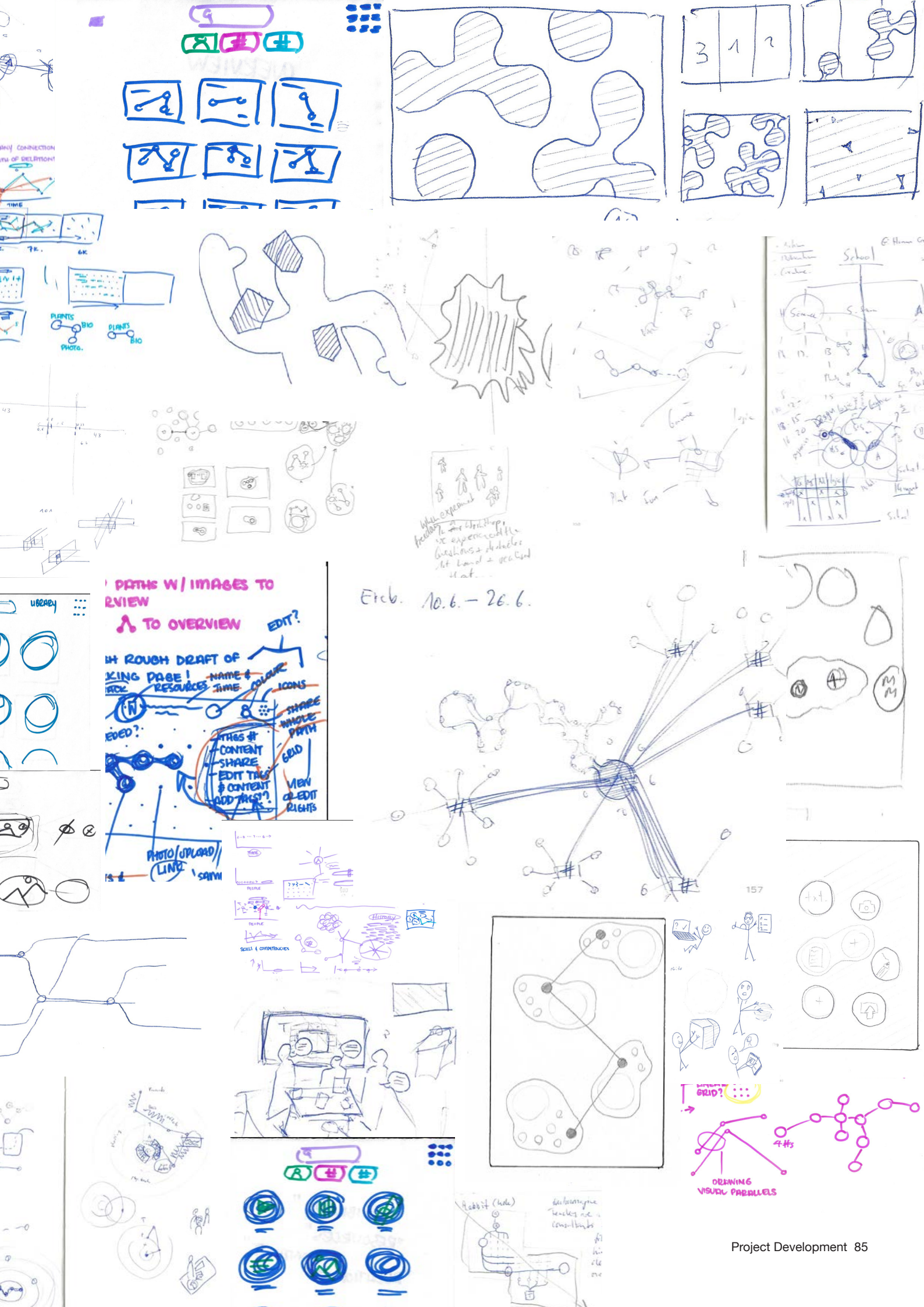

5x burpee
vorder Presentation
IMAGES (WEBSITE) :
- CONTEXT W/ COMPLEX SCREENS *
- ABSTRACT
- STOCK IMAGES ?
→ 12.05 !
DUE 05.05
TAG LIBRARY
CONTENT
ADD TEXT FILE! & LINK
TITLE
MEAN
TAG CLOUD
TAGS OF PATH
COLLABORATE
-COMMENT
-LIKE/DISLIKE
FUNCTION
WHAT IS MOST RELEVANT? (SHOW VISUALLY)
DOUBLE CLICK TO OPEN... WEIRD... USE ICON?
BIA METHOD BLA
(1. Level)
PLANTS
TOPICS

Fig. 75


PATHS W/ IMAGES TO
RVIEW
TO OVERVIEW
EDIT?
H ROUGH DRAFT OF
KING PAGE!
RESOURCES
NAME &
TIME
COLOUR
ICONS
SHARE
WHOLE
PATH
GRID
VIEW
& EDIT
RIGHTS
CONTENT
SHARE
EDIT TAG
& CONTENT
ADD TAGS?
PHOTO/UPLOAD
LINK
Erleb. 10.6. – 26.6.
GRID?
4 Hs
DRAWING
VISUAL PARALLELS

4.2 Learnings from the Workshop

During our workshop we had several insights which influenced our design decisions. In the following section we highlight these insights and explain in more detail why we decided to design an app which guides the student through an intrinsic learning process using documentation, the integration of an intelligent system, and design methods. We also discuss the value we see in creative thinking and collaboration for the future of education, and the ways in which our app looks to encourage such behaviour.

4.2.1 Documentation of the Learning Process

While working with the students it quickly became clear that they associate education, particularly the future of education, with digital technologies. The school is well equipped with modern technologies, and students already use iPads on a regular basis to find information on the Internet and complete assignments. In fact, the school will soon be able to provide an iPad for each student.

While we also value technology, and believe it has potential to help students in their learning experience, we do have our concerns. We worry that technology is primarily being used to perpetuate an outdated model of education. More specifically, that students are using these technologies to continue absorbing and regurgitating information, which we observed with the students from Zofingen when they used the iPad to find information and copy it down. It seemed as if there was no deeper engagement happening, and it was clear the students understood learning as a task to be completed.

We want to use technology to engage students more deeply in their learning and view it as a process. In other words, place more emphasis on the act of learning rather than the outcome. This is because our best learning happens when we try new things and make 'mistakes'.

One way to shift the focus towards process is by having the student document their work in a digital format. Documentation makes process tangible, which would help students to engage more deeply and thoughtfully in their work, not only in the moment, but also after the fact and with others. We also see it as a way for schools to move away from a purely quantitative assessment of students. This is extremely applicable in the case of the Lehrplan 21 in Switzerland, which places more focus on the students' development of skills and competencies. We believe the assessment and interpretation of skills and competencies could be supported with student documentation.

4.2.2 Recognizing Learning Patterns

The digital documentation of work would also allow us to consider the integration of an intelligent system, which could help the student become aware of connections and patterns across their learning processes. For instance, what topics they tend towards, how these topics are related to one another, how and with whom they prefer to work, and what methods they like to use. We can speculate that students might begin to understand learning as interdisciplinary in nature, instead of being strictly categorized into subjects which are taught separately.

4.2.3 Use of Methods

During our workshop we observed students as motivated and engaged when presented with the opportunity to make choices based on their interests and intrinsic motivations. Students were excited with this opportunity and worked diligently at their desks. Having said that, every student required some support and guidance at different points throughout their learning experience—even if it was driven by their interests and intrinsic motivations.

We provided this support offering the students a variety of design methods to help lift them out of moments where they felt stuck or inspired but unsure of how to continue. As designers we use design methods all the time. We use them to explore without a clear direction or intention, to

gather and analyze information, to experiment and prototype, to understand and collaborate with others, to translate and communicate information, and to create and share experiences. Design methods help to keep the learning process going. We therefore see design methods as being extremely beneficial in the learning process in general and want to share them with students to help them create their own approach to learning.

4.2.4 Externalize, Share, Collaborate

The use of design methods could also help students to engage more deeply in their learning process by encouraging them to work analog, creating things with their hands and having experiences off screen. In this sense, our values align with Papert's theory of constructionism. When a student constructs or creates something, they can externalize their thoughts and ideas and better understand themselves. They are also then able to share these thoughts and ideas with others, mainly their peers. By sharing their work, students can inspire one another, teach each other new skills, collaborate, and provide valuable feedback. These soft skills are essential, not only for the classroom environment, but for life post school. Individuals who can think and work creatively, to collaborate, and to share work and give others constructive feedback will be better prepared for a world of increasing complexity, uncertainty, and fragility.

4.3 App Development

After gathering and analyzing our main insights from our workshop we further developed and refined the following main components or features of our app: documentation of the learning process, the built-in intelligent system, design methods, and collaboration.

4.3.1 Documentation & Learning Paths

When developing this feature of the app we had two main concerns. The first was how we could provide students with a simple and yet flexible way of documenting their learning process, and the second was how this documentation would create an understandable learning path for the student.

With regards to the first concern, we are aware that each student learns differently, and therefore should be able to document whatever suits them. For this reason, we provided the student with four options for documentation: taking a photo of their (analog) work directly with the built-in camera of the device, uploading a file (e.g., video, audio, text, photograph, screenshot, etc.), attaching a link to an external resource, and finally a 3D-scan.

We decided to include the camera function of the tablet within the app, primarily because it offers students a fast and uncomplicated way to document their analog work in the moment. We want to encourage students to work off screen with their hands and know from experience as designers that photos are a quick and easy way to show others what you have done, to help explain your thoughts, and to reflect on your work.

As students will be working on their devices, we cannot exclude the option of uploading a file. If students want to upload a screenshot of something that caught their interest, a text file or pdf, a video they have cut and edited, or even an audio recording, they should be able to do so. The iPad, for instance, makes this kind of creative work possible with its pre-installed software such as GarageBand and iMovie.

Of course we want to encourage and give options for analog work, but material produced digitally can also show a student's engagement in their learning process.

We also understand that students will search for information on the Internet, and that this information is an important part of the learning process. Students should therefore have the opportunity to save links to interesting articles, videos, tutorials, etc. to their learning paths, not only to show what contributed to their learning process, but also to easily access these important bits of information again when needed.

Finally, as we are focusing on the digital documentation of student learning processes, we are also considering how modern technologies could be integrated into future learning scenarios. One such technology is the 3D-scanning of objects or environments, which the iPad Pro can now achieve with its built-in LiDAR sensor. We imagine the scanning of 3D objects could allow for student work to be shared and experienced in new ways. One example where such a technology could benefit students is in a remote learning scenario, similar to what we have experienced during the pandemic.

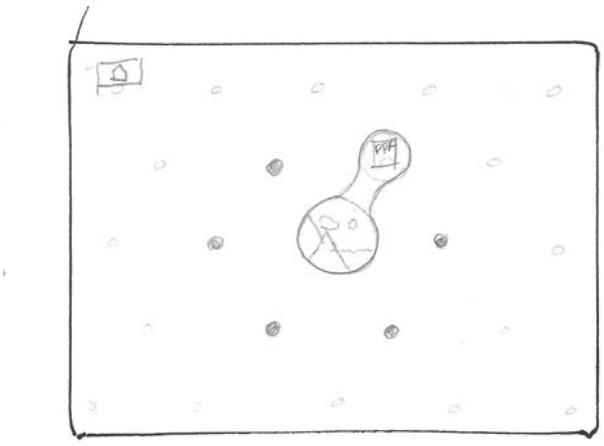
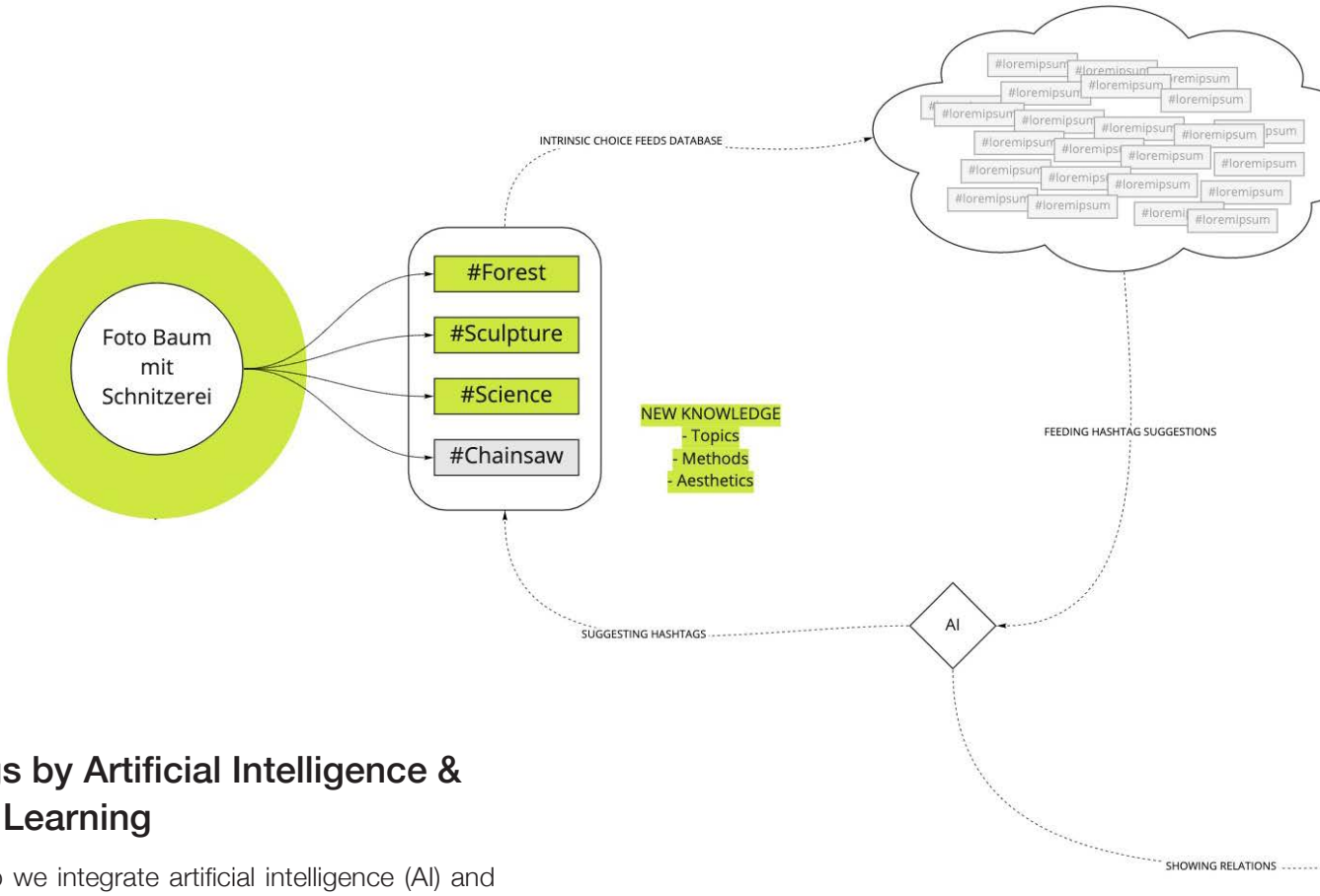


Fig. 76

To address the second concern, students build learning paths on a triangular grid of points (Fig. 76-79). A learning path is created when a student begins to document their work. The path then continues to grow as information is added throughout the project. As the learning process is not necessarily linear, we wanted to provide students with the flexibility to choose which direction they build their learning path, and from which point on the path they build. This means that a student's path could be linear or nonlinear with off-shoots in various directions, indicating that they have tried out different approaches or methods. Building the learning paths in this way might help the student to visually understand how the learning process itself can go in many different directions and take on many different forms, which can be more interesting than the outcome of the work itself. This diversity will be increasingly observable as the student's paths grow and accumulate over time.

Fig. 77-79



4.3.2 Tags by Artificial Intelligence & Machine Learning

With our app we integrate artificial intelligence (AI) and machine learning technologies to support a shift towards interdisciplinary learning (Fig. 80). The technologies function by analyzing and assigning tags to student created documentation across all learning paths. When new content is added to a learning path a list of tags is suggested based on an algorithmic analysis of the information provided, whatever type the file or resource may be. The student is then able to edit the suggested list of tags according to their preference, which in turn trains the system to suggest more suitable tags over time. These tags help the student to reference and search for specific content later.

Having multiple tags for each instance of documentation within a path also allows for the recognition of relationships between different paths. Providing this information for the student in a visual way may help to reveal connections or ‘red threads’ they may not have been previously aware of, as well as inspire new directions. For example, an image of a tree documented by a student within their current learning path about rainforests might show a connection to a previous project about car engines, as they both share a tag titled “CO2”. This could inspire the student to learn more about the impact of car exhaust on the rainforest.

We therefore see value in using AI and machine learning in education to support and strengthen an interdisciplinary approach to learning. Working with tags, and linking similar tags across different learning paths, allows for a more connected learning experience.

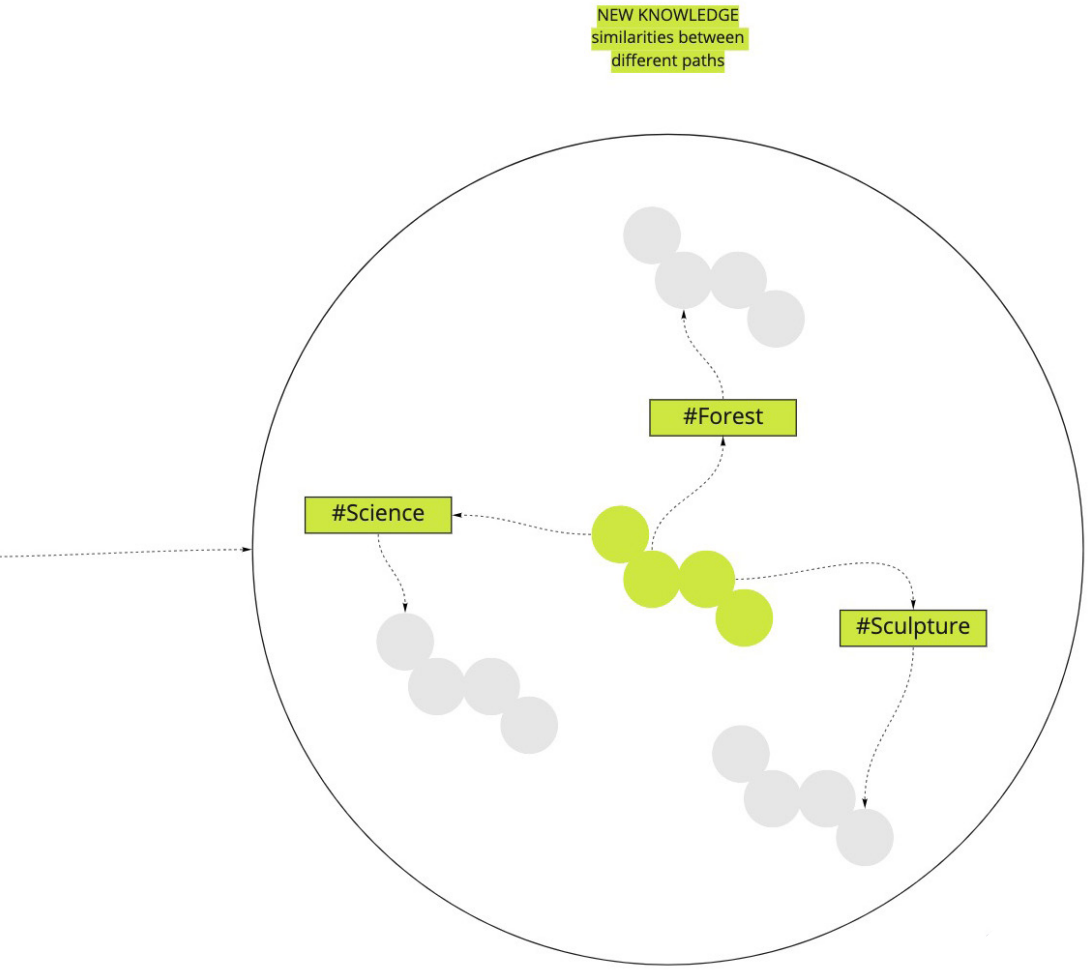

NEW KNOWLEDGE
similarities between
different paths
#Forest
#Science
#Sculpture

Fig. 80

4.3.3 Design Methods

To best support students in an intrinsic learning process we want to provide them with a selection of design methods that show what is possible at different moments in the learning process, and that they can browse through. In other words, these methods should be viewed more as a source of inspiration for students, rather than a set of step-by-step instructions. Furthermore, we want these methods to promote and encourage creative thinking with a specific focus on analog work. The methods should provide a visual aid of how the method works, as well as a brief text which aims to describe its usage in such a way that students feel they can add their own spin to it. It is not about simply delivering information to students, but instead encouraging them to think about how they can use these methods in a way that works for them (Fig. 81).

Fig. 81

We also see value in having methods which provide the students with different learning mindsets. For instance, we believe the best learning happens when we are allowed to make mistakes. We want to provide methods which would encourage an approach such as this by describing the benefits and suggesting ways in which the student could navigate such mistakes. Promoting these kinds of learning mindsets may provide better support for students with lower self-esteem by demonstrating to them, as well as their peers, that learning is less about the destination and more about the journey.

In addition to providing a selection of methods, we see the benefit in having students create and share their own methods. We want students to feel inspired to adapt the methods—even develop their own—and share them with their peers. Students should have a voice in their education, not just in what they choose to learn, but also by contributing to the collective knowledge of the classroom. Learning is a collaborative and collective experience, and we want to emphasize and encourage this.

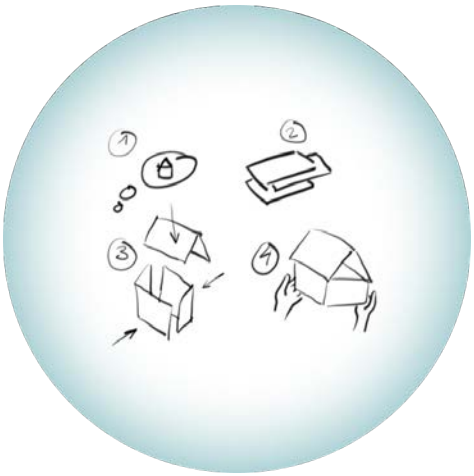


Fig. 82-84

4.3.4 Collaboration

We view collaboration and sharing between students as an important part of the learning process. Whether students are working on a project or assignment together, or wanting to learn from each other, they should be able to share either an entire path or specific path points. We give students this option when they are inside the working path mode. There they can interact with the share icon, where they will be prompted to select what they want to share (i.e. a specific point on the path or the entire path), and whether they want to give editing or viewing rights. A link will then be created for them to share with their peers (Fig. 85-86). Students who receive access to a path or path point will be notified, both by email and within the app. Shared paths and path points can always be found on the overview page, either by scrolling through the section dedicated to shared paths and path points, or by searching in the search bar for the path name or by collaborator.

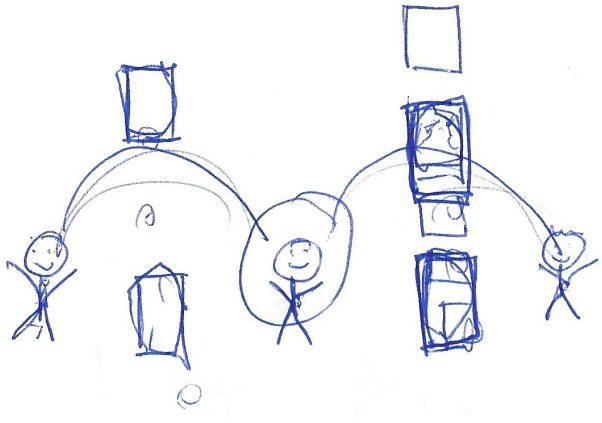


Fig. 85-86

When working on a specific path with their peers, collaborator icons appear on the top right of the screen to indicate who has been given editing rights to the path. These icons contain a thumbnail photo of the collaborator and have an active as well as an inactive mode. When collaborators are actively working on the path their icons are highlighted, and the student can see if and when they are adding on to the path (Fig. 87). Whatever is in the process of being built or added on to the path is indicated with a semi-transparent, ghost-like path point, which becomes fully opaque when added to the path. If the collaborator is not currently active on the path, their icon is no longer highlighted. We believe the ability to see your peers actively working on a path helps to bring this collaboration more to life, especially in remote learning scenarios.

Communication is also an important aspect when collaborating with others. For this reason, we have also provided students with the ability to comment on what their peers have added to the path or changed in general (Fig. 88).

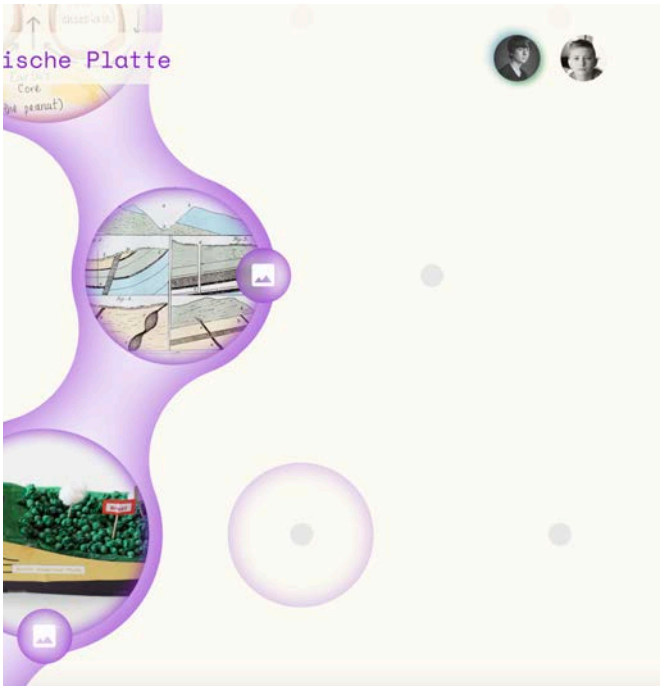


Fig. 87-88

4.3.5 Information Architecture

While developing our learning app the information architecture continued to evolve. We began with the two most important features. First, the path view where the student documents their learning paths, and second the method library, where students have access to a wide range of methods. We also added an overview page which organizes either by learning paths or path points, as well as a connection timeline. Here, students can view all the learning paths they have created throughout their education in chronological order, as well as discover the connections between them. These four features form the basic architecture of our app and create a flat navigation (Fig. 89).

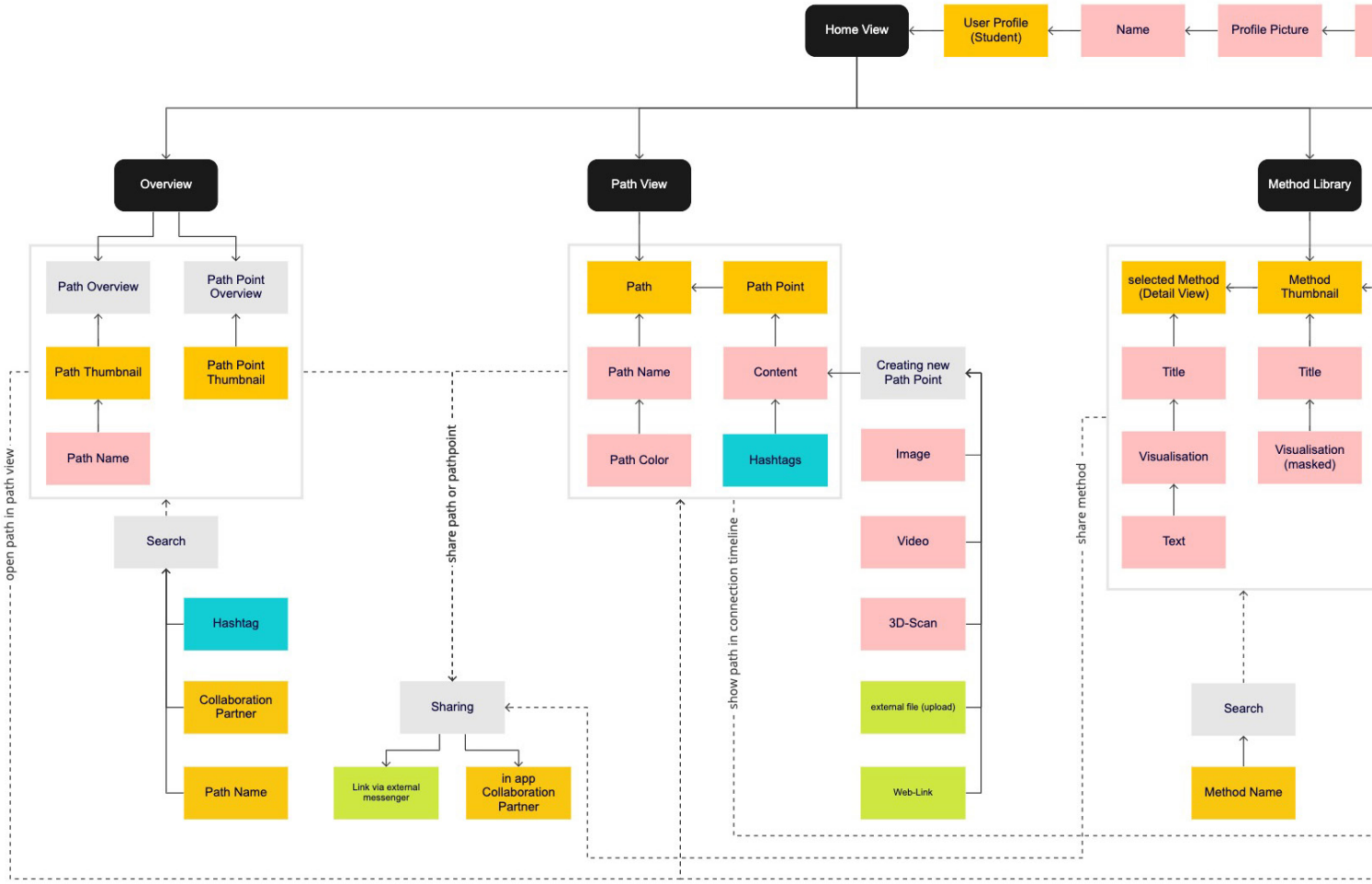
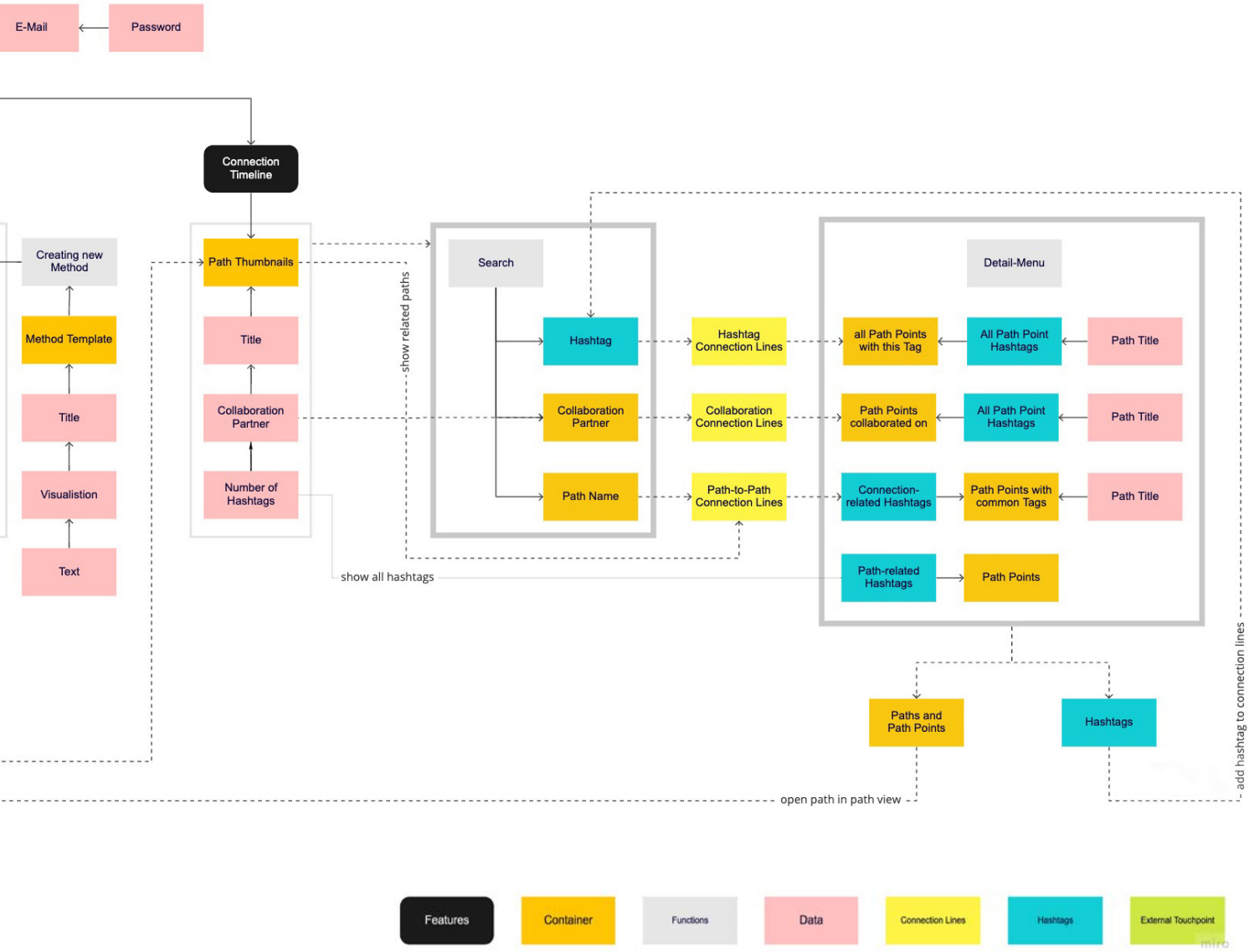


Fig. 89


E-Mail
Password
Connection Timeline
Creating new Method
Method Template
Title
Visualistion
Text
Path Thumbnails
Title
Collaboration Partner
Number of Hashtags
show related paths
Search
Hashtag
Collaboration Partner
Path Name
Hashtag Connection Lines
Collaboration Connection Lines
Path-to-Path Connection Lines
show all hashtags
Detail-Menu
all Path Points with this Tag
Path Points collaborated on
Connection-related Hashtags
Path-related Hashtags
All Path Point Hashtags
All Path Point Hashtags
Path Points with common Tags
Path Points
Path Title
Path Title
Path Title
Paths and Path Points
Hashtags
open path in path view
add hashtag to connection lines
Features
Container
Functions
Data
Connection Lines
Hashtags
External Touchpoint

Home View

Upon opening the app and logging in, the user lands on the home view where all four features of the app are provided. This allows the user to immediately choose what they would like to do and is especially important for new users who may be unaware of what the app offers. We believe a flat navigation helps the user to quickly and effortlessly access all features whenever needed. This is important for an app that is meant to accompany a student throughout their working process.

Overview

There are two types of overviews. While the first organizes student work by learning paths, the second does so by path points. In the learning path overview the paths are organized into three separate sections. The first shows the most recently used paths, the second contains shared or collaborated paths, and the third shows all paths in chronological order. If the user wants to find a specific path or path point in either of the overviews, they can use the search function provided at the top of the overview. The search function allows the student to filter the list by path names, hashtags, or collaborators. In the learning path overview the user may also create or open a new path, as well as share a path with others. In the path point overview the user may share path points with others.

Path View

The path view is where a student documents their work and builds their learning path. Here the student has access to a more detailed view of an individual path. The path view can be accessed either through the navigation menu, or by selecting a path thumbnail in either the overview page or the detail menu in the connection timeline. The path view is one of the most important features offered by our app. What is documented here creates the learning paths which are then accessible in both the overview and connection timeline. To create a new path point the student selects a point on the grid and adds content of their choice. This could be a photo or video created with the device's built-in camera, text, audio, or video files for example, weblinks—even 3D scans depending on the technological specifications of the device. As a path point is created, content-specific hashtags are assigned by the built-in intelligent system and can be edited or added onto by the student. From the path view, students can jump directly to the connection timeline to view how the tags of a path they are working on relates to others. It is also possible for students to share their entire learning path or specific path points with their others.

Method Library

While working, students may want to browse the method library or find a specific method to help them in their learning process. We therefore consider it to be a feature independent from the others, accessible from the navigation menu at all times. The methods are organized on an invisible grid, each containing a title, a visualization (e.g., sketch, photo, or video), and a brief text description. Students may browse the methods freely, search by title in the instant search bar, or create (and share) their own method with a provided template.

Connection Timeline

The fourth and most complex feature of our app is the connection timeline. Here, the user can view thumbnails of all the learning paths they have created in chronological order. Each thumbnail includes the path name, total number of hashtags, and those who you collaborated with. Using this information, the app shows the user connections between different learning paths.

Connections can be generated in two ways. The first, is to interact with the thumbnail of a path. This shows the connection lines to all other paths that share common

hashtags. Furthermore, these connection lines display the exact number of hashtags which are shared. The second way is through the search function, which allows the user to search by a path name, specific hashtag, or collaborator. If a hashtag is searched, a line appears which connects all paths sharing this hashtag across time. Searching for a collaborator produces a similar result, connecting all the paths where they collaborated with this individual. Both the hashtag and collaborator connection lines can also be interacted with. Searching for a path name results in the same type of connection lines as when a user interacts with a path thumbnail.

The three different kinds of connection lines (i.e. path-to-path, hashtag, and collaborator) open a detail menu when interacted with. The detail menu lists all the content and hashtags (if applicable) that a specific connection line represents. When a hashtag connection line is selected, the menu lists all the path points that contain this hashtag. Within the menu, these path points can be further interacted with to reveal the other hashtags they contain. The interaction with the collaborator connection line functions similarly, with the menu showing all the paths points from the various projects where they collaborated with this individual. Selecting one of these path points will also reveal all its hashtags. If a path-to-path connection line is selected, the menu lists both shared hashtags and path points.

In the detail menu, all displayed hashtags are interactive and can be added to the search itself, automatically creating a connection line on the timeline. Furthermore, all paths and path points can be used as a shortcut to access the path view. Overall, the connection timeline is a powerful feature that brings the app together and provides the student with insights into the interdisciplinary and collaborative education they are engaging in.

4.3.6 User Flow

As the features of our app create a flat hierarchy, not much interaction is needed to access, use, and switch between each feature. This is important, as students need to be able to access all features quickly and easily throughout their entire working process. We believe the best way to explain our information architecture, as well as the many ways students will use our app, is through the following three short user flows.

Search Path - create Path Point - share with Peer

The student wants to make a 3D-scan of an object and add it to an existing path. Starting from the home view, the student opens the overview to search for the specific path. When they search by path name, the app brings them to the desired path in the overview. The student then opens the path, which brings them into the path view. With the path now visible, the student selects a point on the grid where they would like to add on to the path. The app then prompts them to add content, which leads the student to select the 3D-scan option. This opens the camera view of the device and allows them to scan their object. Once finished, the student adds the scan to their path point and continues to share this content with one of their peers (Fig. 90).

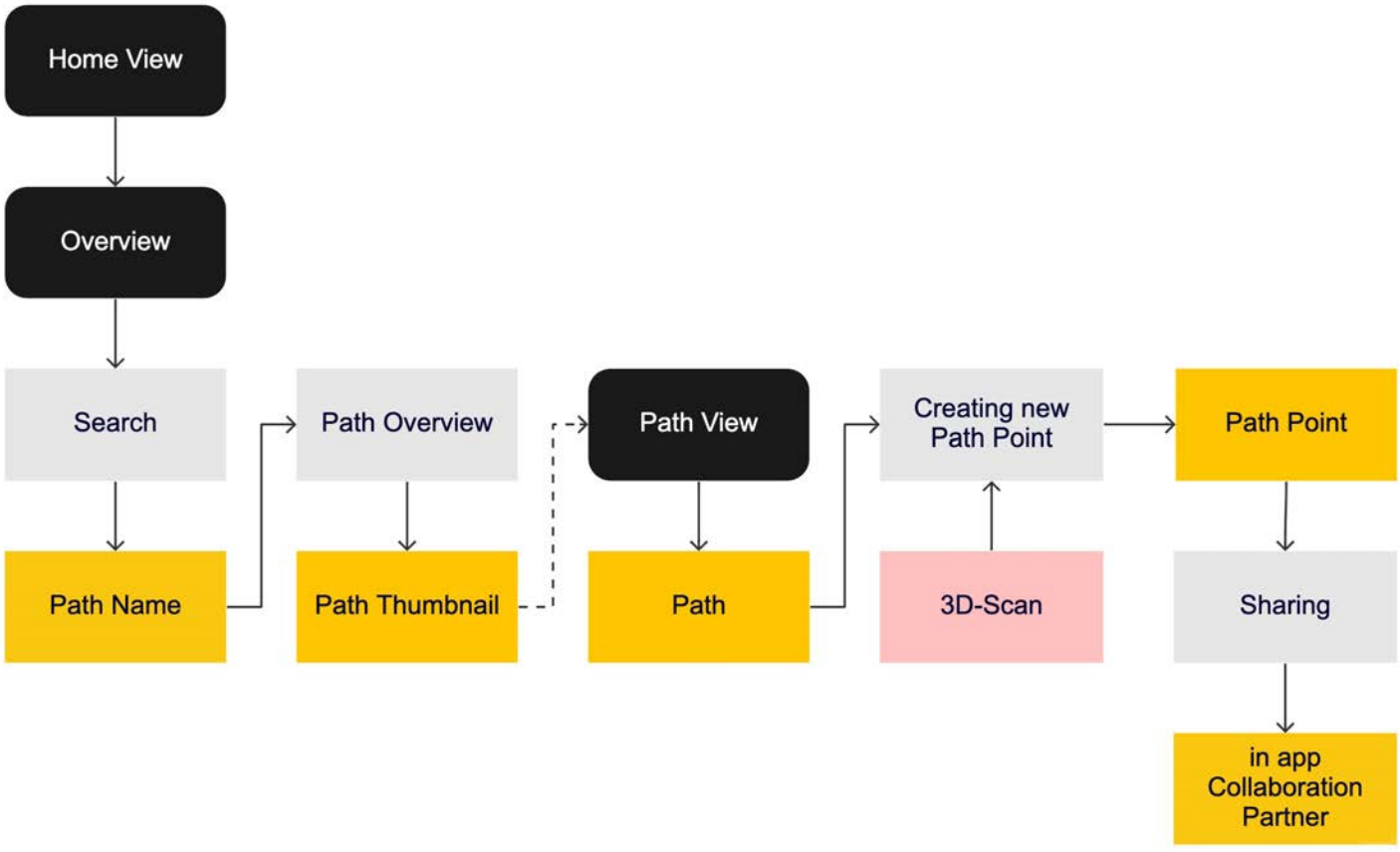


Fig. 90

Display Path from Connection Timeline

In this user flow the student would like to see how they worked with one of their peers over the past few months. In the home view, the student chooses the connection timeline where they can select the collaborator icon of their peer. When selected, a tag with the name of the collaborator is added to the searched tags, and a line appears on the timeline connecting all the collaborator icons for that specific individual. The student interacts with the line to open the detail menu where they can see all the shared path points from various projects. From the detail menu they decide to jump over to the path view of this path point in its path (Fig. 91).

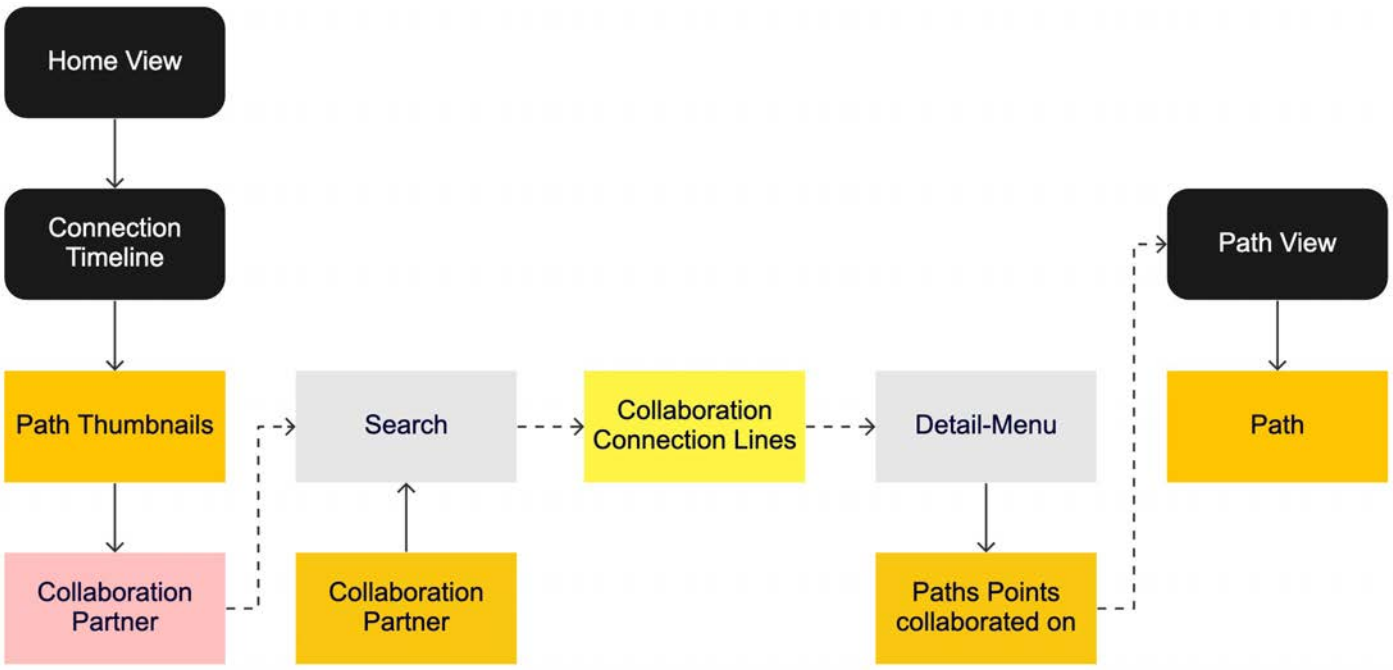


Fig. 91

Create and share new Method

In this user flow the student wants to add their own method to the method library and share it with their peers. They start from the home view and select the method library. Once there, the student begins to add their own method using the provided template. They include a name, brief text, and visualization of some kind (e.g. sketch, video, etc.). In the detail view of a new method the student is also able to share it with their peers (Fig. 92).

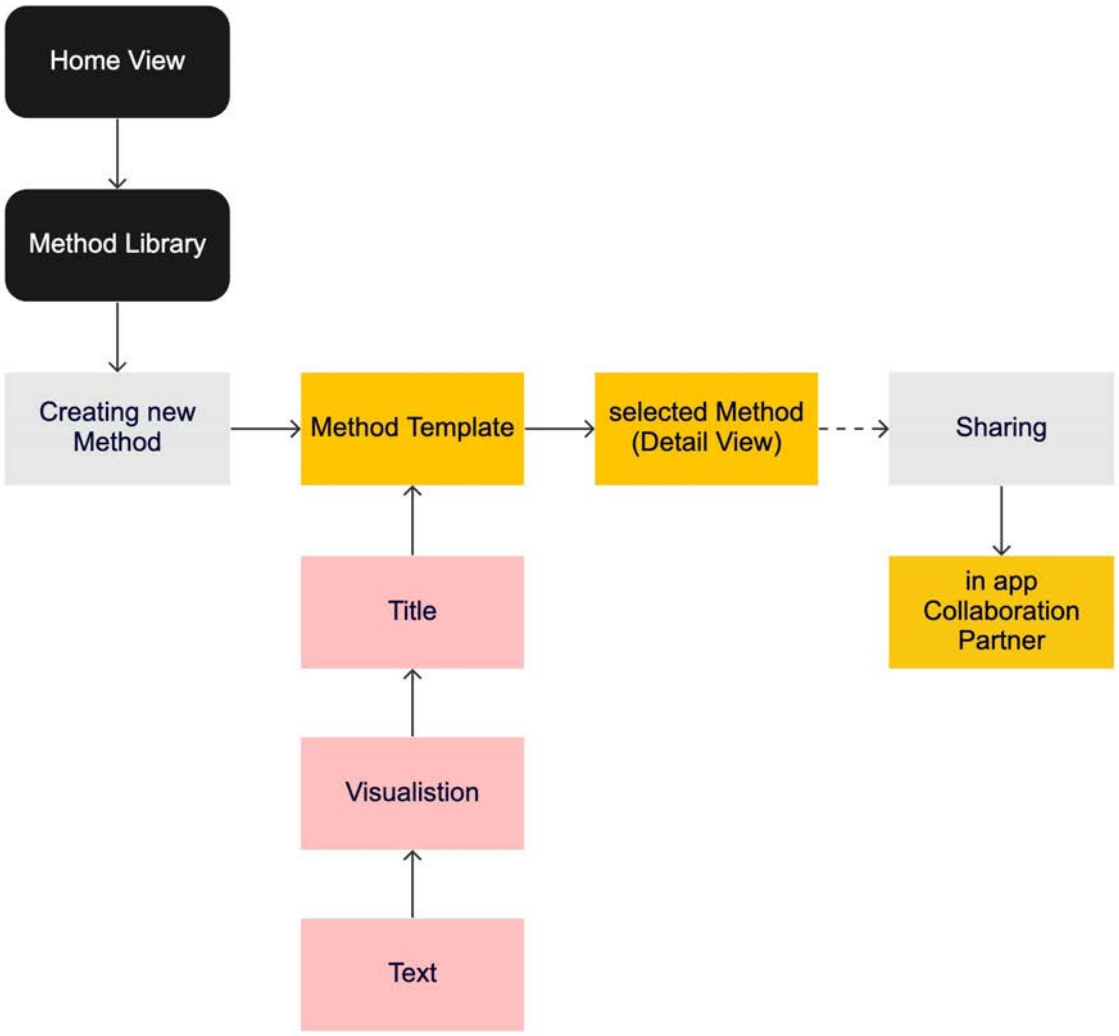


Fig. 92

4.4 Design of Interface

As designers and students ourselves, we view the learning process as being non-linear and organic. We may take two steps forward, one step back—even move diagonally. At times we repeat or skip steps and can change our direction whenever we want. The nature of learning is organic and life-like, and we want our design language to reflect and communicate this to students. We want students to see their learning as alive and continuously evolving and encourage them to build a relationship with and explore their learning paths. We also look to achieve a feeling of diversity by having the students' work and content influence the look and feel of the app. What they choose to document, and how, will make each student's account unique.

4.4.1 Learning Paths

We were inspired primarily by the structure, formation, and movement of cells, as well as how they function both on an individual level and with other cells to perform certain tasks. We wanted to translate this look and feel into our learning paths, focusing on the visual appearance of the paths, the way in which they grow, and how the individual learning paths share connections with and are related to other existing paths.

A learning path is composed of individual path points, each a cell-like container holding information documented by the student, as well as the tags assigned to them. This information, whether it be a photo taken directly with the tablet camera, or an upload of a video, a pdf, or audio for instance, is directly displayed in that point on the path. This means the content provided by the student influences the visual appearance of their path depending on what they have documented at each moment in their learning process.

When new path points are added to a path, the connections between these points visually resemble cell division when one cell splits itself into two copies. While these path points do not contain the same information, they do share a relationship to one another by showing the process of a student's work. Moreover, the growth of the path and whichever direction the student builds can lead to a large variety of learning path shapes and sizes.

Students may also choose the colour of each learning path. This allows them to distinguish one path from another later or use the colour to organize and sort their paths (Fig. 93-96).

Fig. 93-94

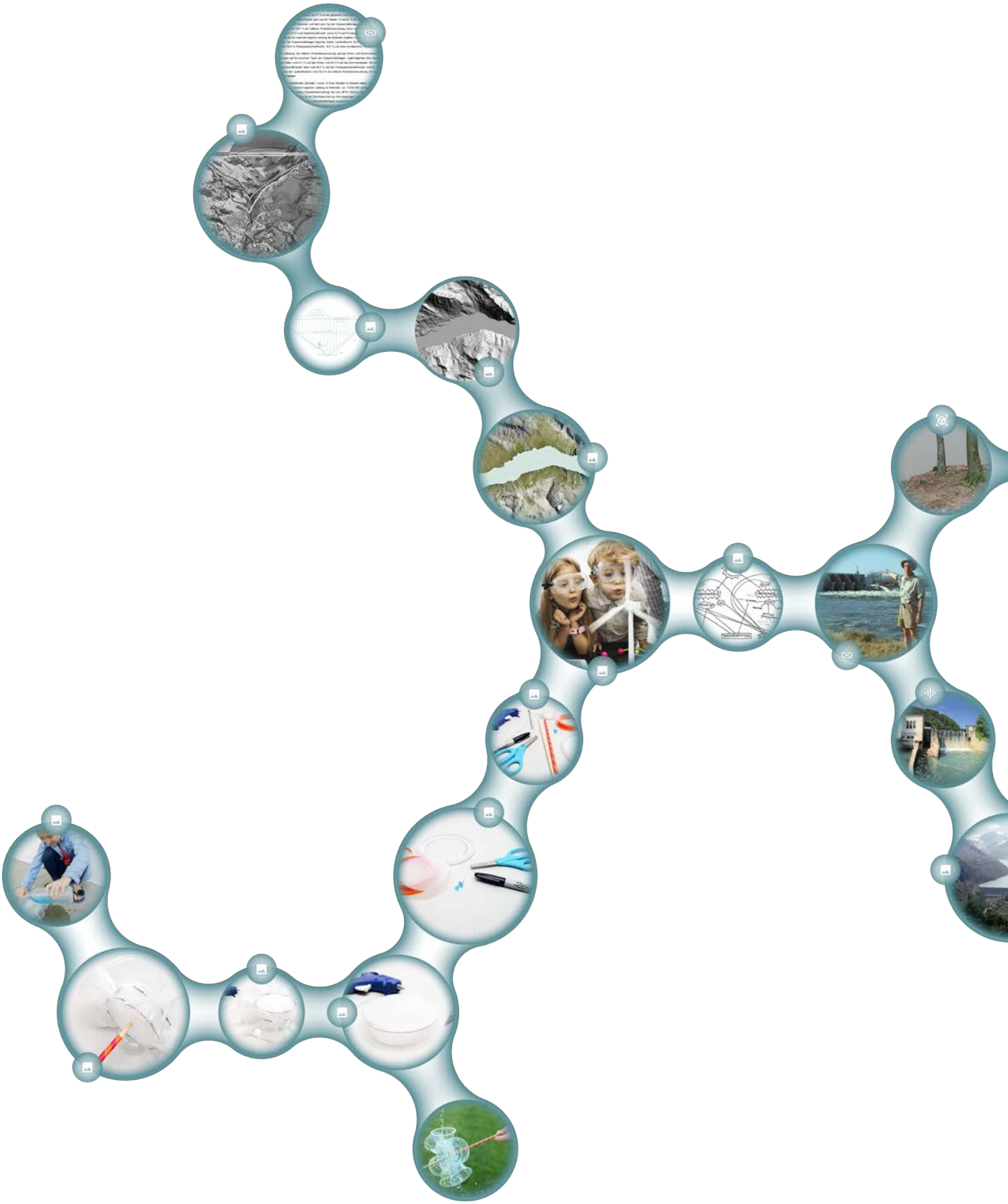
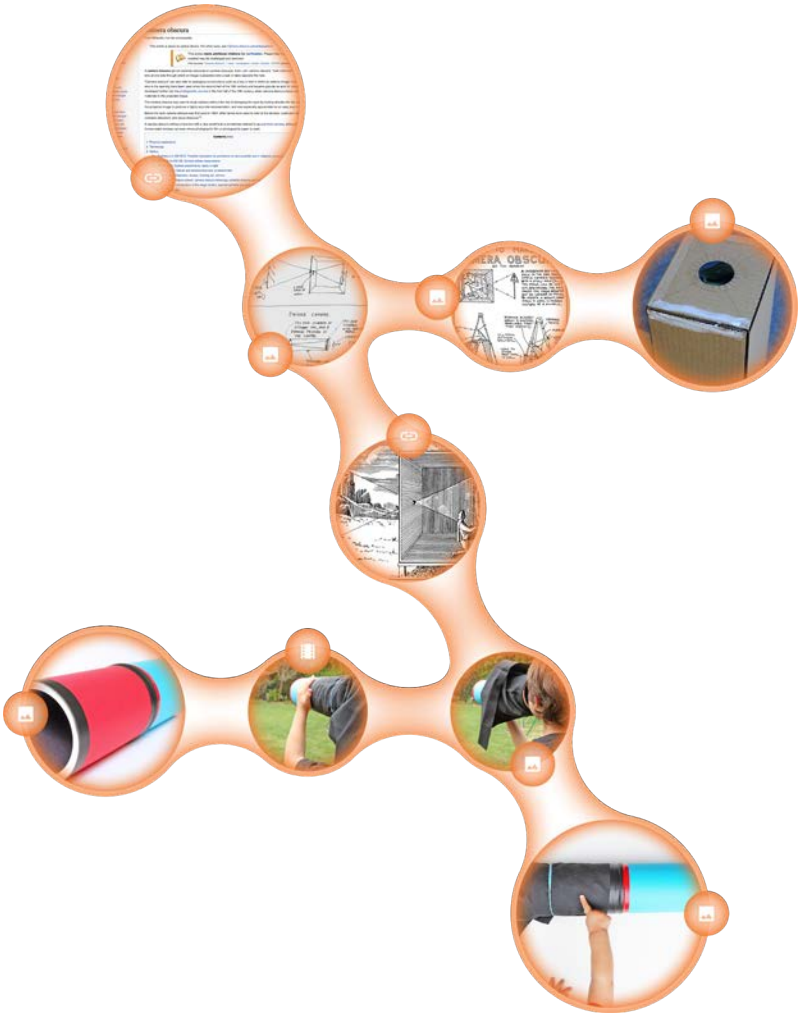


Fig. 95-96



4.4.2 Connections

When viewed in the connections timeline feature of the app, the learning paths would resemble a collection of different cells in a petri dish. Here the student can view all the paths they have created and collaborated on throughout their education at once, as well as how these paths connect based on their assigned tags (Fig. 97). The connections between the paths are visualized by lines which run from one center point of a path to another. There are three different visual styles of lines used to indicate the three types of connections. The first type of connection shows how one path is related to other paths and is indicated with a 0.5pt line in the same colour as the selected path. This line radiates out from the center point of the selected path to the others. The second type of connection shows how a tag has appeared in different paths over time. This line is slightly thicker than the first (2pt), has a slight transparency, and runs from left to right across the screen. The final type of connection shows how frequently and in which projects you have collaborated on with another student over time. This line is also 2pt, with a slight transparency, but is a dashed line.

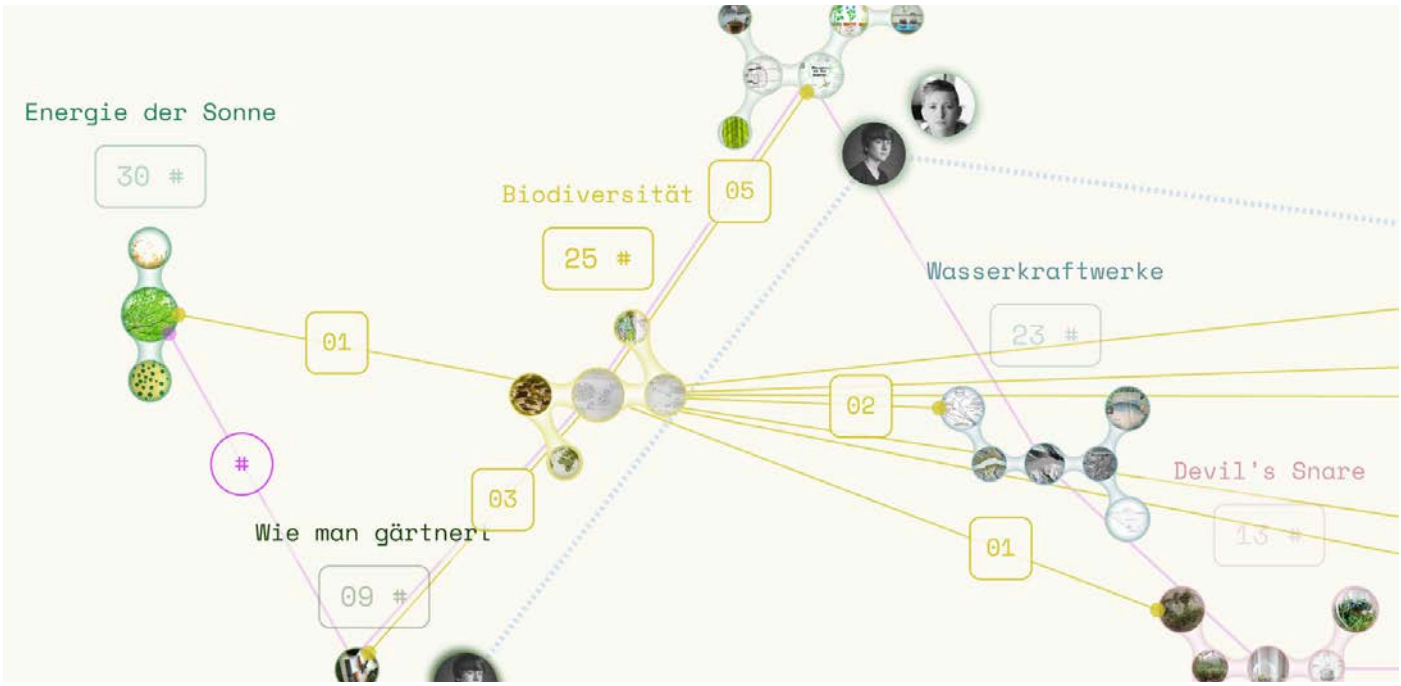


Fig. 97

4.4.3 Methods

The methods, or ‘containers’ which hold the methods, were designed using the most basic element of the learning paths—a circle—as the building block. These methods are arranged around each other on the screen, and the students can browse through them as they wish (Fig. 98).

Each method container holds an thumbnail representing the method, a visual of some kind demonstrating the use of the method, and a brief description (Fig. 99). The style of these icons and illustrations will consist of different mediums, materials, and media formats. We have decided for this visual style because we would like to provide students and teachers with the opportunity to contribute their own methods in a way that inspires them. As we cannot guarantee which style or format they will want to communicate in, we would like to encourage this diversity of expression.

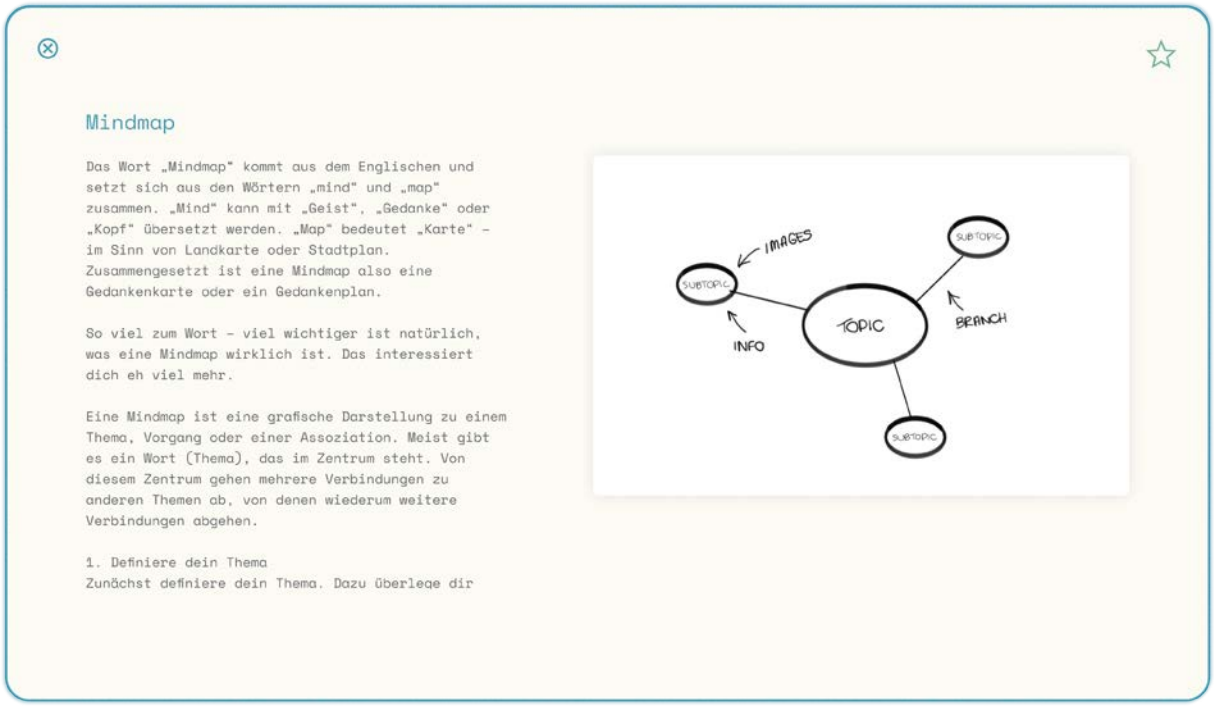


Fig. 98-99

4.4.4 Icons

As our app is designed primarily for students ages 8 to 16, we wanted to provide a fun and engaging way of navigating through and interacting with our app. We therefore focused on designing visually playful navigation icons, rather than buttons with text (Fig. 100). Most (if not all) of the icons were created by using the most basic element of the learning paths as a building block—a circle. Each icon is composed of a cluster of different sized circles—or shapes with rounded edges—whose arrangement is inspired by the feature of the app that the icon represents. The methods icon, for instance, is a miniature version of the layout of method containers found in this feature of the app. While this allows for better readability of the icon, we also included all navigation icons on the home screen with labels to ensure students' understanding of them.

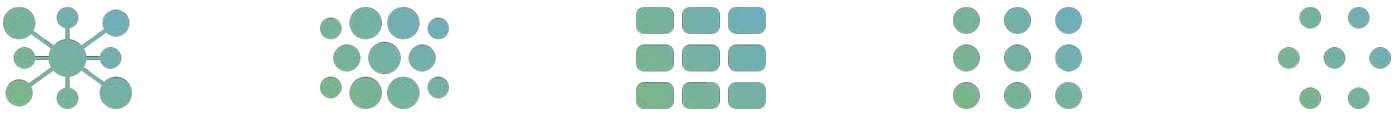


Fig. 100

4.4.5 Micro Interactions

To bring our organic design language to life, we have also considered the use of playful micro interactions within the app.

Learning Path

The learning path will also include micro interactions. When navigating within the working path mode, for instance, the path point which is nearest to the center of the screen will be magnified. This micro interaction helps to provide the student with a feeling of exploration and curiosity as they investigate what they have already documented, and how it connects to previous learning paths.

Icons

When students interacts with an icon, we imagine a jelly-like micro interaction will occur, mimicking a similar cell division process we used as inspiration for the learning paths. In the case of the icons, the micro interactions function more on an aesthetic level to bring the visual language to life.

Methods

The micro interaction when exploring the methods functions similarly to the magnification micro interaction in the learning path. When the student scrolls through the methods, the methods will magnify and reveal more information the closer they are to the middle of the screen, and then become smaller again as they move away from focus. In addition, we imagine the method containers to show a kind of collision behaviour when they move around and come into contact with one another. In other words, they have a fluid- or molecule-like behaviour.

4.5 Results

Home Screen

The home screen mockup shows the app logo and introduces students to the navigation icons representing the major features of the app (Fig. 101).

Fig. 101

Overview

The overview allows student to see their work, either as a list of whole learning paths, or as individual path points.

Sorted by paths, the path overview mockup shows learning paths and the different ways they can be organized and viewed by the student (i.e. most recent, shared, and by year) (Fig. 102).

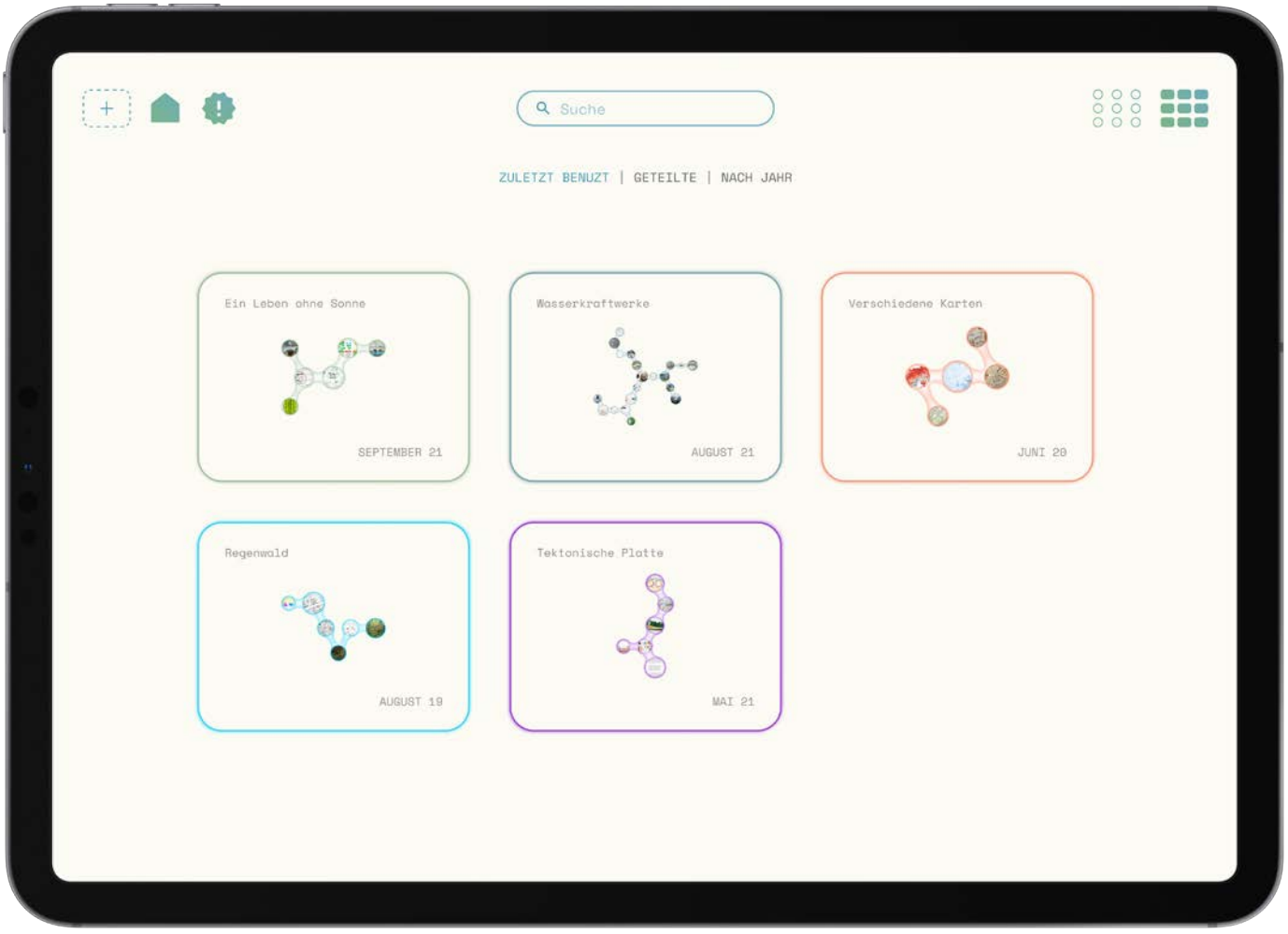


Fig. 102

The path point overview mockup shows all path points related to a specific tag search. If multiple tags are added to the search, the result is narrowed down and shows only the path points that share all the selected tags (Fig. 103).

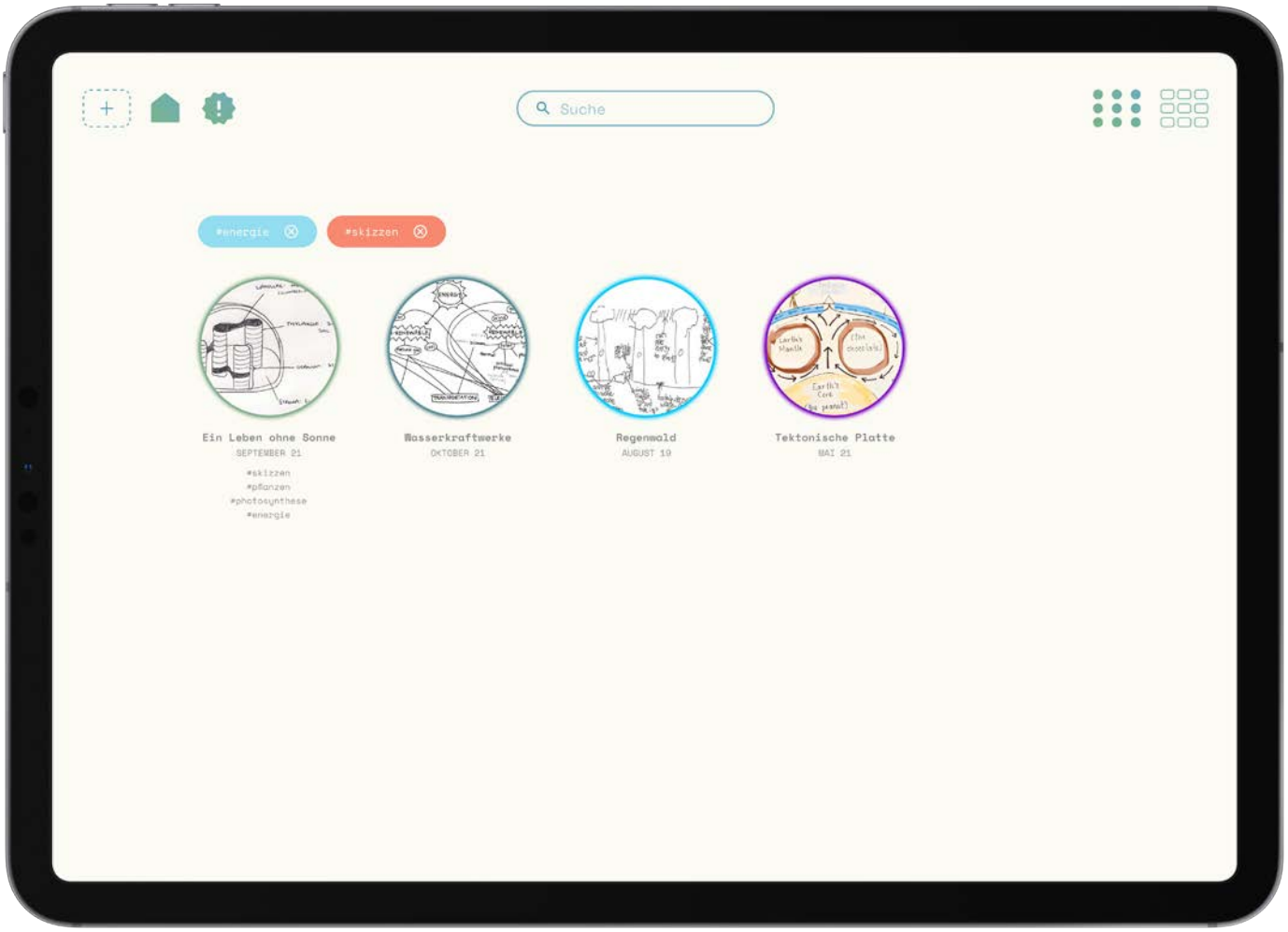


Fig. 103

Path View

This path view mockup shows the moment a new path point is being added to the learning path. When an existing path point is selected, the grid points which can be built on become highlighted, the tags for this path point are revealed, and a menu appears providing the students with several options to document (i.e. add photo, 3D-scan, or file, or save a link (Fig. 104).

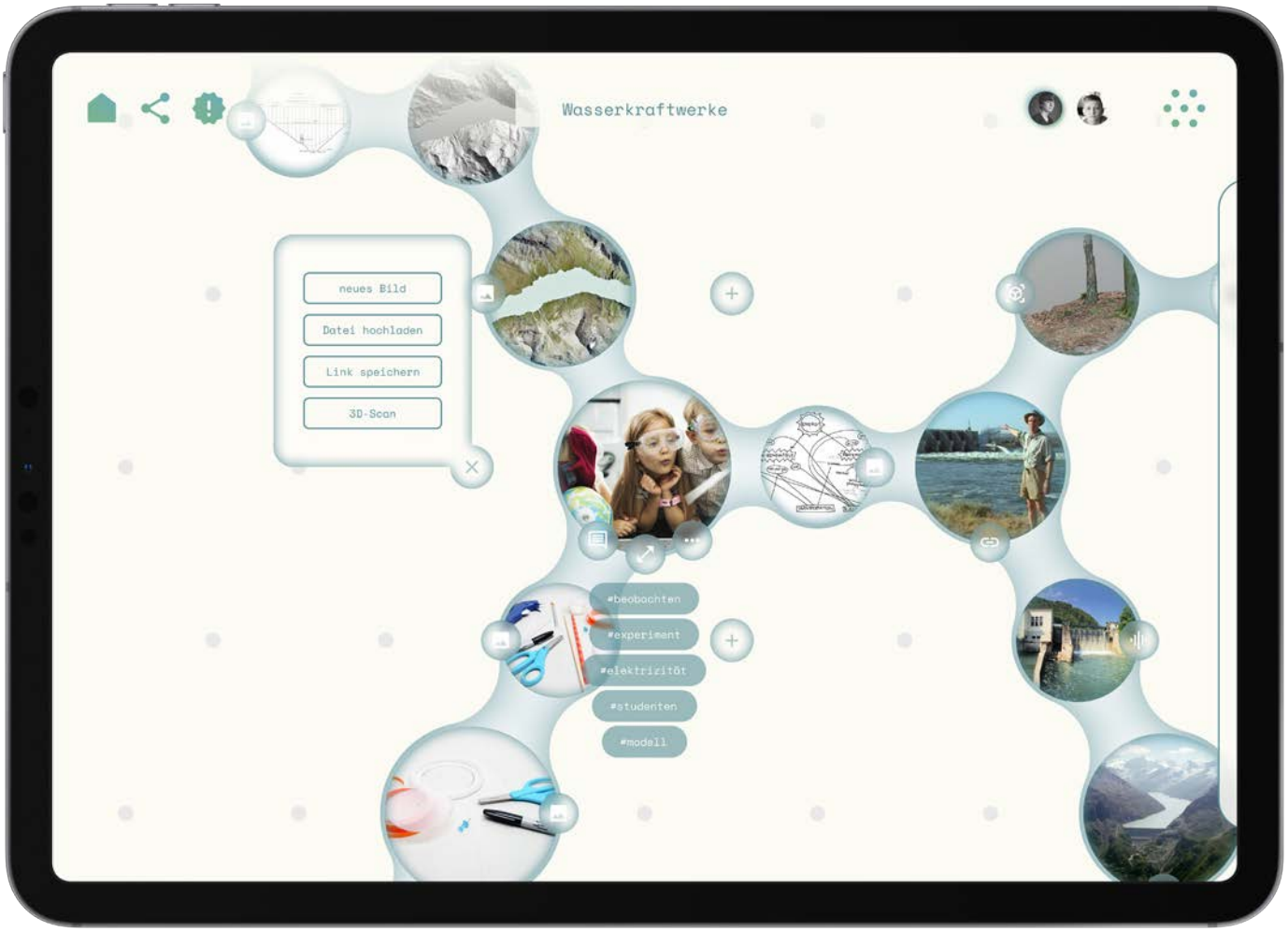


Fig. 104

This path view mockup reveals a side menu that contains the tags from each and every path point in this specific learning path, as well as a button to view this path in the connection timeline (Fig. 105).

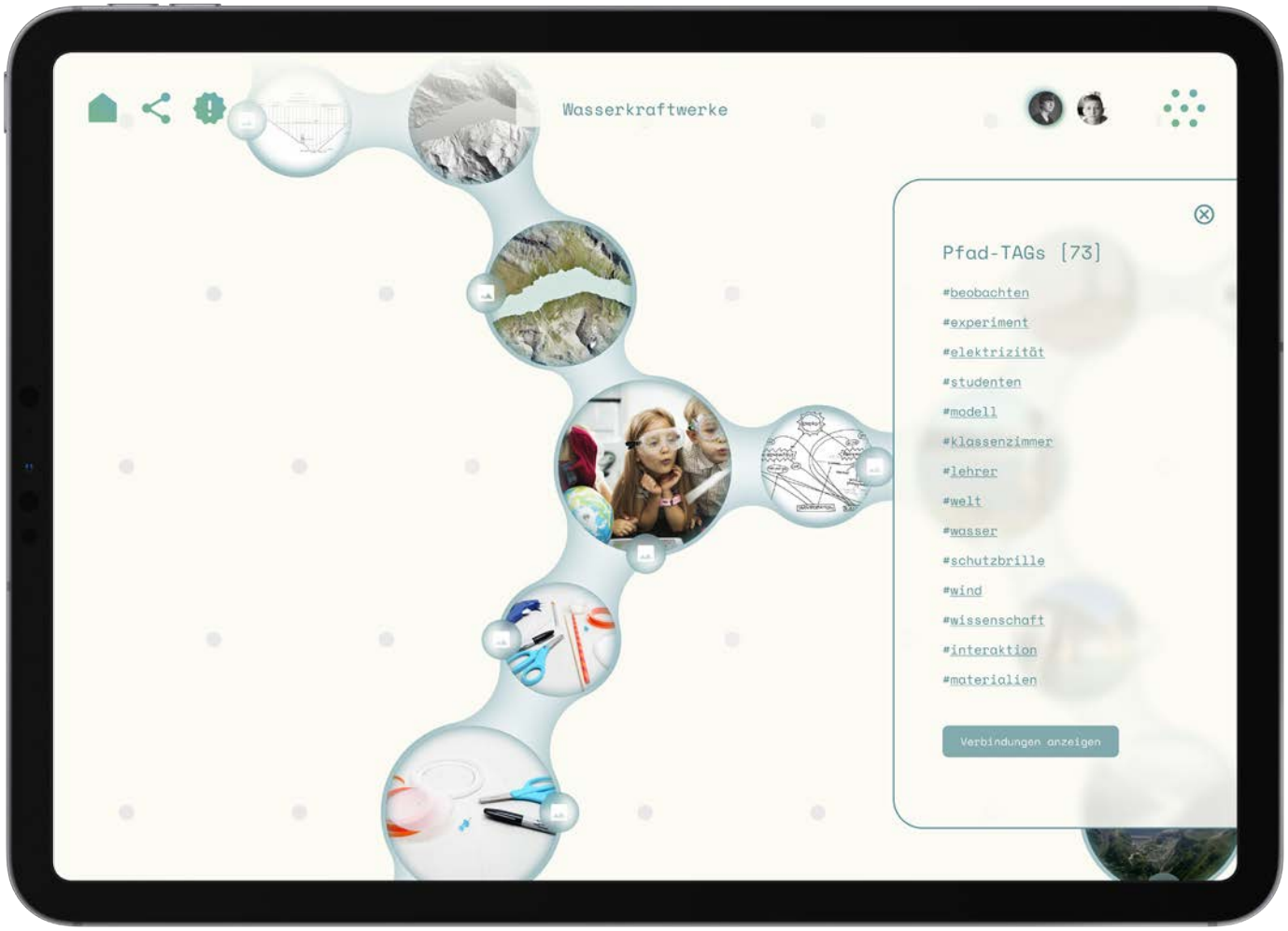


Fig. 105

This path view mockup shows how students can share an entire path or an individual path point, either with viewing or editing rights (Fig. 106).

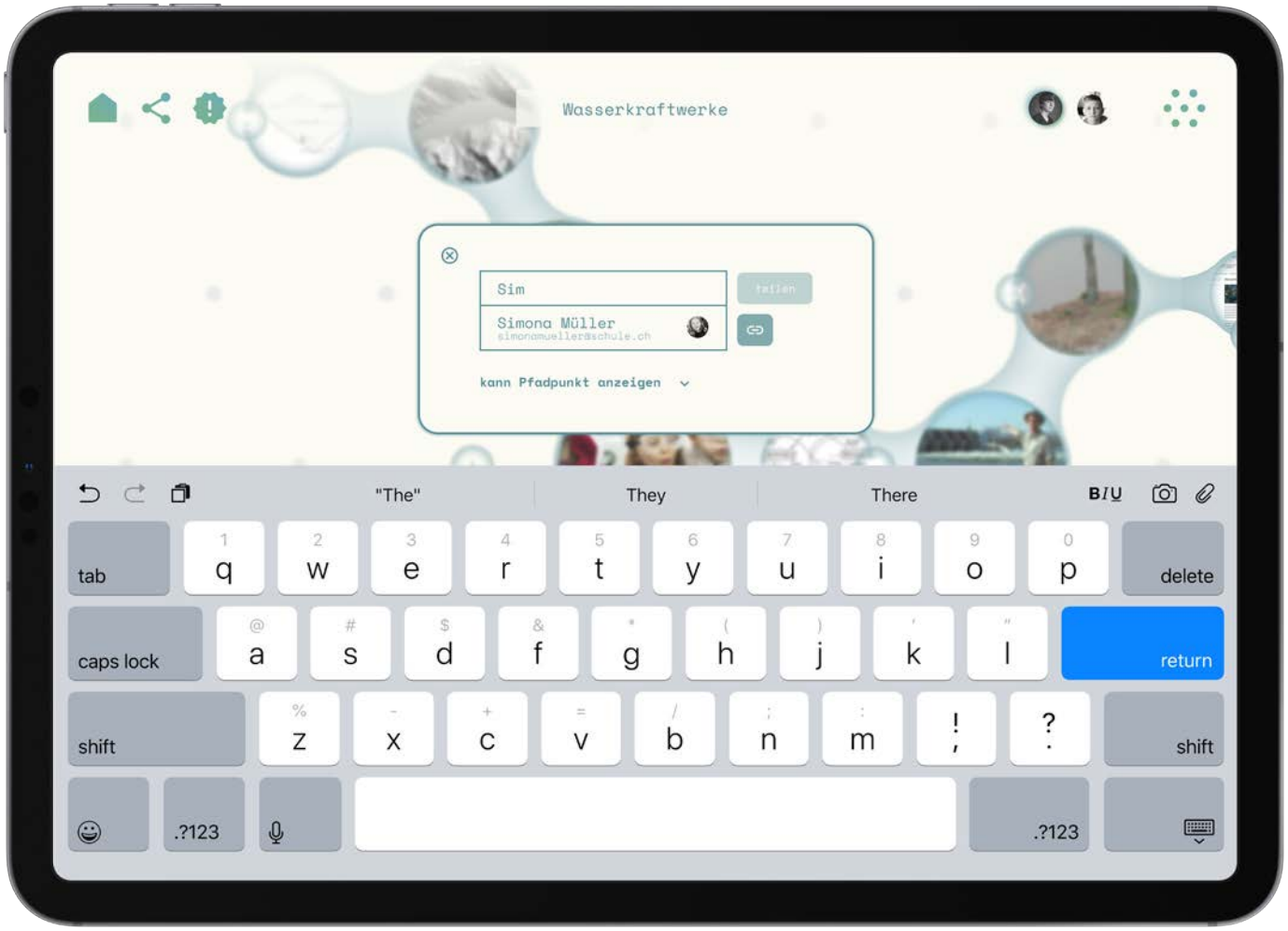


Fig. 106

This path view mockup shows the commenting function for path points. Students can add notes for themselves or others who are collaborating on the same learning path (Fig. 107).

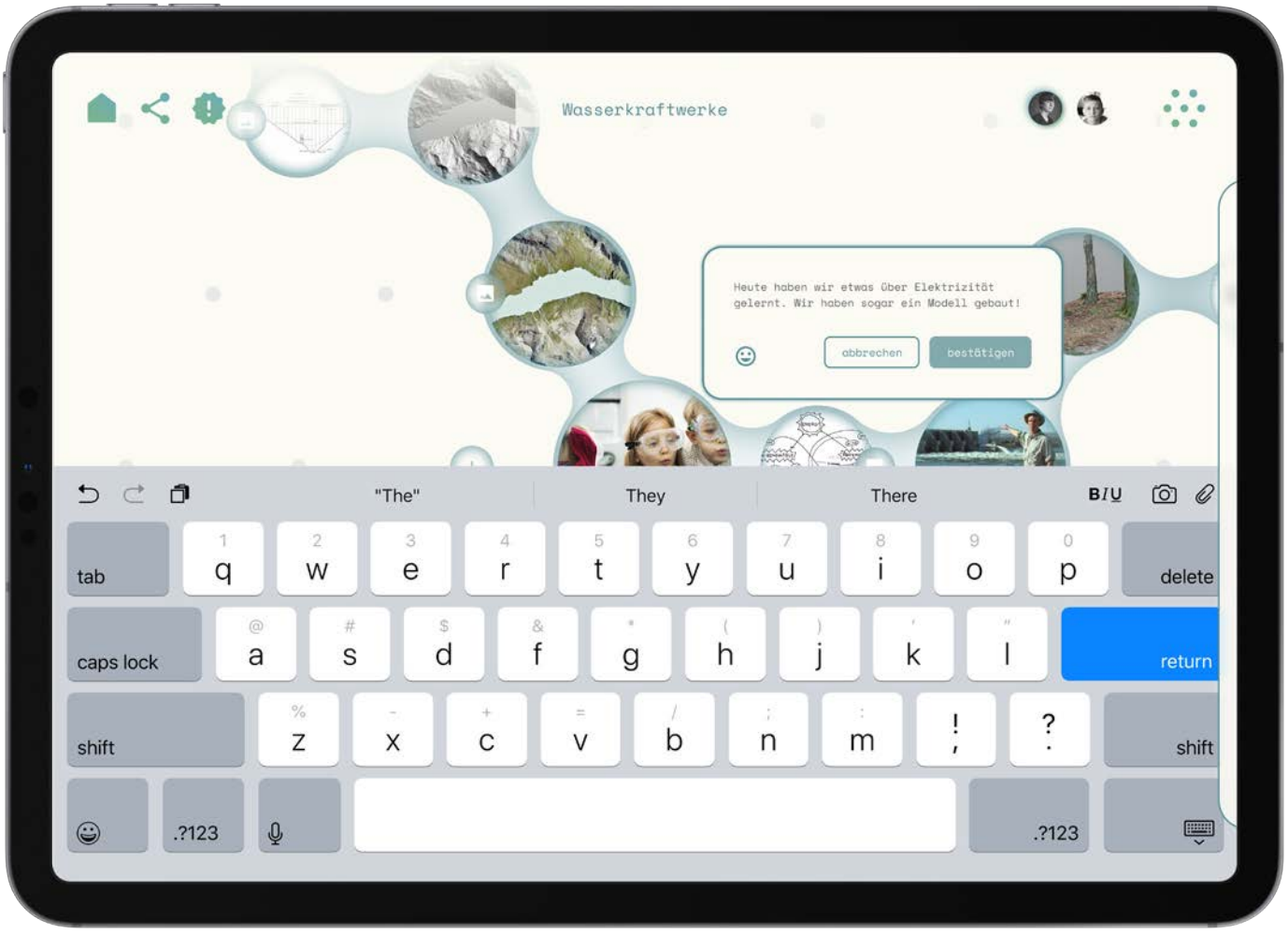


Fig. 107

This path view mockup shows the detail menu of a specific path point where the tags can be viewed and edited. Students can see which tags have been automatically selected for them, as well as further suggestions they can add. They are also able to add their own tags. It is important to note that students can only have a total of five tags per path point (Fig. 108).

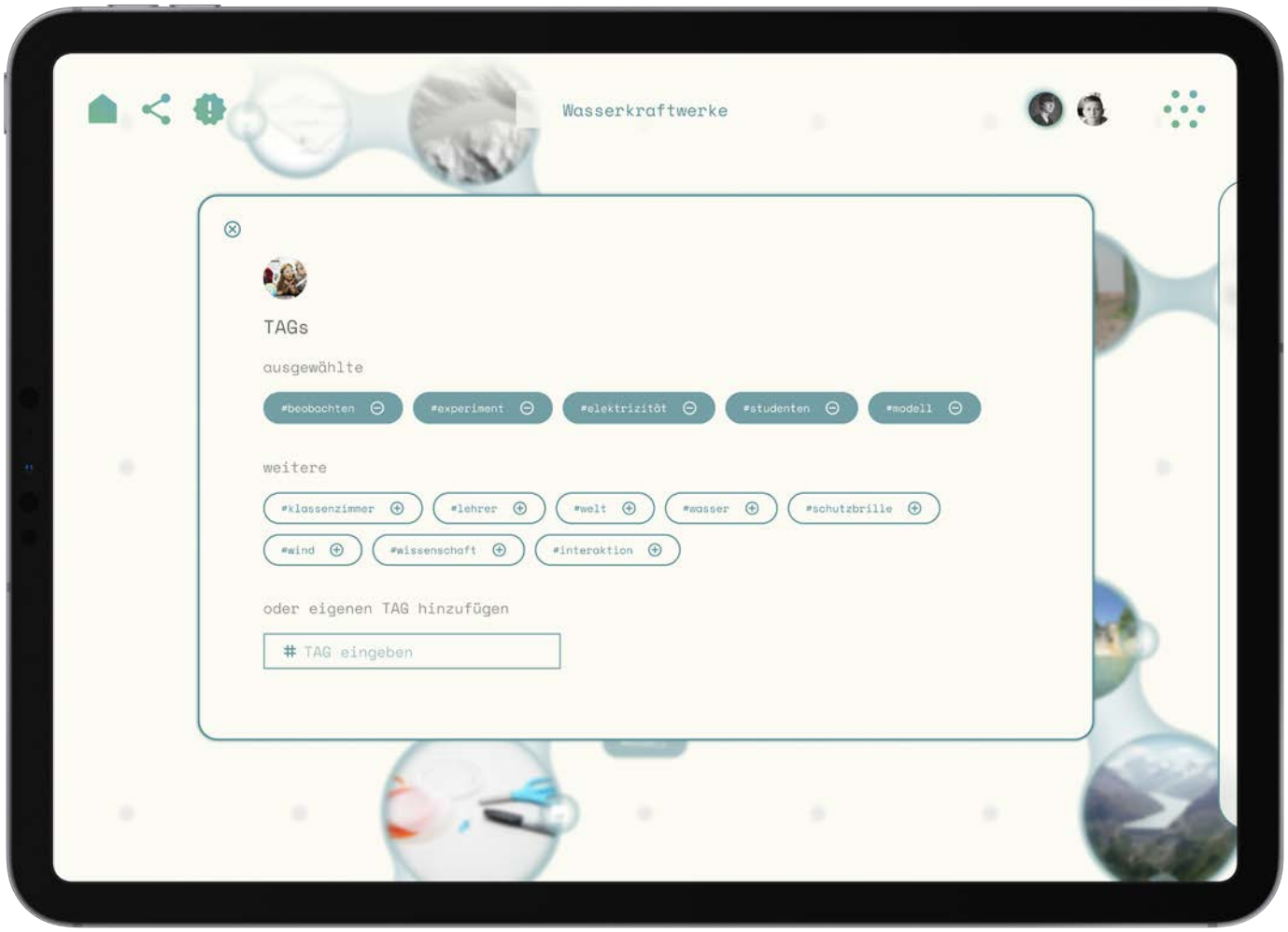


Fig. 108

Method Library

This method library mockup shows the wide range of methods that can be scrolled through freely by the student. The methods are both provided by the app, as well as created and shared by the students (Fig. 109).

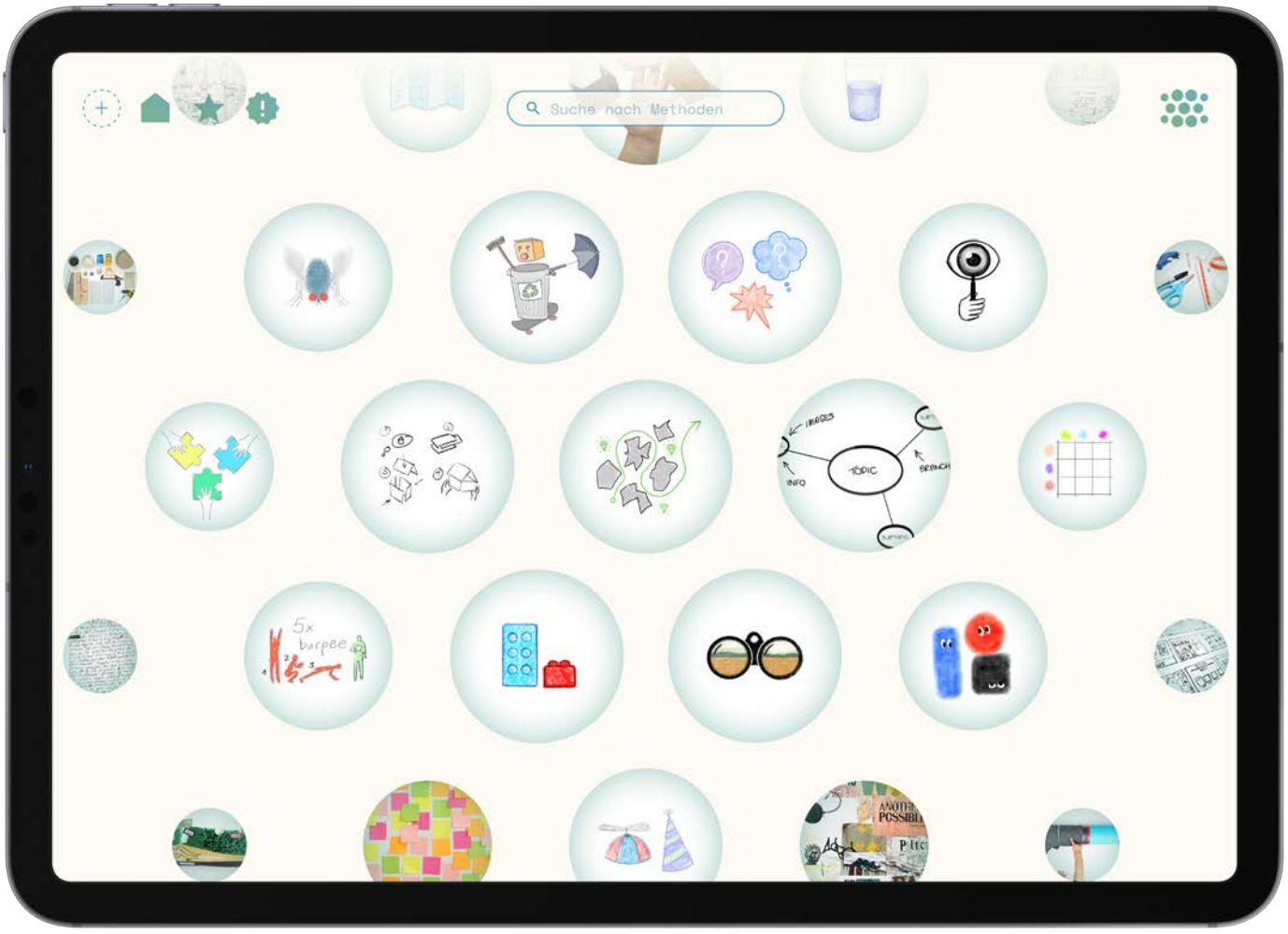


Fig. 109

This method library mockup shows the detail menu of an individual method. The menu contains a method title, descriptions, and visual. When viewing the detail menu, the share function becomes available at the top of the screen for methods which have been created specifically by the students (Fig. 110).

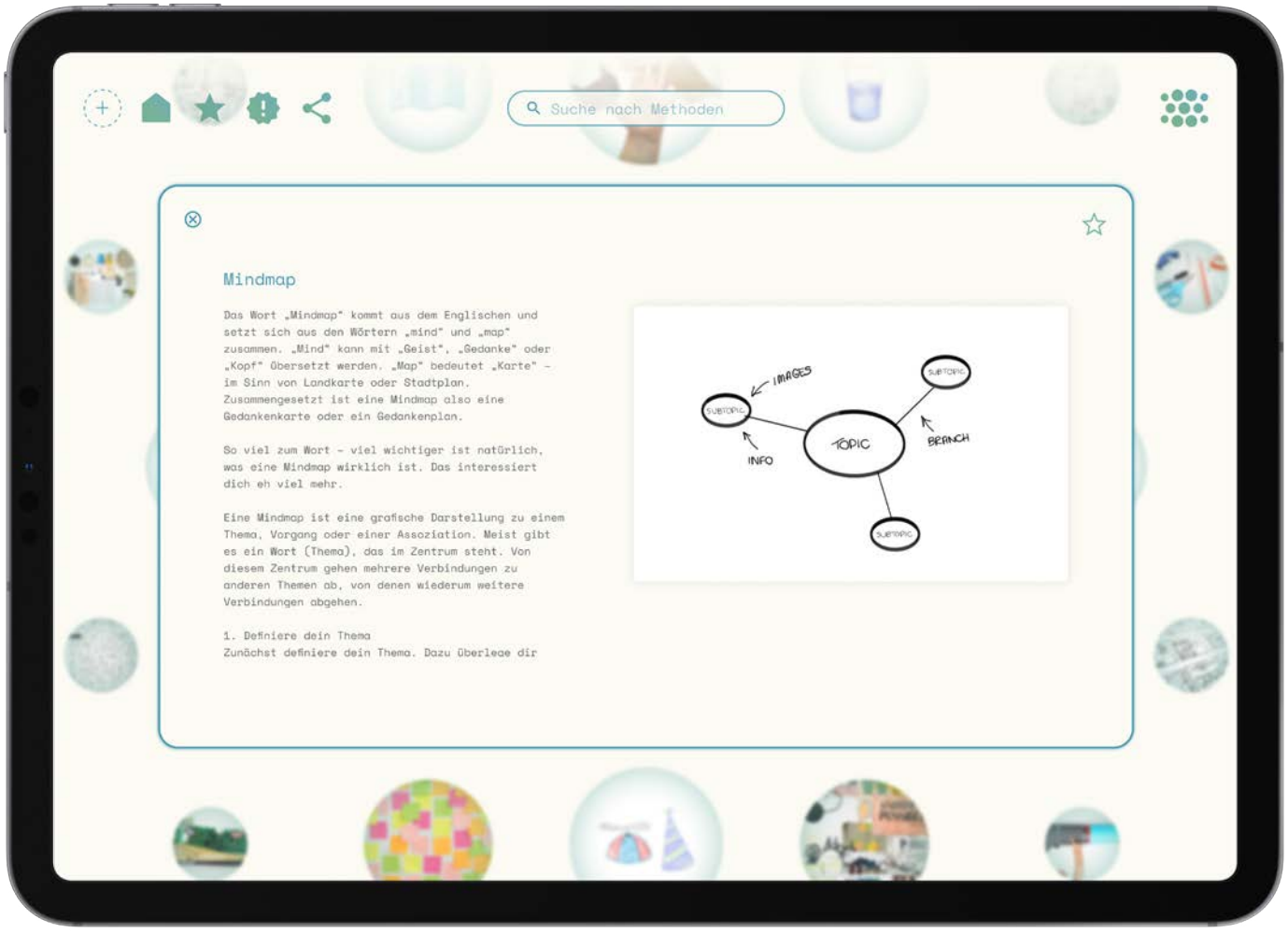


Fig. 110

This method library mockup shows the template for students to create and add their own method to their library. These methods may also be shared with others later (Fig. 111).

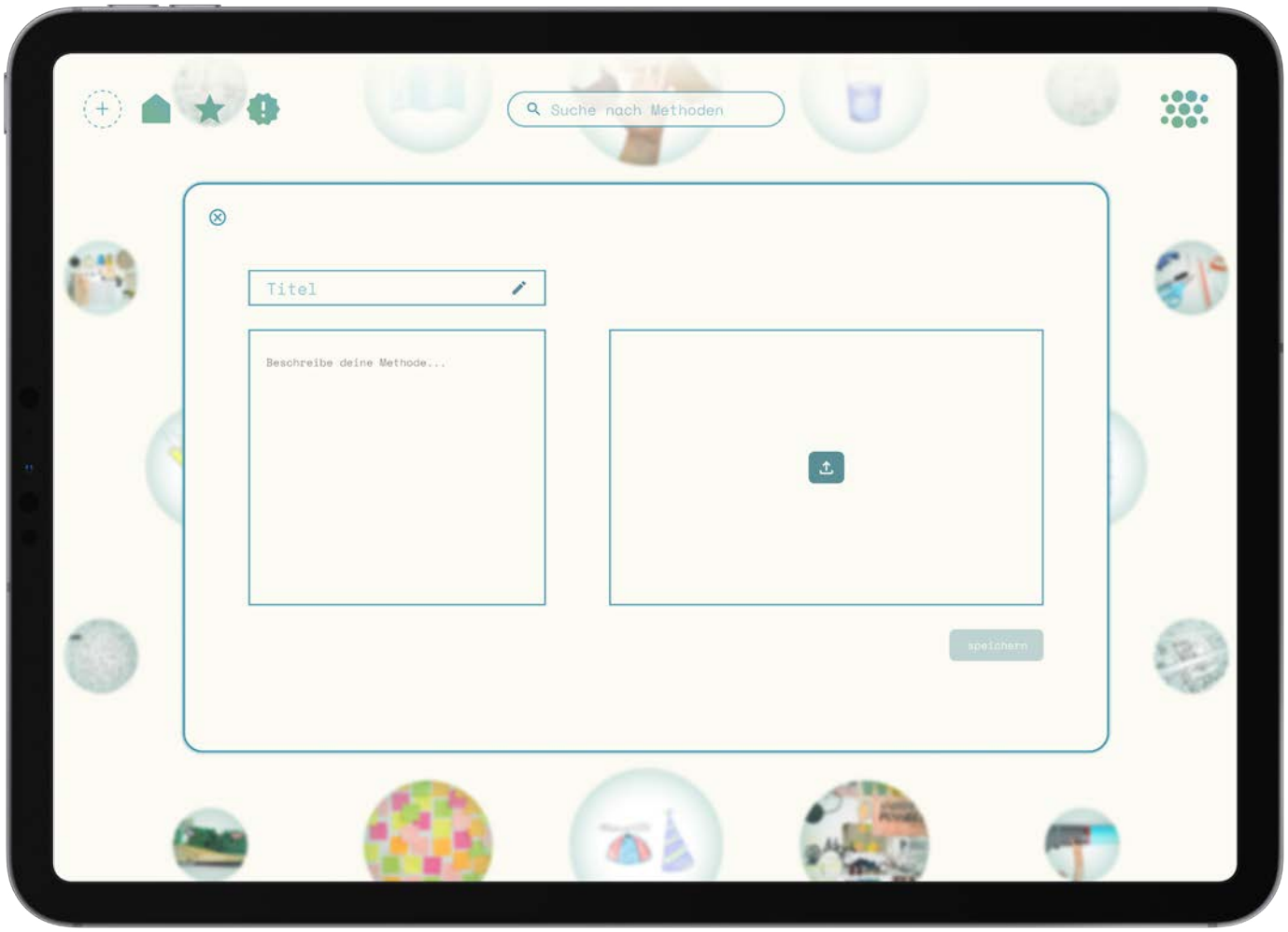


Fig. 111

Connection Timeline

This connection timeline mockup shows how student learning paths are collected over time, as well as how these paths are connected to one another in different ways. In this example, the yellow lines represent all the connections other paths share with the selected „Biodiversität“ path, the pink line shows where a searched tag appears in different paths, and the blue line represents all paths collaborated on with another peer. Each line can be interacted with to reveal further information. In addition, time stamps are added to the bottom of the screen to show when relevant paths were created (Fig. 112).

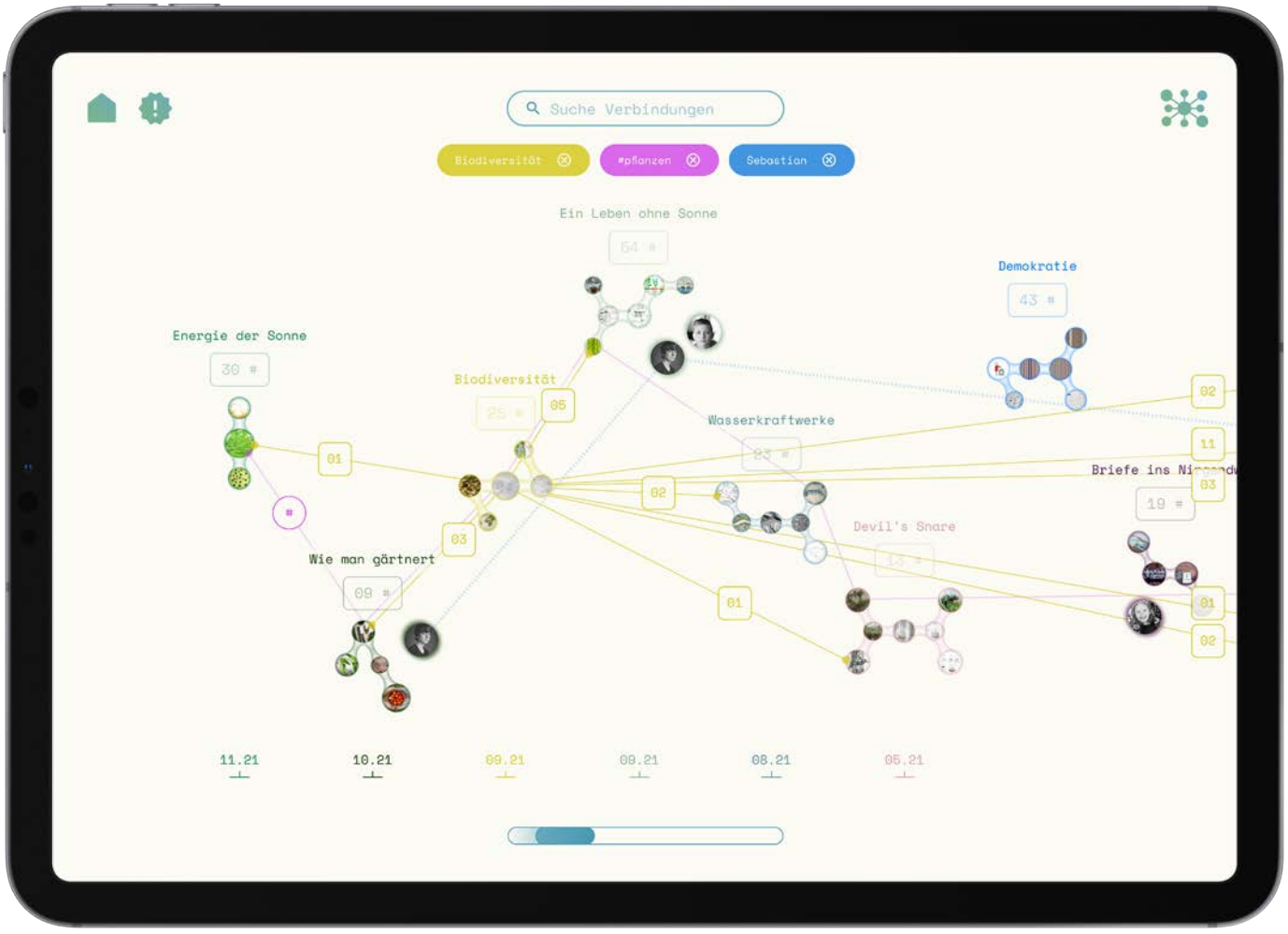


Fig. 112

This connection timeline mockup shows the detail menu of a connection between two paths based on shared tags. The menu reveals which tags are shared (see „gemeinsame Pfad-TAGs“), as well as all the path points from both paths. When a path point is selected, all the tags it contains will be shown below. If any of those tags belong to the shared tags, they will be highlighted in that section. Furthermore, any of these tags can be selected and added to the searched items in the connection timeline, which will create new connection lines based on these tags. (Fig. 113).

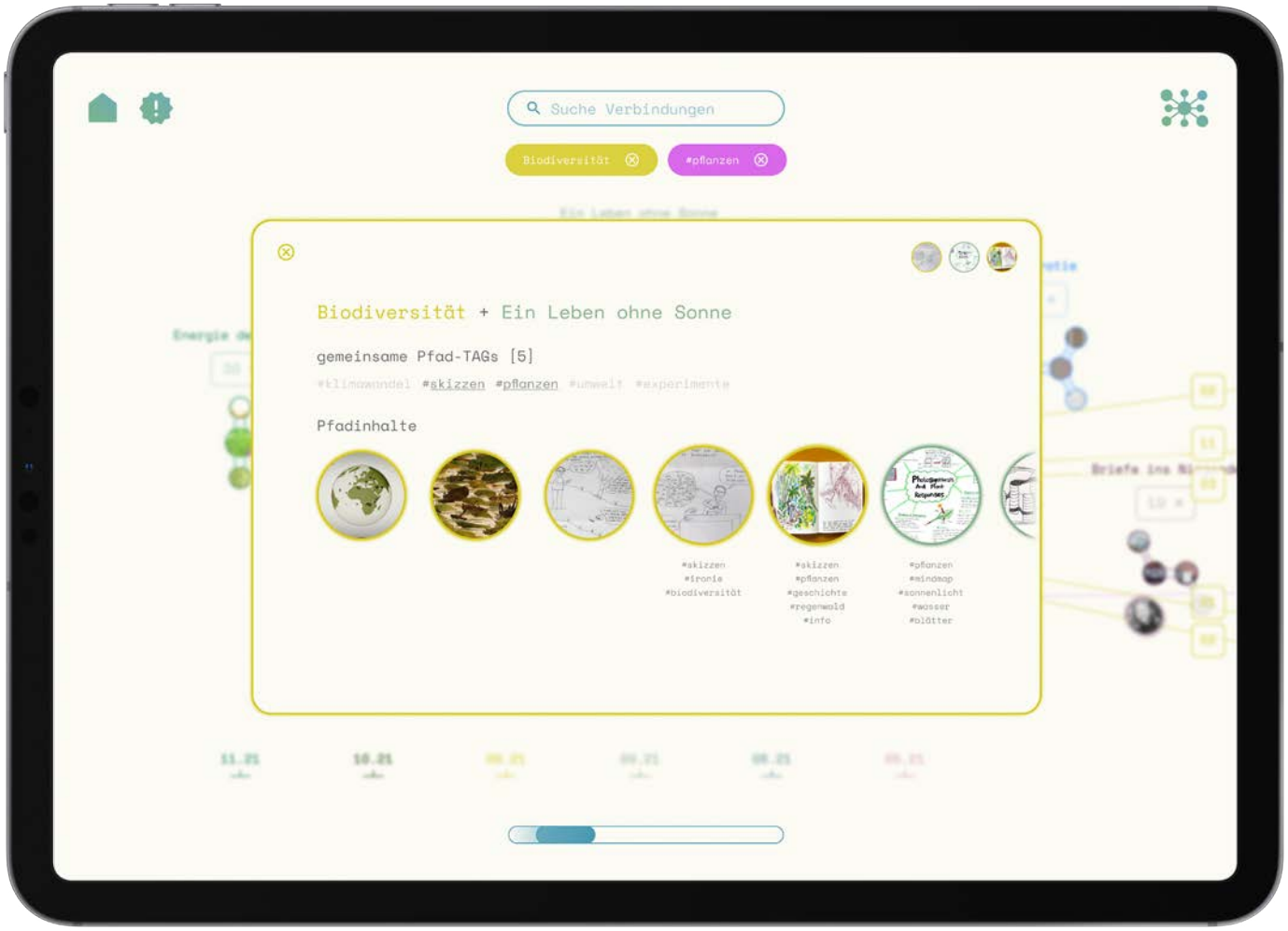


Fig. 113

This connection timeline mockup shows the detail menu of a selected path, which contains all the path‘s tags and path points. When a path point is selected, all the tags it contains will be shown below, as well as highlighted in the „Pfad-TAGs“ section. Any of these tags can be selected and added to the searched items in the connection timeline, which will create new connection lines based on these tags. This menu also allows students to open the learning path in the path view (see „Pfad öffnen“ button) (Fig. 114).

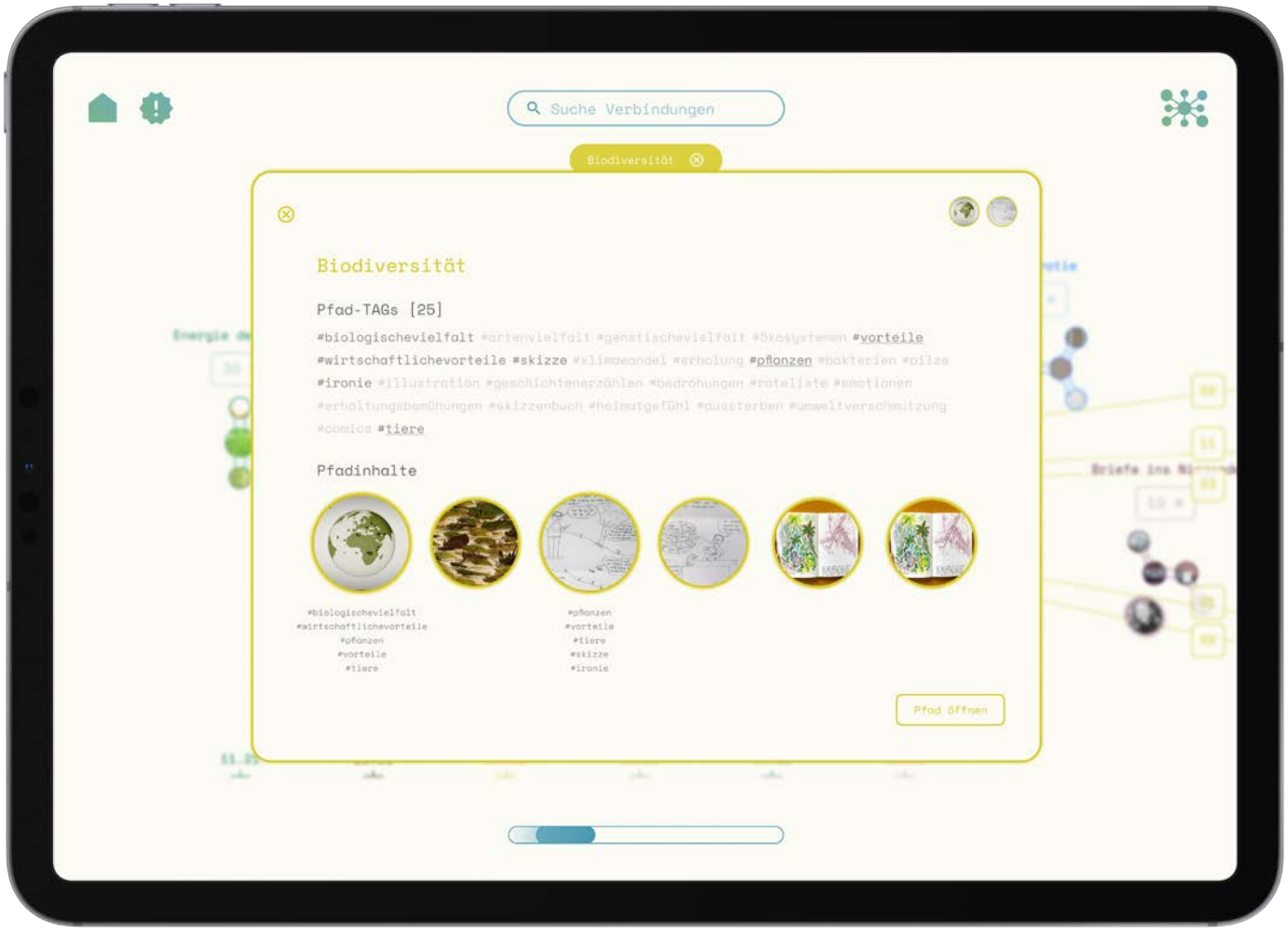


Fig. 114

This connection timeline mockup shows the detail menu of one tag connecting all related path points. When a path point is selected, all the tags it contains will be shown below. Any of these tags can be selected and added to the searched items in the connection timeline, which will create new connection lines based on these tags. This menu also allows students to open the learning path of a selected path point in the path view (see „Pfad öffnen“ button) (Fig. 115).

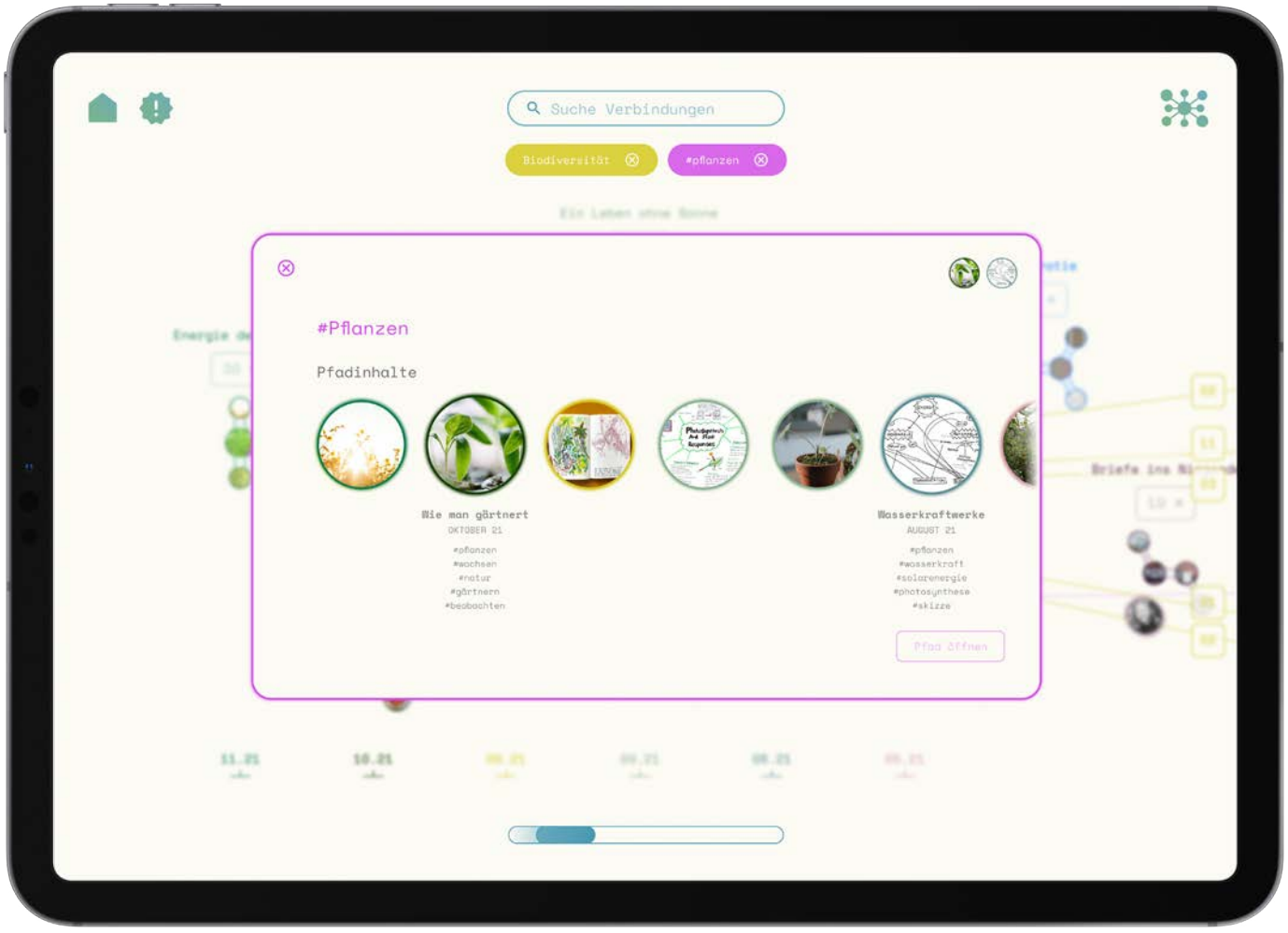


Fig. 115

4.6 Service Concept

4.6.1 Overview

We view our app as a service which impacts different stakeholders at various levels. The stakeholders that appear in the education system and that we address in our service are students, teachers, parents, public schools, and the environment. We want to have a clear understanding of the role that each of these stakeholders play, the opportunities inside the education system, and how our service builds touchpoints for these opportunities and stakeholders.

4.6.2 Stakeholder Interest

The various stakeholders within the education system have different interests. The following sections describe these interests for each of the stakeholders.

Students

As main users of the app, the student is the first stakeholder we consider. Students attend school, complete their assignments, and develop the skills and competencies expected by the curriculum. School is also a place for students to enjoy learning and socialize with their peers. For this reason, the app needs to address all these needs and more. The students use the app and its features to document their learning experiences, try out new methods, and collaborate with peers. Since students are young, the design of the app needs to appeal to them both visually and conceptually.

Teachers

After the students, teachers are another important group of stakeholders. Teachers are directly involved in the students' learning in the classroom and through the app. The teachers need to deliver the curriculum to their students, as well as assess their progress. Besides topic specific knowledge, teachers also have a responsibility to help students develop social and organizational competencies, as well as create an inclusive and pleasant learning environment. By using the app in their classes, teachers can help students learn topic specific knowledge, practice soft skills, and assess them in their learning.

Parents

The parents have a secondary role within our service. We view their interest as being primarily concerned with their child's performance and wellbeing. Through the app, the parents can learn about their child's interests, relationships, and progress throughout their education.

Schools

Schools as public institutions must comply with certain rules and regulations regarding education. The implementation of Lehrplan 21 is a good example of this, as it has affected all elementary and secondary schools in the German-speaking cantons and brought about several major changes. Schools are therefore interested in tools that can be easily implemented and scaled across the institution. Our learning app is designed to run on devices (tablets) that are often already existing in the schools or are planned to become an integral part of classrooms soon.

Environments

Although this last stakeholder is not directly connected to our app, and is not a stakeholder in the traditional sense, we still see it as relevant for our app. Our vision with this app is to develop students to be better prepared for the future and the various challenges they will face in their environments. Moreover, we want to help students become engaged, responsible, and contributing citizens.

4.6.3 Defining the Target Group

The target group or users of our app are elementary school children in the Swiss education system, ages 8-16. Defining this target and age group was a challenge as we had to consider the development of children, as well as their current learning experience.

We believe our app, both conceptually and visually, has the potential to be used throughout one's entire education, from kindergarten to university—even further, as learning is a lifelong process. Based on what we have read in the research, as well as our conversation with Christine Urand, the principal of Montessori Rietberg in Zürich, a child's natural curiosity is better suited to an intrinsic learning approach. For this reason, children could benefit from using our app (or certain features of it) from quite an early age. Many children also already have some experience using digital devices such as this. One of the most crucial factors, however, is the age at which students learn to read and write. Our app requires students to be able to do so, particularly in the connections timeline feature.

We imagine, however, that teachers might introduce the app to their students at different ages. At an early age, students could use the app to simply document their day or activities in a learning path by taking pictures and speaking about them. In this scenario, the app might also simplify text to playful and intuitive icons or limit certain options. From here, more experienced students could use the collaborative features and benefit from the intelligent tagging system. The creative methods could also develop alongside the students, from simple games to more complex design methods. The features offered by our app could therefore support the students until they finish their basic education and transition to a professional career or higher education (i.e. 16 years of age). Around this time the app, specifically the connections it creates, would be particularly useful in helping students make important decisions.

As we have developed this project in the context of Switzerland, our design has been tailored to suit the Swiss market and educational system. Having said that, we want to address the change that is happening in education on a global scale. We imagine our concept could be adapted to other education systems or inspire similar approaches in different countries. Furthermore, though we see the impact of our concept being strongest and most scalable in the school system, we also imagine our approach could be used in other fields.

4.6.4 Opportunity

To consider all stakeholders in our service we need to find opportunities within their combined interests or pain points.

By shifting the focus towards the development of skills and competencies, schools in Switzerland are placing more emphasis on interests and motivations of students. When students have a voice in their education, they become more motivated and engaged. This change also benefits teachers, as the students work in a self-organized manner. We look to support this shift with our app.

We have also considered the ongoing digitalization of school IT infrastructure in Switzerland. Many schools, teachers, and students are becoming increasingly accustomed to the use of learning apps and digital devices—including tablets— in the classroom. For this reason, an app could be easy to integrate into the classroom learning experience.

From a government standpoint, digital learning materials allow for scalability and uniformity across education. This is important especially in the case of the Lehrplan 21 whose main aim is to standardize education and learning materials across German-speaking cantons in Switzerland. Such tools allow for a more efficient evaluation of strategies.

Our vision with the app is to support the transition to an education that prepares students for the future and develops them as global citizens. More specifically, we believe placing an emphasis on soft skills such as creative thinking and collaboration will help students navigate future environments in their adult life.

4.6.5 Touchpoints

Using a system map (Fig. 116), we illustrate the various layers of interaction our app offers to its stakeholders. We explore the following five layers of interaction: app, peers, teacher, school, and environment.

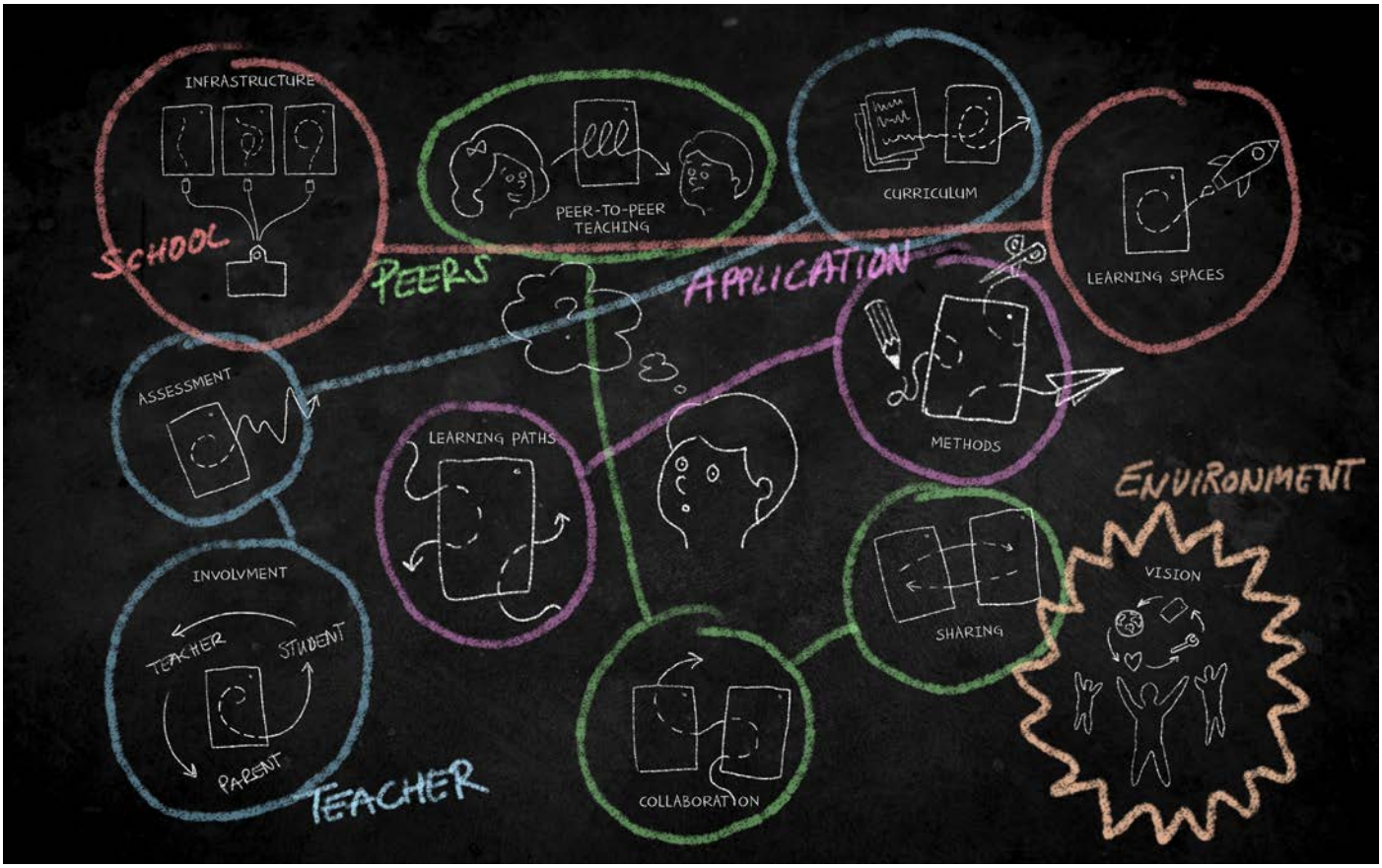


Fig. 116

App

The layer closest to the student is the app (Fig. 117-118). Here the student interacts with and uses the app. For us, the creating of learning paths and use of methods is central to our system. This first layer responds directly to our main goal of supporting an intrinsic, interdisciplinary, creative, and collaborative learning approach.

Fig. 117

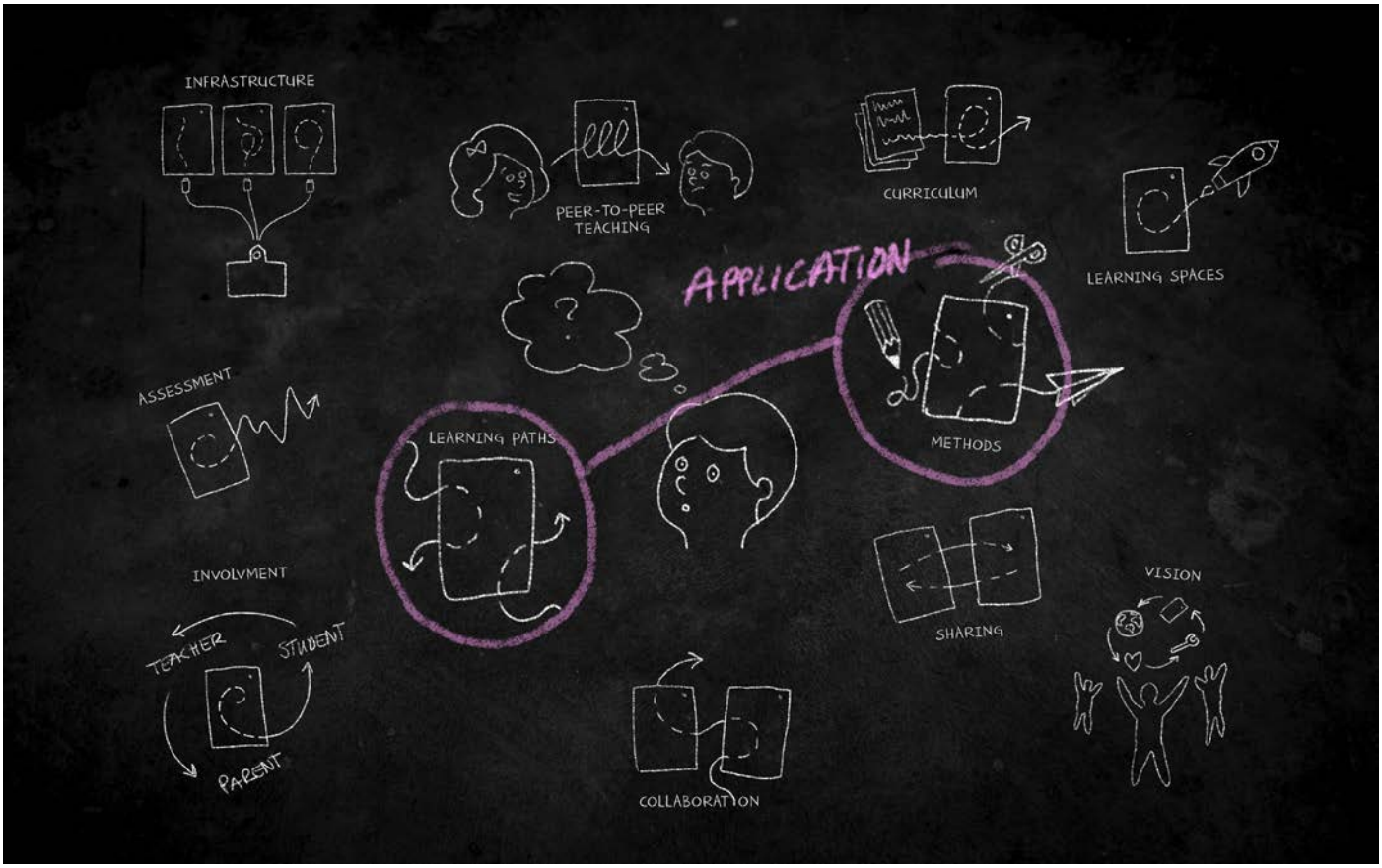

INFRASTRUCTURE
PEER-TO-PEER TEACHING
CURRICULUM
LEARNING SPACES
APPLICATION
ASSESSMENT
LEARNING PATHS
METHODS
INVOLVMENT
TEACHER
STUDENT
PARENT
SHARING
VISION
COLLABORATION

Fig. 118

Peers

The app also offers ways in which the student can collaborate, making peers the second layer in the system map (Fig. 119-120). Students may share content directly through the app, work on the same learning path with their peers, or use the methods and paths to teach one another. We see such collaboration as an essential part of a learning experience as it helps students to gain new perspectives.

Fig. 119

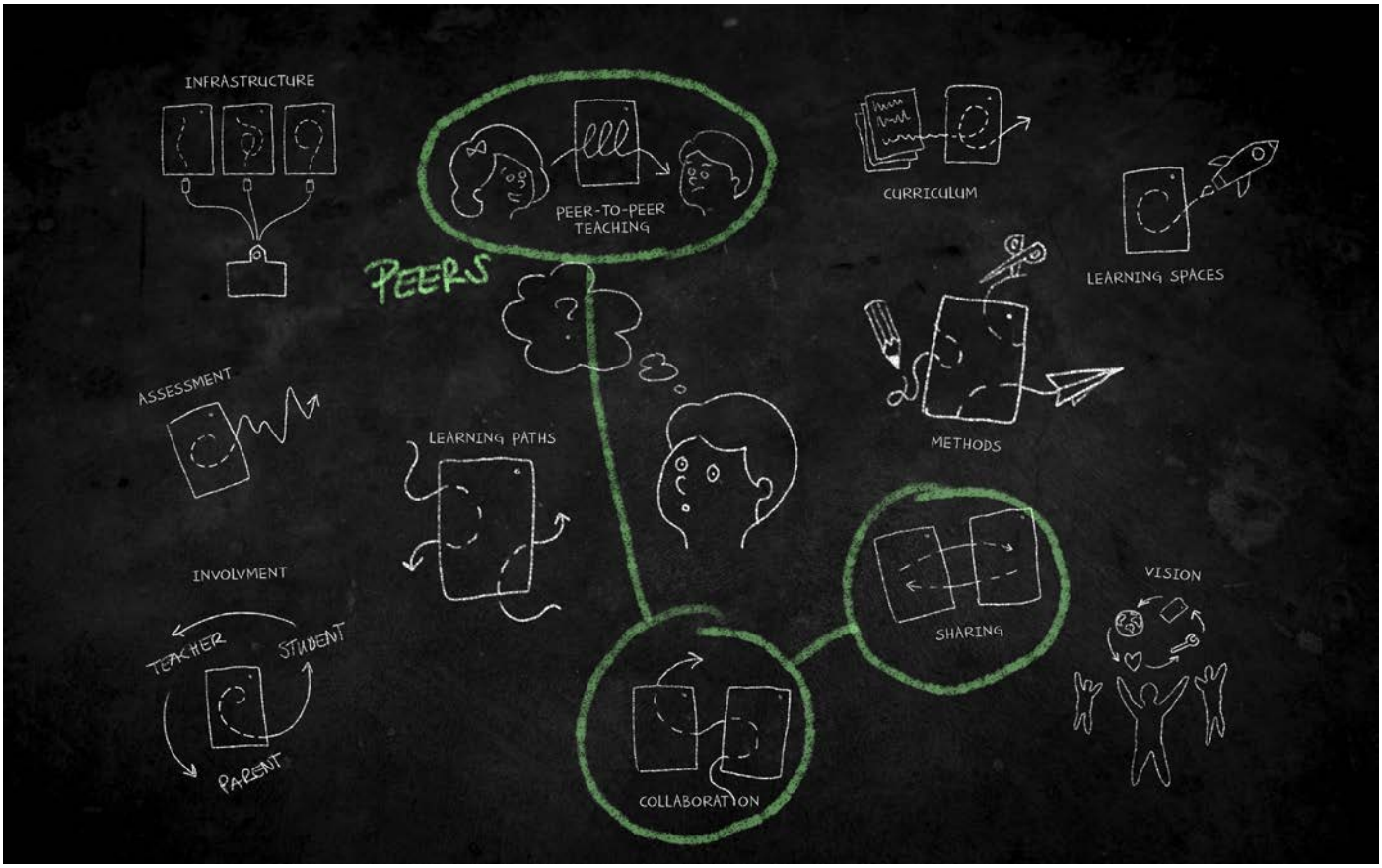

INFRASTRUCTURE
PEER-TO-PEER TEACHING
CURRICULUM
LEARNING SPACES
PEERS
ASSESSMENT
LEARNING PATHS
METHODS
INVOLVMENT
TEACHER
STUDENT
PARENT
SHARING
VISION
COLLABORATION

Fig. 120

Teacher

The relationship between student and teacher forms the third layer (Fig. 121-122). Teachers interact with the application on a different level and in various situations. The first is by using the app to implement a curriculum. Whether this curriculum is how we understand it today, or a future version focused entirely on student interests, teachers can help ensure their students are learning what is required of them. More specifically, the teacher can assign content to a class or to individual students in the app. In addition, teachers can follow the learning paths of students over time. This helps the teacher to better understand and assess the progress of a student, as well as provide assistance when necessary. The insight into the learning process of an individual student is therefore just as interesting to parents. In a parent-teacher-student talk, the visualizations in the app could help to provide the base for a constructive conversation between all stakeholders.

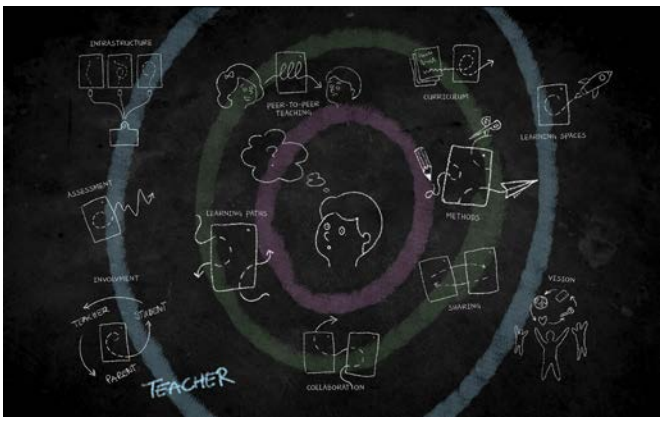
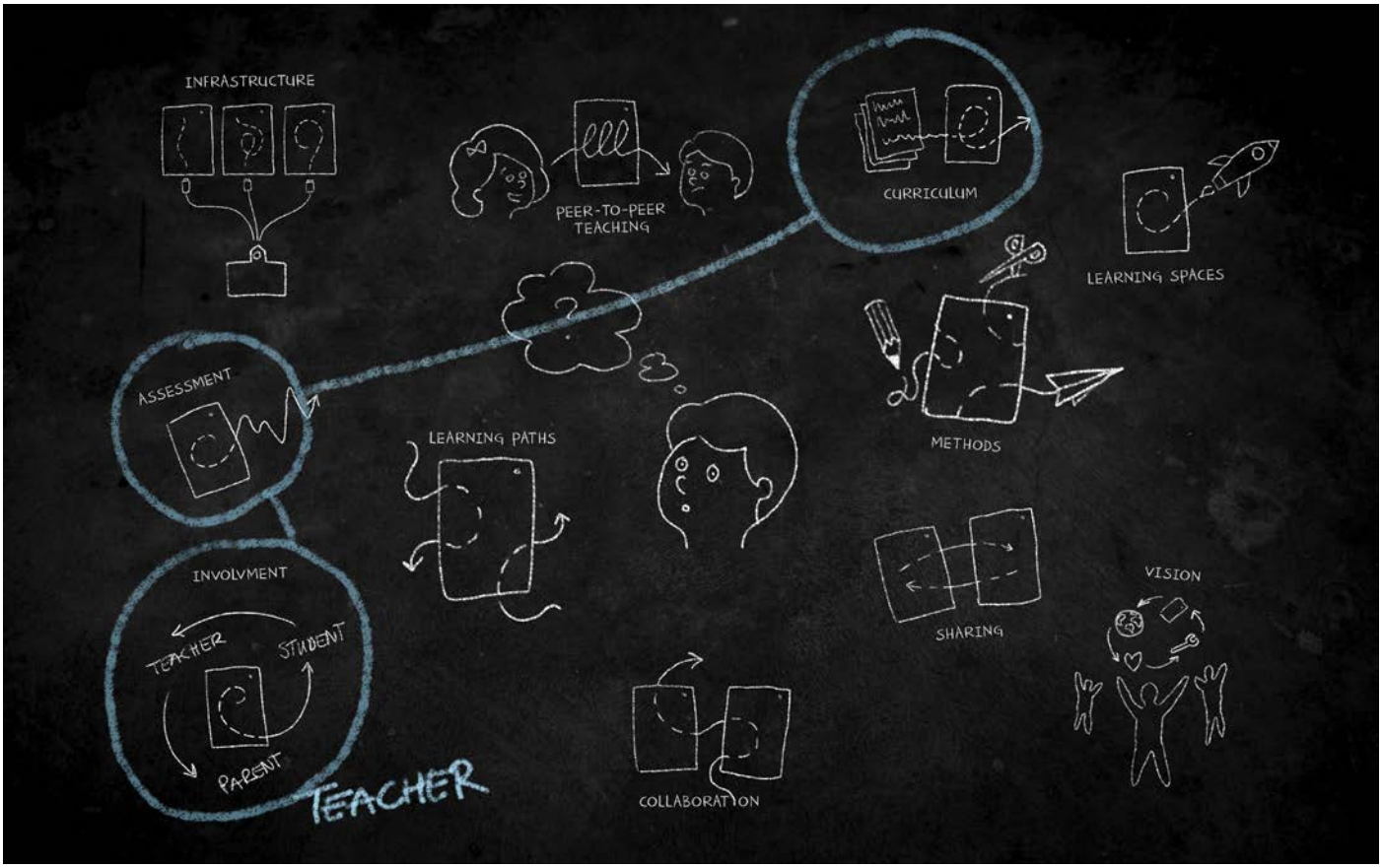


Fig. 121


INFRASTRUCTURE
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LEARNING SPACES
ASSESSMENT
LEARNING PATHS
METHODS
INVOLVMENT
TEACHER
STUDENT
PARENT
TEACHER
SHARING
VISION
COLLABORATION

Fig. 122

School

The fourth layer of our system map is concerned with the role of the school and functions outside of the app (Fig. 123-124). As government institutions, schools are responsible for providing IT equipment and infrastructure. For our app to be implemented, schools will have to provide the necessary digital devices—in our case tablets—to their students. As digital technologies are becoming increasingly prevalent in the classroom, in part due to the Lehrplan 21, as well as the effects the pandemic has had on the education system, our app is situated well in the current circumstances.

In addition, digital technologies are changing the way we learn. As information becomes increasingly accessible and new learning spaces emerge, schools need to reconsider what, how, and where students learn. Our app embraces these changes by encouraging students to think creatively and explore their interests in new ways. Furthermore, the use of a tablet allows a student to learn on the go and be active, rather than passively learning at a desk.

Fig. 123

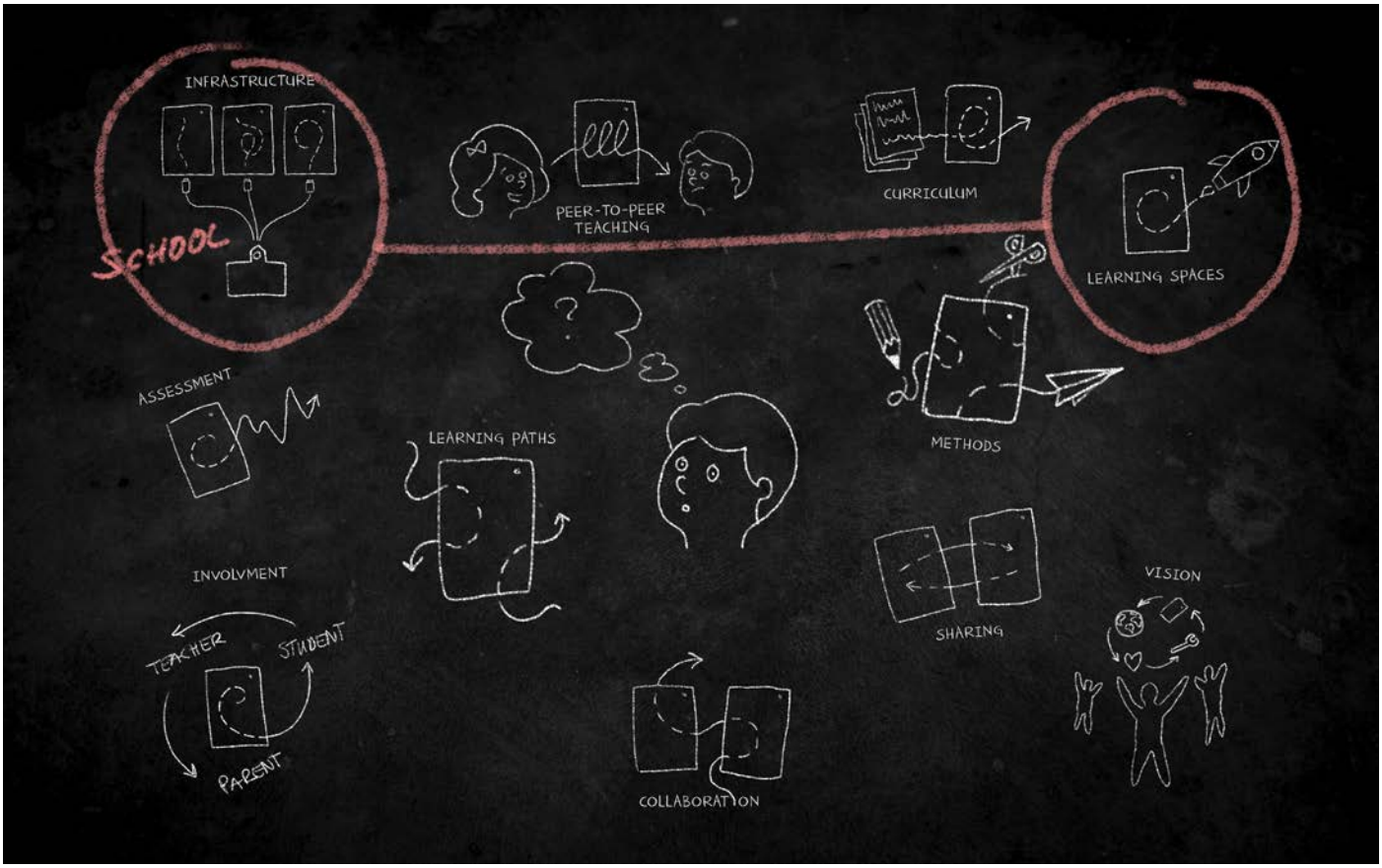
INFRASTRUCTURE
SCHOOL
PEER-TO-PEER
TEACHING
CURRICULUM
LEARNING SPACES
ASSESSMENT
LEARNING PATHS
METHODS
INVOLVMENT
TEACHER
STUDENT
PARENT
SHARING
VISION
COLLABORATION

Fig. 124

Environment

In the fifth and final layer we place our project into relation to the environment and formulate our vision (Fig. 125-126). Our app aims to develop students both within and beyond the classroom environment. We envision students as being confident, responsible, and engaged members of their society.

Fig. 125

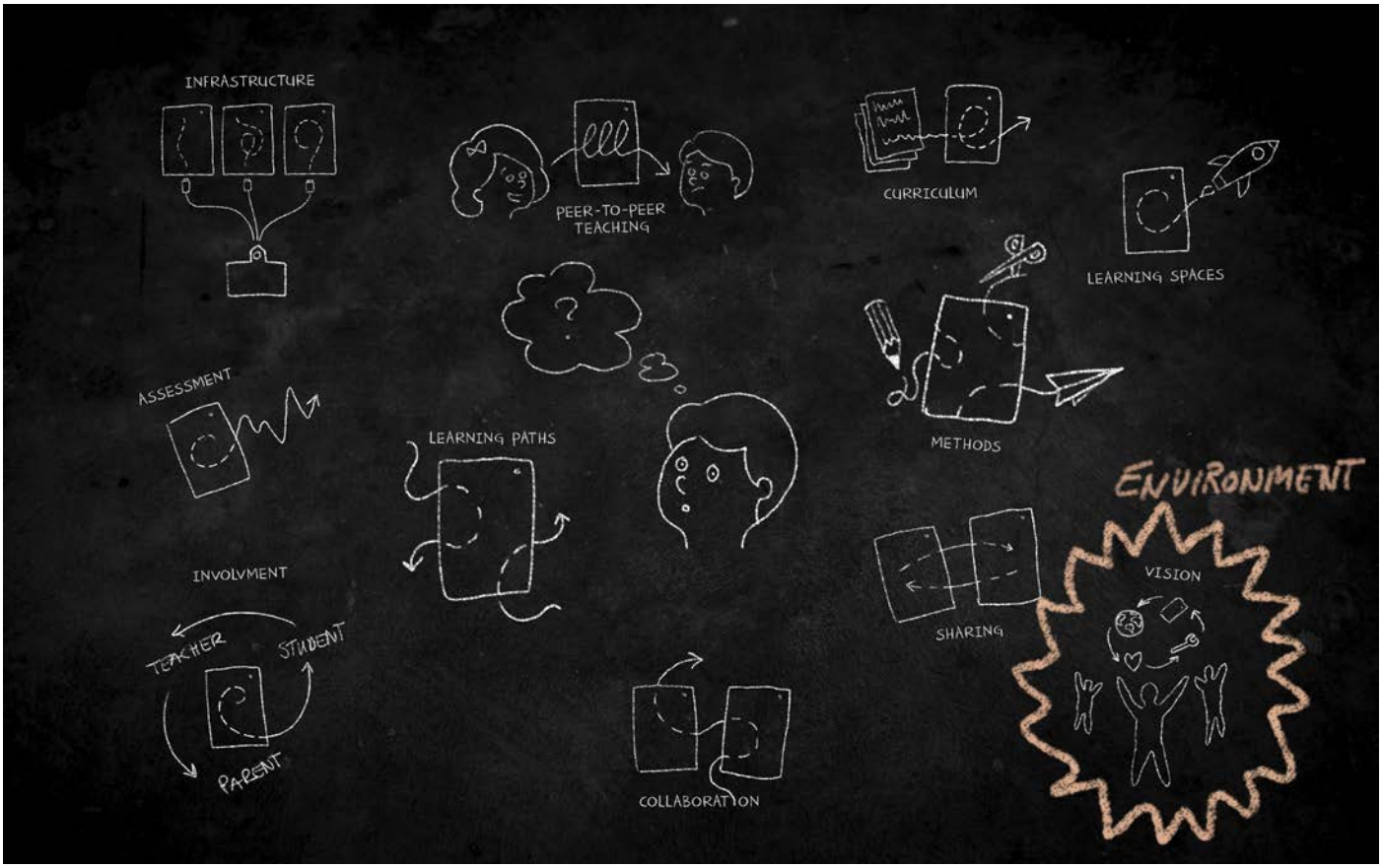
INFRASTRUCTURE
PEER-TO-PEER TEACHING
CURRICULUM
LEARNING SPACES
ASSESSMENT
LEARNING PATHS
METHODS
ENVIRONMENT
INVOLVMENT
TEACHER
STUDENT
PARENT
VISION
SHARING
COLLABORATION

Fig. 126

4.6.6 User Journeys

We imagine a future where students are no longer bound to subjects or classrooms, and learning is understood as non-linear and exploratory. We believe that our application will work best in such a scenario and provide user journeys to help explain this (Fig. 127).

User Journeys that Intersect

Our diagram or sketch illustrates how three different learning paths or user journeys intersect. We chose to show the journeys as sketches, rather than linear visualizations commonly found in other service design projects, as they are better able to communicate the non-linear and interconnected learning process that our app provides. The user journeys shown in the diagram are only selections of certain parts of the learning paths. We chose not to include entire learning paths in this diagram to make the user journeys and their connections more readable. In the diagram the white figure represents the teacher, while the yellow, blue, and green figures represent students who work either in a team or alone.

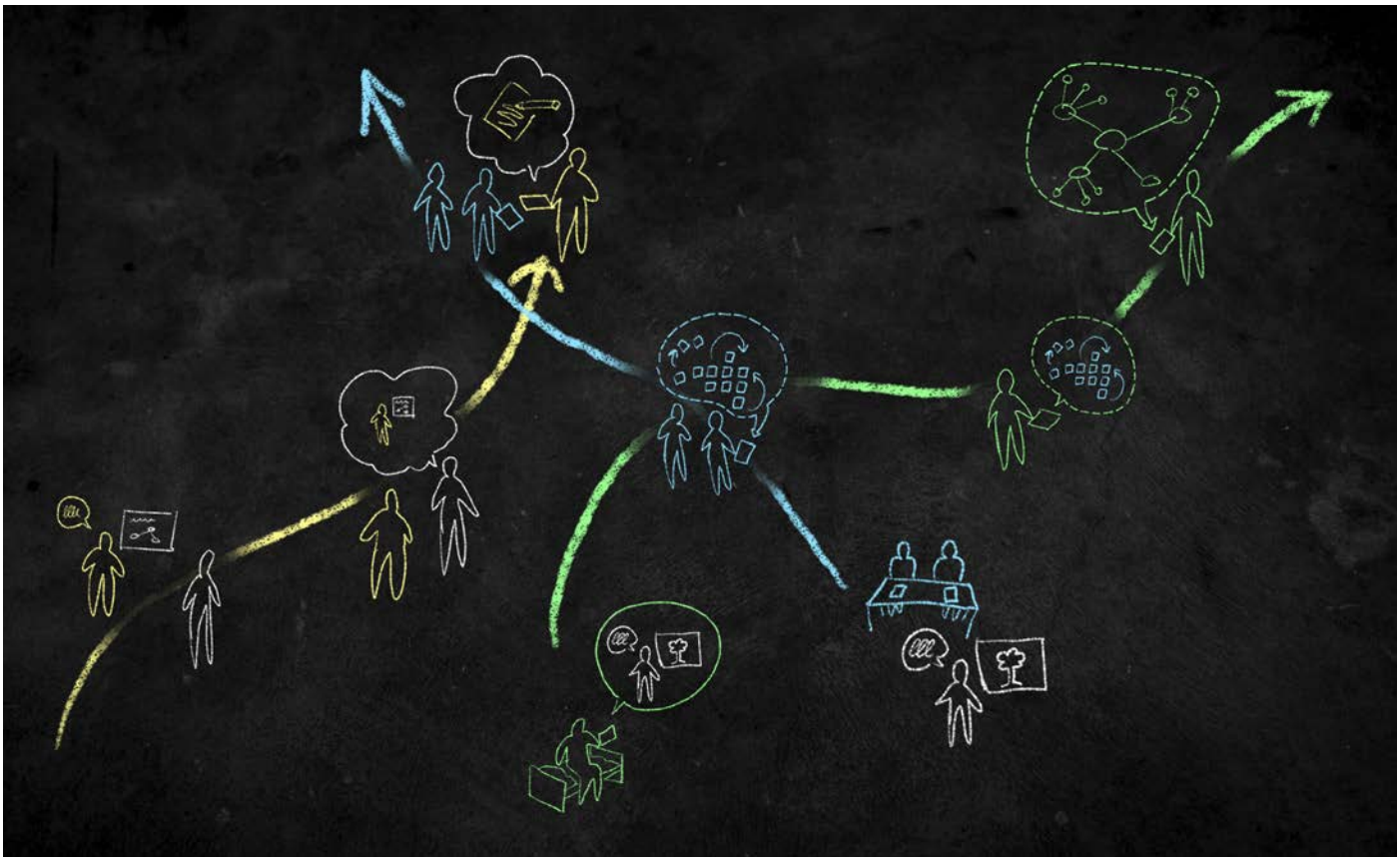

Fig. 127

Yellow Path

The yellow student creates a presentation by looking over the documentation in their learning path. Once the presentation has been prepared, they add it to the path so that they can access it in the future. The student then shares their presentation with the class.

After the presentation, the teacher and yellow student have a quick discussion about the project. Together they overlook the path and discuss the project and the student's main learnings.

Now that they have finished their project, the yellow student has time to help their peers. One friend in particular asks the yellow student if they can show them the sketching technique they used in their presentation. The yellow student shares the path point which contains an image of their sketching technique and shows them which method from the app they used.

Green Path

The green student is ill today and decides to stay home sick. Though they missed the input for a new project, their teacher has added it in a new path for them. Upon watching the input, the student feels inspired and begins thinking of new ideas for the project.

During this time, the student's classmates have ideated project topics with post-It notes on the classroom wall. They decide to share their ideas with the green student who is working independently from home and share the path point from containing a photo of the post-it notes. The green student is notified and finds the path point in the shared section of the overview.

While working from home the green student looks for a way to structure their own thoughts and ideas without using too many materials. They browse the app's method library and stumble across mind maps. Once they have read the provided description and gained a better understanding, they draw their own mind map on paper and upload a picture to their path.

Blue Path

The two blue students are in class listening to their teacher give an input for a new project. For this project, the students will document their process and learnings with our app.

The two students decide to work on this project together and begin discussing their thoughts and writing notes. As the teacher has suggested that the class find out more about post-it note ideation, the two students search for the method in the app's method library. They read in more detail how brainstorming and idea clustering works with post-it notes and start putting their thoughts on the wall. Excited about the work they have done and their use of this new method, the two students take a photo of the post-it notes with the tablet and upload it to a new path point beside the teacher‘s input.

The following day at school, the teacher asks the two blue students to share their post-it note ideation with the green student who is at home sick. More than happy to share their work, the two blue students open the learning path on their app and share the necessary path point with the green student.

Using the post-it note ideation method has helped the two blue students formulate some interesting ideas for their project. After agreeing upon an idea, the students use laptops provided by the school to find out more information. They browse the Internet and happen across a miniature model built by someone else. Fascinated by the model they decide to build their own version. As they want to draw up a quick plan first, the students ask their friend—the yellow student—if she can help them with their sketching technique. With the yellow student's help, the two blue students find a method in the app which explains easy ways to sketch ideas. They proceed to sketch a plan which is then documented and added to their learning path before they start looking in the classroom for some cardboard to build.

Teacher

In these scenarios the teacher (white) coaches and supports the students throughout their learning process. More specifically, they provide inputs at the beginning of projects, assist the students throughout their learning paths, and have discussions with the students to discuss their process and learnings. They also look to connect students with similar interests and suggest methods for inspiration.

4.7 Project Communication

4.7.1 Concept Video

Over the course of our bachelor project we have been extremely fortunate to work with students and teachers from a school in Zofingen. The valuable insights we acquired have helped us to understand how we as interaction designers can contribute to future of education, one which supports an intrinsic, interdisciplinary, creative, and collaborative learning approach. Our learning app and its features were inspired by these insights, and we want to emphasize this in our video.

To achieve this, we decided to film in a classroom at the school in Zofingen. This helped us to place our learning app in context and show how it could support and benefit students in their learning experience. Our footage focuses mainly on students collaborating, having discussions, and exploring different methods, but also shows students using their tablets to help give a visual impression of how the app works in certain moments. We do not focus directly on the features of the app, but instead frame them as our solutions to the problems and opportunities we experienced while working with students. Furthermore, we do not want to imply that learning happens only through our tool on a screen. In addition, we include voices of the students to give the viewer a better feeling for the modern student, how they envision the future of schools, and what they enjoy about learning.

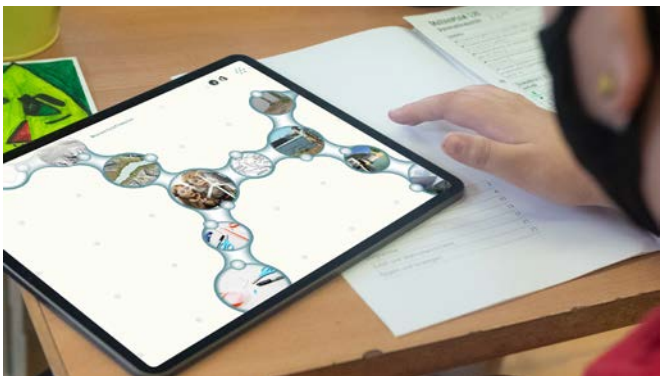

Fig. 128-129

4.7.2 Exhibition

Our exhibition concept communicates the aim of our learning app primarily through the juxtaposition of a traditional and futuristic classroom (Fig. 130). As designers we want to support schools in their transition to a more intrinsic, interdisciplinary, creative, and collaborative learning approach, and believe outdated models of education have run their course.

Visitors of the exhibition are reminded of their own experiences and can reflect on their own education. We want to evoke emotions and have people contemplate how their education would be today or in the future.

We recreate a typical classroom setting inspired by including a school desk and blackboard as the main elements. While the school desk is an older, more traditional model, we have changed its appearance by painting it in a bright and unexpected colour. This change represents or suggests a transformation in education. On the desk we have included our printed thesis, as well as an iPad showing the click dummy of our learning app.

The blackboard is an original piece as well, coming from an old elementary school building in Egliswil. On it we display a chalk drawing of our service system map. As our app will only be visible on the iPad, we want to use the illustration on the blackboard to give insight into our project for those passing by and observing the exhibition, as well as an added layer of information. Illustrating the system map on the blackboard will also allow us to refer to it during our final presentation, which happens in front of the exhibition. If time allows it, we will enhance the illustration with animations or by highlighting certain parts with a projector, while the corresponding explanations can be heard over headphones.

As our project is a service, we also emphasize the human aspect of our project. We do this by positioning both a student's and teacher's bag next to the desk. These bags include a written statement, representing the student's and teacher's perspective towards our app. Our exhibition places the visitor into the center of our concept, infrastructure, stakeholders, and users.

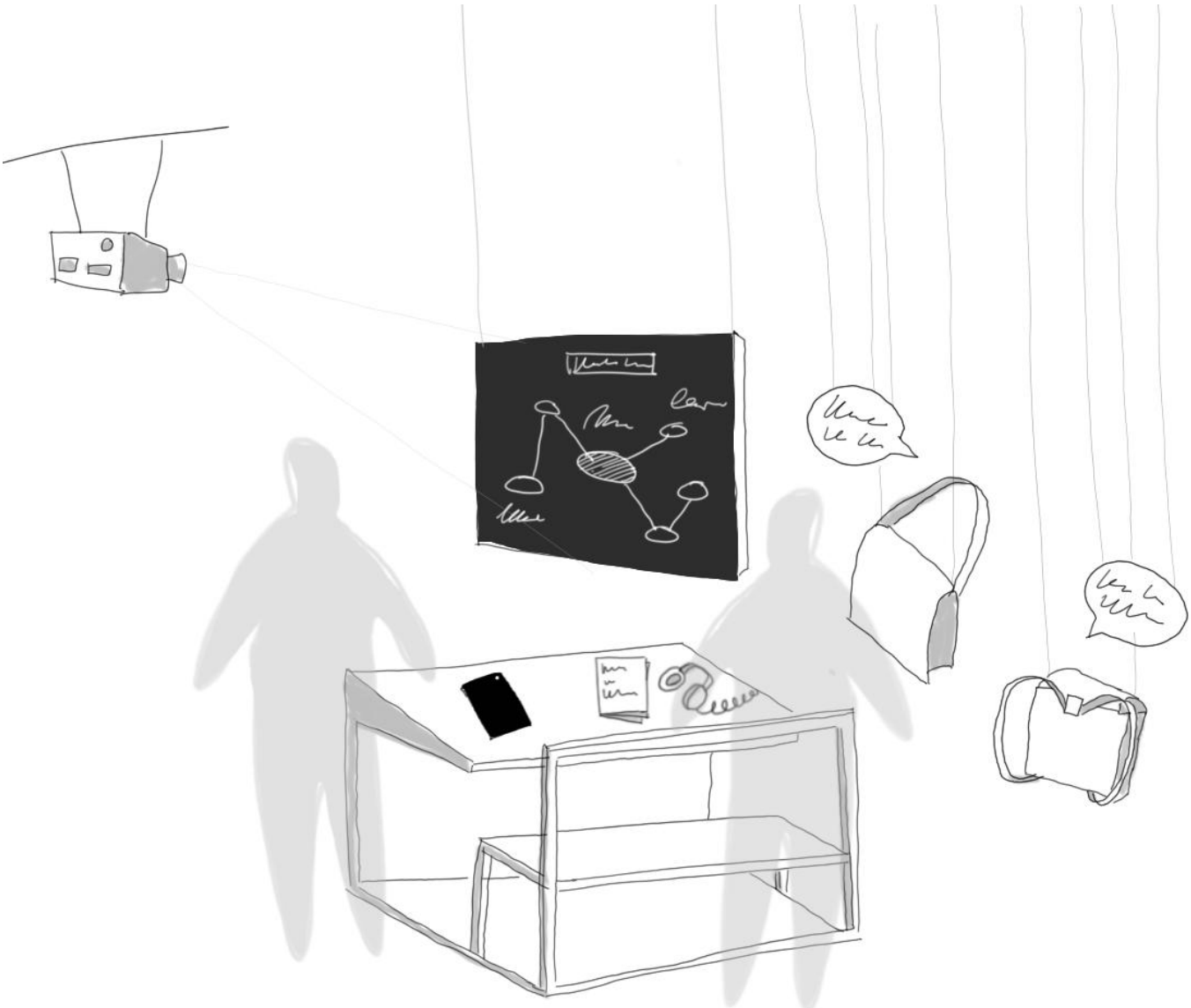

Fig. 130

5 Conclusion & Reflection

5.1 Conclusion

To conclude our thesis we will begin with an overview of our project, focusing on the most important developments which occurred over the course of four months. We will then reflect on our process as a whole, discussing in more detail what we accomplished, as well as what we would have done differently. Following this, we will highlight the lessons we learned during this time, describe in which ways our project contributes to the field of education, and outline our future steps.

Our bachelor project and learning app is the culmination of the literary and field research, as well as design work, which happened over the past fourth months. In other words, our project matured and developed as our knowledge and experience grew. Initially we teamed up as a result of our shared interest in education. Despite having had quite different learning experiences, looking back we wish we could have felt more connected to our education in our youth. We both felt that our education had valued certain kinds of information and learning styles over others. For us, our education wasn't supporting or celebrating individuality—it was looking to shape us in its image instead. For this reason, we wanted to contribute to a future of education which places more focus on the individual student.

To consider the future of education, however, we knew it would be important to challenge our assumptions of modern education. We needed to work together with students to better understand their experience of education, and to know in which ways education may have changed over the years. Fortunately during our project we were able to find a school in Zofingen who was happy and willing to work with us and support our work despite the pandemic.

We began with the following research question: "How might we create an experience that supports elementary students in their understanding of the self in education, and in preparation for the lifelong development of the self?" With this question we were looking to better understand how students perceive themself within education. In other words, we wanted students to reflect on what their education means to them, as well as what value it brings them. To explore this question we designed a series of cultural or 'exploratory' probes for a class of 9th grade students in Zofingen. Our findings indicated the following: student motivations and interests tend not to play an active role in their classroom learning experience; students view their free time as enjoyable and separate from their education; and students enjoy thinking creatively but require creative methods that suit their interests and abilities. What we realized at this moment was that our project should be less focused on having students actively reflect on their education, and more concerned with how we as designers can address the disconnect students experience with their education. How could we help students become more actively involved in and engaged with their education? This led us to refine our initial research question to: "How can an intrinsic learning experience help students gain a sense of ownership over their education?"

Using the findings from our probes we developed a workshop to investigate intrinsic learning. We had discovered during our literary research that the intrinsic motivation of students can be better integrated into the classroom learning experience by providing students with a variety of choices, such as what they learn, who they work with, or how they present or show their learnings. For this reason, we designed a task for the students that would allow them, not only a series of choices, but complete freedom in a learning situation. It is important to note that we were very fortunate during this time to have certain pandemic restrictions lifted which allowed us to visit the students in Zofingen and hold the workshop in person.

In the end we were able to gather very valuable insight from the workshop. As predicted, students struggled with complete freedom of choice in general. Whether it was choice of topic or choice or how they share their work with their peers, students needed some level of structure or guidance. For instance, when presented with a blank page the students were unsure of how to visualise, formulate, and process their thoughts. In other words, they seemed

to be lacking creative methods to engage in their learning process. Having said that, we also experienced that with the right amount of guidance (provided by us), whether it be in choosing a topic or a method, the students became extremely engaged, excited, and proud of their learning and work. They were excited to share what they had accomplished with their peers. It was only after the fact that we realized our knowledge and sharing of design methods and processes with the students helped provide them with the guidance needed for an intrinsic learning experience. As interaction designers, this is what we felt we could contribute to education.

Overall our time spent at the school in Zofingen was extremely valuable for our work. Not only were we able to work with students and learn more about how they experience education today, as well as how they navigate an intrinsically motivated learning experience, but we also gained insight into how students work and behave in a classroom setting. We observed moments where students were working together to solve problems, collaborating on assignments, and also sharing work with each other. The entire time we had been so focused on the individual learning experience we hadn't closely considered that learning and sharing knowledge is a collective experience. As a result we began to incorporate more collaborative aspects into our concept. We were also fortunate enough to experience teachers presenting their students with opportunities to make their own choices in the classroom (e.g., choice of topic, project partner, medium, etc.). These students were visibly more motivated and engaged in their learning, and the variety of quality of the projects they produced was quite impressive.

In addition, we noticed an increased presence of digital technologies in the classroom. Students could often be seen using iPads to research and complete assignments. While this is not inherently negative, we worried that the primary and sole use of technology to learn would only continue to perpetuate an outdated model of education that values the absorption and regurgitation of information. For this reason, we knew it would be important for us to consider how we use technology to encourage students to interact and engage with the information and material they are learning.

Much of what we experienced and observed in Zofingen helped to bring nuance to our final project. While our primary goal was to design a tool that would support students throughout an intrinsic learning process, we also considered other important aspects of learning. For instance, how could our tool support student collaboration, sharing of work, and peer-to-peer teaching? How could we shift the focus towards the act of learning, rather than the outcome? How could we make the best use of digital technology in a classroom setting, and how can we encourage students to incorporate analog methods into their working process?

5.2 Reflecting on Process

Looking back at the past four months it's become clear that our process makes up a large portion of our bachelor project. From cultural probes to workshops, we were able to apply many of the methods we have acquired from our studies during this time. For us, these methods allowed us to connect with students and teachers and gain a better understanding of the modern classroom and learning experience.

What became increasingly apparent towards the end of our project was the complexity of our learning app. Providing students with the ability to create learning paths throughout their education, which they can then compare after the fact, is no easy feat. This kind of app requires the consideration of many different elements and how they work together as a system. For this reason, we had to focus primarily on the main functions of the app, which are the building of paths and the connections between these paths. These functions are what best communicate the goal of the app and were therefore our top priority. We also addressed other functions of the app, but perhaps not to their full extent or potential. One aspect we have yet to address, but are aware it is needed, is the user interface for the teacher. For instance, we have imagined a scenario in which the teacher is able to share an assignment-specific path to all the students in their class. This path would include an input of some kind and would be viewable in the student's learning path overview screen. As our main priority from the beginning was the student, the teacher's interface became secondary, and we did not have time to address it.

During our project we were both unfortunate and fortunate with the pandemic and its restrictions. We knew from the very beginning that to gain a better understanding of the modern student and their educational experience we would have to meet with the students in person as early as possible. Unfortunately, the pandemic and its restrictions put our plans on hold until we held our workshop, which meant that some of our insights were gained slightly later in our project timeline than we would have liked. Moreover, not knowing when and what restrictions would be in place, affected how we designed our approach with the students. Throughout our project we planned first for in person meetings, but always had to be prepared for our work to be communicated in a virtual setting. This made both the implementation and qualitative interpretation of our cultural or 'exploratory' probes slightly more difficult than we had anticipated. Despite these setbacks, however, we were extremely fortunate to find a school who was willing to work with us and support our project during this time. Whether it was over Zoom or in person, working together with the teachers and students from the school in Zofingen was invaluable for our project.

5.3 Learnings

Since the start of our bachelor project four months ago we have experienced a wide range of emotions and been faced with a variety of challenges. While at times tough, it was in these moments we had our most valuable learnings. The knowledge and experience we gained has helped us to better understand our role and value as interaction designers, not only for the field of education, but others as well.

One of the most important and perhaps obvious learnings we had during our project, was that we are interaction designers, not teachers with a pedagogical background. This meant we had to take the inputs from teachers into account, particularly when it concerned the developmental stages of children and what we could expect of them. For instance, when considering how to support students through an intrinsic learning process, we were made aware that the younger the students are, the less life experience they have, and should therefore be encouraged to explore and learn many different things. This does not mean they cannot learn intrinsically, but rather that they require structure and guidance to explore.

This is also where we realized how we as designers can contribute to the field of education. Our work with the students, particularly during the workshop, revealed to us the similarities that exist between the design process and an intrinsic learning process. As designers we don't necessarily know which directions our learning or process will take us, but we are equipped with a diverse set of methods that encourage us to keep exploring and to try out new things. Our process and methods in general are designed to keep the learning process flowing.

Throughout our project we also experienced design methods as being context-dependent, meaning we adapted them to fit the situation they were being used in or applied to. For instance, we took inspiration from cultural probes to gain further insight into how students perceive themselves within education, but did so without first holding qualitative interviews, and did not include an assortment of artifacts or a diary for them to write in throughout the week. In fact we viewed our probes as more exploratory, as they were really our first interaction with the students from the school in Zofingen due to the pandemic and its restrictions. The flexibility and adaptability of design methods was a learning we carried with us throughout our process, and a quality we decided to give the methods offered by our learning app. We wanted to provide methods in such a way that they inspire the student and perhaps provoke new ideas, which can then be added to the student's method library.

Another important learning for us happened during our workshop with the students in Zofingen. As we walked around the classroom, providing them with support and guidance, we quickly recognized how easily influenced they are. Though we attempted to offer our ideas as suggestions, many of the students did exactly what we said. Of course we realize that students of this age do not have the same life experience as us and are therefore still exploring and learning. Nonetheless, we felt it was important to strike a balance between providing guidance and providing instruction in our project. We believe that guidance in an intrinsic learning experience should inspire the students and show them what is possible.

Overall, the use of our design skill sets in real situations and environments has brought us invaluable experience as interaction designers and shown us where we have potential to contribute to other disciplines.

5.4 Contribution

Education has always been and continues to be one of the most important aspects in preparing children for the future. As the world changes, however, so too must education. Education needs to rethink its priorities and consider alternative learning experiences that will help prepare students for a plurality of possible futures. We believe shifting the focus towards an intrinsic, interdisciplinary, and collaborative learning approach is one way to do this.

With our bachelor project and learning app we are providing schools with a way to implement these changes now, as well as into the future. As we cannot be certain of how the curriculum will change over time, or which aspects of education itself will change and how much, we designed a learning app that is flexible and can easily adapt to the needs of the user. Overall, we believe it's important to encourage and support change now, rather than say what could be done 5 or 10 years from now.

Our thesis also reaffirms and contributes to the existing but limited research on choice provision in the classroom. During our time at the school in Zofingen we were able to confirm more or less what we had read in the literature. First, students who are presented with a series of choices in the classroom are more motivated and engaged in their learning. Choice provides students with a voice and allows them to become the author of their own learning. Second, when given too many choices or complete freedom of choice, students can become overwhelmed and therefore less motivated or engaged. And third, some kind of structure or guidance is required to properly support students in such a learning approach. As interaction designers we were able to contribute to this research by using the act of documentation, as well as design methods, to provide a possible structure and form of guidance for an intrinsic learning process. Our learning app could therefore further research into choice provision in the classroom by offering an alternative structure and/or form of guidance. Moreover, if the app was implemented in schools and enough data was collected over a certain amount of time, this data could potentially be used to analyze and study intrinsic motivation, as well as intrinsic learning approaches.

With our learning app we redefine the role of digital technologies in the classroom as working hand in hand with analog methods. While we don't believe that technology is inherently bad, its perpetuation of outdated models of education are. Students are using computers and tablets to search information on the Internet, which they then copy down on paper without actually thinking about or engaging with the information. We believe students should cultivate a more balanced relationship between digital and analog technologies. For this reason, we offer the student a selection of analog methods to encourage them to work with their hands and think creatively—not just type on a keyboard.

5.5 Future Steps

Our bachelor project allows for future steps in various directions, both app and project related. With regards to the app, we believe the methods library has the potential to be further developed. At the moment, our app provides students with a selection of methods, while also allowing them to add their own. Where we see potential is in the creation of different sets of methods for each age group, or methods which accumulate over time. The reason for this, is to offer age appropriate methods which develop alongside the student, becoming more nuanced and complex over the course of their education. This would help the app to better support the needs and maturity levels of a wide range of age groups and could be developed and refined through user testing with students of different ages.

In addition, we would like to further develop the app interface for other devices. While our first priority was to consider how we could help students in the classroom, we also see the value in having an app that moves off the iPad screen and beyond the classroom. We want to encourage and support learning that happens in a variety of environments, which means the app would need to allow students to document their work and access methods on any device, whether it be their mobile phone when they are on the go, or a desktop computer at home.

As we have designed this app in the context of Swiss education with the intention of having it be implemented now, we would like to push our project forward in the coming months. Whether this means submitting our project to design competitions or applying for crowdfunding, we would like the opportunity and funding to develop the app and therefore test its potential with real users over time. If funded, a business concept would also have to be developed.

To conclude, we believe certain models of education have run their course, and change needs to happen now. Promising steps are already being taken by governments, schools, and teachers to reimagine the future of education. As interactions designers we want to help schools and their students transition to this future, particularly one that places emphasis on the intrinsic motivations of students, the interdisciplinary nature of education, creative thinking, and collaboration. Our learning app was designed to place exactly this kind of emphasis.

Fig. 131

6 Bibliography

6.1 References

Apps

ClassDojo. (n.d.). *ClassDojo.* Retrieved May 17, 2021, from https://classdojo.com/

Books & Book Chapters

Deutschschweizer Erziehungsdirektoren-Konferenz (D-EDK). (2016). *Lehrplan 21*. https://v-ef.lehrplan.ch/container/V_EF_DE_Gesamtausgabe.pdf

Patton, L. D., Renn, K. A., Guido, F. M., & Quay, S. J. (2016). Student Development in College: Theory, Research, and Practice (3rd ed.). John Wiley & Sons.

Resnick, M. (2002). Rethinking learning in the digital age. In G. Kirkman (Ed.), *The global information technology report: Readiness for the networked world (pp. 32–37).* Oxford University Press.

Resnick, M. (2018). *Lifelong Kindergarten: Cultivating creativity through projects, passion, peers, and play.* MIT press.

UNESCO. (2015). *Rethinking education: Towards a global common good?* United Nations Educational, Scientific and Cultural Organization. http://unesdoc.unesco.org/images/0023/002325/232555e.pdf

Images

[The Swiss Education System]. (2016). Educa. Retrieved May 17th, 2021 from https://swisseducation.educa.ch/en/swiss-education-system-5

Legal Articles

Federal Constitution of the Swiss Confederation. (2021, January 1). SR 101 - Federal Constitution of 18 April 1999 of the Swiss Confederation. https://www.fedlex.admin.ch/eli/cc/1999/404/en#art_62

Projects

Stic Stac. (n.d.). *Stic Stac Code Blocks.* Retrieved May 17, 2021, from https://www.sticstac.com/

The Suggestion Box. (n.d.). *The Suggestion Box.* Retrieved May 17, 2021, from https://schoolslearntoo.media.mit.edu/

Videos

RSA. (2010, October 14). *RSA ANIMATE: Changing Education Paradigms.* https://www.youtube.com/watch?v=zDZFcDGpL4U

Web-Journals

Baxter Magolda, M. B. (2002). Helping Students Make Their Way to Adulthood: Good Company for the Journey. *About Campus*, 6(6), 2–9.

Beymer, P. N., & Thomson, M. M. (2015). The effects of choice in the classroom: Is there too little or too much choice? *Support for Learning, 30*(2), 105–120. https://doi.org/10.1111/1467-9604.12086

Eriksen, K. (2006). The Constructive Developmental Theory of Robert Kegan. *The Family Journal, 14*(3), 290–298. https://doi.org/10.1177/1066480706287799

Ivanitskaya, L., Clark, D., Montgomery, G., & Primeau, R. (2002). Interdisciplinary Learning: Process and Outcomes. *Innovative Higher Education Innovative Higher Education, 27*(2), 95–111. https://doi.org/10.1023/A:1021105309984

Netcoh, S. (2017). Balancing freedom and limitations: A case study of choice provision in a personalized learning class. *Teaching and Teacher Education Teaching and Teacher Education, 66*, 383-392. https://doi.org/10.1016/j.tate.2017.05.010

Panke, S. (2019). Design Thinking in Education: Perspectives, Opportunities and Challenges. *Open Education Studies, 1*(1), 281–306. https://doi.org/10.1515/edu-2019-0022

Parmaxi, A., & Zaphiris, P. (2014). The Evolvement of Constructionism: An Overview of the Literature. *Lecture Notes in Computer Science., 8523*, 452–461.

Radenski, A. (2009). Freedom of choice as motivational factor for active learning. *ACM SIGCSE Bulletin, 41*(3), 21–25. https://doi.org/10.1145/1595496.1562891

Web-Links

Brilliant. (n.d.). *Learn to think*. Retrieved May 17, 2021, from https://brilliant.org/

Deutschschweizer Erziehungsdirektoren-Konferenz D-EDK. (n.d.). *Ziele*. Ziele | Lehrplan 21. Retrieved May 17, 2021, from https://lehrplan21.ch/ziele

Educa. (2016, January). *The Swiss Education System*. https://swisseducation.educa.ch/en?was_redirected=1

intrinsic. (n.d.). *Intrinsic Campus*. Retrieved May 17, 2021, from https://www.intrinsic.ch/

Volksschule Baden. (n.d.). *1:1 Tablets*. Volksschule Baden | Tablet. Retrieved May 17, 2021, from https://www.schule-baden.ch/themen/11-tablets/

6.2 Figures

Fig. 1: Description of the education system in Switzerland. Reprinted from Schweizerische Konferenz der kantonalen Erziehungsdirektoren (EDK), Retrieved May 24th, 2021 from https://www.edk.ch/de/bildungssystem/grafik. Copyright 2021 by Schweizerische Konferenz der kantonalen Erziehungsdirektoren (EDK).

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Fig. 57: „Lernerfolg ist lernbar“ cards used by the students of the 9th class, discovered during FotW [Photograph]. (2021, March). Copyright 2021 by Roman Engler & Zoë Urand.

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Fig. 87: Elements of GUI showing how students collaborate on the same path from different devices (i.e. „ghost“ path point and collaborator icons) [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 88: Elements of GUI showing the commenting of path points [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 89: Information architecture showing the app‘s main features and functions [Diagram]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 90: User flow showing how a student searches for an existing path, and then creates and shares a new path point [Diagram]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 91: User flow showing how a student is able to jump from the connection timeline to the path view in order to see a specific learning path in detail [Diagram]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 92: User flow showing the creation and sharing of a new method with a peer [Diagram]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 93: Colour wheel GUI element used by students to select colour for learning path [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 94-96: Diversity of learning path content, shapes, and colours [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 97: GUI elements showing different types of connections between paths in the connection timeline [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 98: GUI elements showing a wide range of methods, both provided by the app, as well as created by the students [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 99: GUI elements showing the detail information of an individual method [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 100: Navigation icons for each of the main features provided in the app. Starting from the left: connection timeline, method library, path overview, path point overview, and path view [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 101: Home screen mockup showing the app logo and introducing students to the navigation icons [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 102: Path overview mockup showing paths and the different ways they can be organized/viewed (i.e. most recent, shared, and by year) [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 103: Path point overview mockup showing path points related to a specific tag search [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 104: Path view mockup showing the moment a new path point is being added to a specific point on the learning path [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 105: Path view mockup showing the side menu which contains all the path‘s tags, as well as a button to view this specific path in the connection timeline [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 106: Path view mockup showing the sharing of a path or path point [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 107: Path view mockup showing the commenting function for path points [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 108: Path view mockup showing the detail menu of a specific path point where the tags can be edited [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 109: Method library mockup showing the wide range of methods, which can be scrolled through freely by the student. The methods are both provided by the app, as well as created by the students [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 110: Method library mockup showing the detail menu of an individual method. The menu contains a method title, descriptions, and visual [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 111: Method library mockup showing the template for students to create and add their own method to their library. These methods may also be shared [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 112: Connection timeline mockup showing how student learning paths are collected over time, as well as how these paths are connected to one another in different ways [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 113: Connection timeline mockup showing the detail menu of a connection between two paths based on shared tags [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 114: Connection timeline mockup showing the detail menu of a selected path, which contains all the path‘s tags and path points [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 115: Connection timeline mockup showing the detail menu of one tag connecting all related path points [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 116: System map showing the five layers of stakeholder interaction [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 117: System map showing first layer—the application and student [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 118: System map showing the interactions which occur between student and app [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 119 System map showing second layer—the peers [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 120: System map showing the interactions which occur between students and their peers [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 121: System map showing thid layer—the teacher [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 122: System map showing the interactions which occur between teachers, students, and parents through the app [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 123: System map showing fourth layer—the school [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 124: System map showing the interactions which occur on the level of the school as an institution [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 125: System map showing fifth layer—the environment [Image]. (2021, April). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 126: System map showing how the app develops students who go on to have an impact in their environment [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 127: Illustration showing three, intersecting user journeys [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 128-129: Stills from the concept video [Photograph]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 130: Illustration of the exhibition setup [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.

Fig. 131: Two BA students (aka. team bun) barely able to smile after 3 hours of sleep [Image]. (2021, May). Copyright 2021 by Roman Engler & Zoë Urand.