Chapter 13
Game Design with Portfolios and Creative Skills

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13.1 Introduction

The project combines art education approaches and portfolio work to develop artistic processes with digital media technology. A new concept to support digital media literacy of young people is developed, tested and evaluated. It brings together art and technology education accompanied by a specific mentoring concept including portfolios. The project realizes an education-through-art approach to technology in five thematic media modules such as robotics, interactive light installation, smart textile, sound as well as games. The latter will be described in the context of the GamesLab ON/OFF, realized at ZKM with student mentors and young people. The GamesLab ON/OFF approach encourages the participants to develop, design and perform their own game concept using the Web, a variety of media, technologies and the physical learning space of the ZKM media museum.

Digital technologies determine today's everyday life. They are used by the younger generation as a matter of course in their daily life. Pupils love to play games, especially if they are linked to computers and digital media. Furthermore, they like the idea of developing a game by themselves, according to their own imagination as we came up with in earlier projects developing mixed reality games (Reimann and Blohm 2007). However, in the research project MediaArt@Edu (Acronym), we intend to address a special mix of on- and offline game scenarios to introduce game design in a wider sense than screen based, including performative activities and expressions in physical space and the integration of the urban environment. The media education approach integrates different tools (such as Makey Makey, Dead drop as well as iPads and a QR code generator) to support complex design processes of shaping technology as a space for aesthetic experiences. The

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Fig. 13.1 Performative activities supporting an electronic circuit through body connections

aims of the project are as follows: firstly, to realize an artistic media education approach including a scenario to support social and core skills through creative project work in team-based arrangements. Secondly, the mentoring of such processes with university students is a goal to aspire to. In the paper, we look at examples developed in the GamesLab workshop. The projects presented are based on 3-day workshop settings which were developed, realized and applied with education students who collaborate with students of technological subjects (e.g. such as electronical engineering, computer science, architecture as well as machine engineering) who attain so called key qualification/transferable skills[1] in the framework of a seminar at university level (Fig. 13.1).

The qualitative research methodology is based on the continuous observations of lessons by the mentors as well as on feedback rounds and semi-structured group interviews with the participants. As a result, the workshop scenario as well as projects developed by the young people are introduced in the following. In conclusion, the paper looks at the lessons learned through artistic game education as didactic tool for unlocking creativity in vocational preparation.

The project aims to scrutinize artistic approaches to media design and mentoring concepts and to enable students to accompany game development projects in creative contexts. It brings together game design and portfolio practice to reflect and

[1] The German term of Schlüsselqualifikationen.

visualize the processes by the learners themselves, following a constructivist and artistic learning approach. In order to improve media literacy of the young participants, the project aims to support them to shape their own vocational biography towards the development of a vocational identity in the future.

In Germany, vocational preparation is organized separately both at school and out of school in vocational preparation measures. An uncoordinated and confusing variety of offers exist for the young people to deal with. However, most measures do not lead to a profession according to the German dual system. Young people are prepared for work or advised to take up formal vocational apprenticeships. They are placed in a transit situation, hoping to enable their employment in future.

The project is based on the idea of integrating the target group of young people in vocational preparation who usually are characterized by having experienced negative learning situations and failure in their school careers. Most of them are holding leaving certificates of the secondary school (Hauptschule) or middle school (Realschule) with bad grades. Some even miss any leaving certificates. They are aged 15–21. The young people compete on the labour market with the increasing number of school leavers of academic secondary schools holding the A levels (Abitur), so that there is poor school to work transition for them. The number of such disadvantaged youngsters is increasing not only in Germany. However, it is the main pedagogical aim of the project to focus on their creative capacities, which can be defined as processes of developing and designing original ideas which have value (Robinson 2001), in order to enable them to investigate their own strength, and interests through developing and designing integrated on- and offline games.

The integration of the physical environment and technology was realized by equipping the young people with tools and media in order for them to experiment with it, to develop interest and to explore their own resources, rather than to focus on updating technical and job-related skills and competences. By developing a project, based on their own ideas and negotiations in the teams, they are expected to deal with their own concepts, to find solutions and to develop responsibility towards the realization of the game. Summing it up, they imagine an idea and give life to it, passing all processes of production, design as well as construction, testing, redesigning and problem solving.

13.2 Creative Game Development in Education and the ‘GamesLab ON/OFF’ Approach

Games represent activity systems in which the subjects act and communicate on the basis of using game specific tools according to the given rules. The latter is an overall agreement by the players. Activity theory can be perceived as an overall theoretical approach analysing human actions which are mediated by the tools used as well as the cultural environment wherein the subjects and objects of activity are operating and develop meaning (Engeström 1987; Reimann and Blohm 2007). The concept of play and the games developed in our culture constitute a special sort of

activity system. Kafai (1995) has highlighted the significance of game design in education to make pupils teach fractions to other kids of lower grade. She introduced the 'designer notebook' for kids to develop the story board and document the design processes and revisions. It stems from the tradition of constructivist pedagogy and *constructionist* technology education introduced by Papert, which were employed for development purposes in the project and considered in the light of the project goals. Following an integrated approach of constructionist technology and art education, in our project, the designer notebook as well as the art education idea of process development was taken into account when developing the design process oriented by MediaArt@Edu project portfolio.

However, rather than constructing virtual worlds or augmented reality applications, this paper looks at a particular concept of creative game development, that is, the invention and design of on- and offline games using different sorts of tools, materials and media, such as Makey Makey (MIT), an Arduino-based technology to turn everyday objects into computer keys and use the tangible physical objects of the environment as a computer keyboard. It was inspired by the do-it-yourself (DIY) and maker movement. Further, the art project 'Dead drop', a shared offline data store in public space to engage people in participating in it, and the software iMovie which comes along with the iPad were introduced.

We use the term of the GamesLab ON/OFF, which addresses the linking of the physical and the digital world in a wider sense, bringing together a variety of levels of reality to virtual spaces of the computer. Imagination, analogue and digital media as well as the physical bodies of the players, as well as the issue of motion, are considered the basis of our human existence. Different to the typical and widely spread screen-based computer games, our approach is not focusing on the construction of virtual worlds but on the game concepts embedded in the physical world, the objects, bodies, materials required as well as shaping and communication processes between the learners. Our online-offline game design approach also differs from new edutainment applications, which extend and augment the space of physical acting (augmented/mixed reality, as described in the context of mixed reality learning spaces (Reimann 2006). Rather than developing computer-based systems, we intend to make them invent complex game conceptions, which bring together digital and physical space and media in rather unusual, new ways to them.

As kids love to play computer games, such media serve as motivators to learning, that is, the activation of young people as learners in vocational preparation. In our education scenario, we support the processes of game invention in cooperation with education students. Jenkins has introduced 'play' as relevant skill for the twenty-first century, defined as 'the capacity to experiment with the surroundings as a form of problem solving' (Jenkins 2009).

The students in the project act as mentors and researchers who scientifically observe the design and learning activities of the young people. The mentoring concept aims to support all processes of creativity, such as the conception, the development of a narrative, that is, the storytelling and game flow, as well as the interface design and the technical realization. The processes include basic social, communicative and collaborative activities, practised in team-based arrangements.

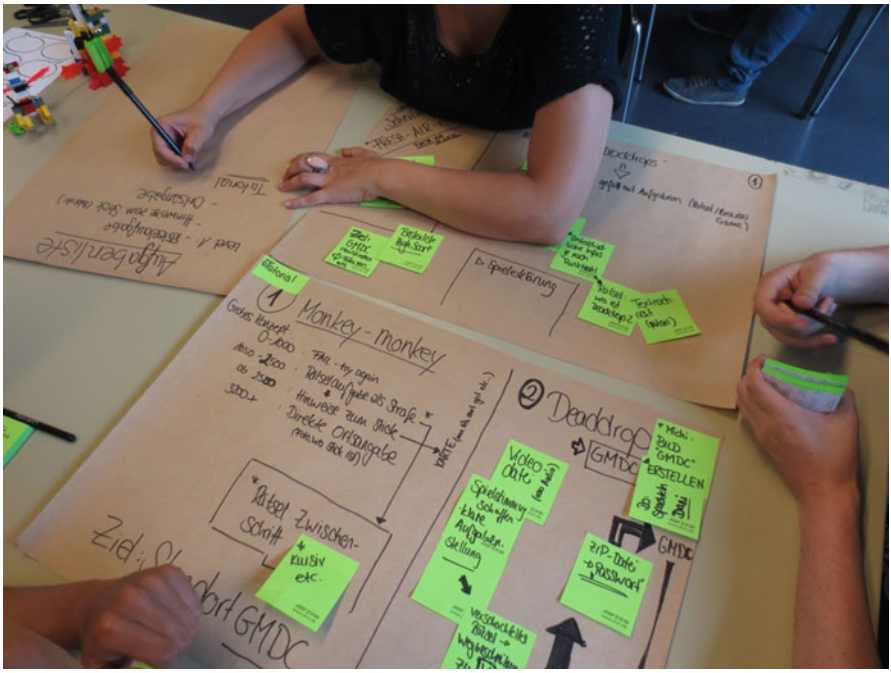

Fig. 13.2 Portfolio process supporting the game development

However, as we found, most of the participants have little or no awareness about their own capacities, the skills practised as well as the learning contents attached to it, nor do they have an idea about the meaning of such team experiences for future jobs and employment requirements. Additionally to the invention of a game, in order to improve the participants' awareness concerning their own learning processes, the project portfolio was introduced. It serves not only as a tool for visualizing the abstract idea of the game towards a clear structured story with different parts and tasks for the players to fulfil. It was intended to accompany the processes and to become a familiar practice of design and reflection (Fig. 13.2).

13.3 Game Design ON/OFF Linking Physical and Digital Spaces

The GamesLab ON/OFF module combines games and media, reality and virtuality. In the 3-day workshops, the participants are asked to develop and design games that are played with the help of digital media on the Web, on the computer tablet and in the offline world.

The workshop participants are given the opportunity to deal with digital media on a level other than that of their experience, i.e. at the interface of digital and ana-

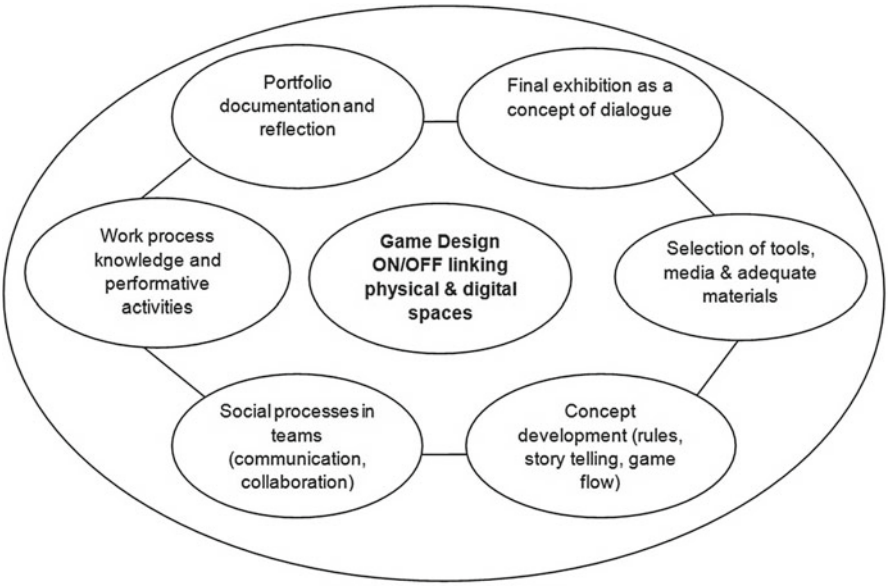

Fig. 13.3 Activities and learning contents practised in the game development process of the GamesLab ON/OFF workshops

logue – reality and virtuality. For this purpose, the GamesLab ON/OFF workshop module was designed and organized at the KIT, Karlsruhe Institute of Technology, and ZKM, Karlsruhe Center for Art and Media. The four workshops of 3 days' duration each were directed by a media pedagogue, whose scope of tasks covered both workshop design and technical aspects.

The workshop modules focus on multidisciplinary competencies needed by the participants to prepare for their profession rather than on job-specific competencies. The module and the associated learning objectives will be explained in more detail below (Fig. 13.3).

13.3.1 Selection of Tools, Media and Adequate Materials

The workshop started with a presentation of the tools available, i.e. the hardware and software, according to the principle of 'learning by doing'. This means that the tools were tested in practice by the participants before the game development. The four following tools were available for selection: the Makey Makey (MIT), an Arduino-based technology to turn everyday objects into computer keys and use the tangible physical objects of the environment as a computer keyboard. It is inspired by the do-it-yourself (DIY) and maker movement. Further, the art project 'Dead drop', a shared offline data store in public space to engage people in participating in

it,[2] and the software iMovie which comes along with the iPad (in particular for videos and photos taken, Stop-Motion production and audio recordings) were introduced as well as Google Maps. In addition, single-lens reflex cameras were used for photography, encoded zip files were generated and QR codes were generated with a QR code generator to link to videos recorded and stored on, for example, YouTube.

The tools were selected since they met the following criteria: They supported the flexible and mobile use in the learning environment of the museum (e.g. the continuous exhibition ZKM_Gameplay[3]) as well as in the public space (such as iPads). They were either available on the Web (such as Google Maps or free apps), as open source (such as 'Dead drops'), or came along with the hardware (such as iMovie), or low budget (such as 'Makey Makey').

The participants' own skills were incorporated into the project, such as film cutting and programming. Presentation of the tools was aimed at developing an understanding of the technology and its potentials by direct application. Every tool was discussed theoretically and with respect to games and game development.

13.3.2 Concept Development (Rules, Storytelling, Game Flow)

After the presentation of the media and tools available, the participants were asked to choose some tools (or an individual tool or medium) and to design in working groups a game at the interface of online and offline. This general task definition resulted in various approaches to game development pursued by the working groups. While one group applied a technical approach by identifying technically feasible options, other groups decided in favour of a content-related approach by developing the background story of the game. In general, free working was highly appreciated by the workshop participants. This is also obvious from the interviews and online questionnaires. One participant commented: 'We were free and we could decide what to do, which is much more fun. Otherwise, we would have been caught in a type of labyrinth'. And another participant added: 'Free work allows to be more creative and to contribute own skills'.

For every game, instructions had to be written for the future players to know what the rules are and what the objective of the game is. For this purpose, the participants had to analyse their game on a meta-level and to assume the role of a future player in order to decide which information and aid might be helpful and how the game has to be explained for playing it.

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[2] Website: http://deaddrops.com/blog [20.6.2014].

[3] "ZKM_Gameplay is the new permanent exhibition on the theme of video games and experimented forms of play. Since its opening in 1997, numerous computer games have been presented at the ZKM | Media Museum in Karlsruhe, since these reflect an essential part within modern society heavily influenced by digitalized realities of life. For centuries new artistic, experimental, media-reflective as well as 'serious' games have evolved. The cultural and economic power of digital games and gameplay have experienced and continuous growth. This has made the games an important object of the ZKM." http://on1.zkm.de/zkm/stories/storyReader$8340 [20.6.2014]

13.3.3 Social Processes in Teams (Communication, Collaboration)

Two working groups were formed with up to three participants in the vocational preparation workshop and one student mentor each. The group had to jointly develop and plan a game concept. Hence, the group members interacted. In the planning and development phase, social skills, such as the ability to work in a team, the ability to establish contacts, the ability to solve conflicts and the ability to become accepted, were required in particular. The workshop trained the participants' ability to cooperate and to agree on a game idea by making compromises as well as the ability to solve conflicts and technical problems arising.

In addition, the groups had to plan the work and time. Accordingly, the working group members also had to share the work to reach the defined objective. In this case, individual work was required and observed. The workshop focused on aspects such as the perception and defence of own interests, the ability to work under pressure, own responsibility and the ability to reach decisions.

13.3.4 Work Process Knowledge and Performative Activities

In the following table, the game design and learning contents are summarized (Fig. 13.4).

In order to present the variety of different game concepts developed, the following examples are presented.

13.3.4.1 The Game 'Fresh Air GMDC'

The game 'Fresh Air GMDC' combines virtuality and reality. For instruction purposes, a video was produced. It included photos of objects and drawings together with the spoken explanation of the game flow and the objective of the game. This tutorial leads the player to the first level, a game station. A beamer transmits the computer game onto a big screen, and the player can play the game with the feet or the hands via two metal plates connected with the computer by Makey Makey. Depending on the score reached, the player has to repeat the game, is asked a riddle that has to be solved and is given a hint or the direct coordinates of the next game station. This station is located outside of the ZKM. There, Dead drops can be found at various points (park bench, staircase, a wall of the building). These are USB storage media that are publicly accessible. On these storage media, a self-generated audio file is found. It explains level 2 and poses the next task. A riddle has to be solved. The solution is password and a hint where the next Dead drop can be found. There, the password can be used to open a new self-generated audio file. This audio file contains another password. At the

Activities of the pupils	Learning contents
Working methods (single person working, team based working)	• Work planning • Self-dependent • Commitment • Accuracy • Concentration and endurance • Social role in the team • Team communication and agreements • Collaborative problem solving • Collaboration
Media design and use	• Material and media selection • developing ideas and game concept (on and offline) according to one's mental model • realisation of concepts • Testing the concept of the game using the prototype • Improving the games • Use of hard-and software • Exploration of the tools • Creativity • Dealing with the unknown / unpredictable • artistic acting and means • research of media and material
Portfolio practise	• Aesthetic appeal • Accuracy • Self dependency • Portfolio structure

Fig. 13.4 Game design activities and learning contents

next Dead drop, an extension of the browser game is to be played (which was not possible during the workshop for reasons of time). When winning the browser game, the players are given the coordinates of the last Dead drop containing the final file 'Final GMDC' with the winner photo. This project can be seen as a kind of a paper chase (scavenger hunt).

13.3.4.2 The Project 'Shake a Leg'

The game 'Shake a Leg' is a dance battle instead of the often encountered war games. The participants wanted to design a game, in which the players themselves had to act. At the beginning, a self-produced video is shown. The background story of the game is told with the help of video recordings, photographs and drawings. Then, the player can watch a self-developed tutorial. Here, video recordings and audio recordings explain how the game has to be played and who the winner of the game is. On a self-designed dance floor, a self-developed dance video is projected onto the wall by a beamer. Two player groups have to dance as it is shown on the video. With a decibel app started on an iPad near the dance floor, the winner is determined by the applause of the audience. The game is characterized by competition.

13.3.4.3 The Project 'The Last Big Thing'

The game 'The Last Big Thing' is about a bank robbery. At the beginning of the game, the player is given a laptop and a photo of the Dead drop 'Z'. This Dead drop has to be found by the player. There, the player can connect his laptop. The Dead drop contains a self-developed audio file simulating a phone call. The work order and the objective of the game are explained. The player has to solve various riddles (e.g. poem) and to move through the ZKM. At various works of arts, he is given new hints regarding the location of the final action. There, a safe is located, which is connected to a notebook via Makey Makey. When the safe is opened slowly, a video file starts on the connected notebook. This file shows the explosion of a safe (self-cut video). A self-developed stop-motion video production shows how the safe opens and what is contained in the safe. The objective is reached, and the safe is opened (Fig. 13.5).

13.3.5 Portfolio Documentation and Reflection

Portfolios usually are considered, and used as, collections of originals, such as sketches, drawings, and other documents, or as combinations of methods, processes or options for action. Aims and objectives of portfolios are self-management, documentation and reflection as activation of the learner(s) (Häcker 2007; Schwarz et al.

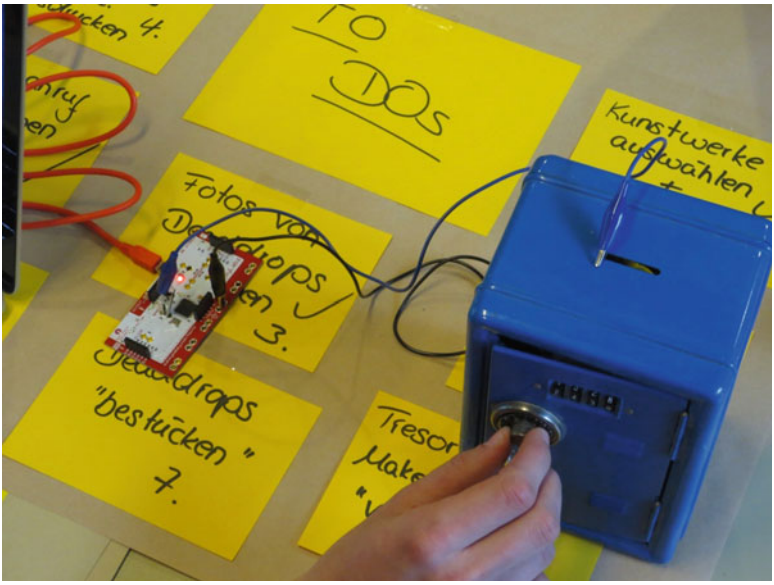

Fig. 13.5 Testing the interactive safe based on Arduino Makey Makey technology

2008; Reimann 2014). The specific MediaArt@Edu portfolio[4] design goes beyond the tool idea. It serves as a means to support self-managed learning, imagination, representation, visualization, documentation and reflection.

The portfolio consists of several parts. Firstly, it serves as a poster, including the structure of the games, which is presented in the exhibition. It follows the idea of visualizing and documenting the processes, to support the reflection about one's own acting, designing and thinking.

Secondly, the portfolio contains an online questionnaire and feedback session with the student mentor. Thirdly, the digital version of the portfolio is an explanation video as well as a blog, developed and realized by the participants themselves. In the explanation videos, they present the final project and the development and design processes (Fig. 13.6).

13.3.6 Final Exhibition as a Didactic Concept of Dialogue

A major element of the didactic concept was a public exhibition of the games at the ZKM museum. The exhibition was aimed at presenting the participants' work in the context of the museum and describing the process of game development. The

[4]The MediaArt@Edu research project portfolio refers to preparatory work tried at universities within the framework of the 'Aesthetic Research Book' portfolio variant and the 'Artistic Research Book' (Reimann and Biazus 2007) portfolio variants.

Fig. 13.6 Final portfolio including the structure of the game 'Shake a Leg'

work phases were documented by portfolio posters, sketches, photos and by the explanation videos. The participants also used the posters for presenting and explaining their game concepts to the spectators. In this way, the visitors were given the opportunity to discuss the work with the makers at the stations in the museum. Posters also presented those games that could not be developed to maturity due to reasons of time.

In the course of the exhibition, the participants were confronted with ideas, associations and new contents of the games expressed by the visitors, which resulted in an extensive exchange between designer and visitor. The possibility to present the games in a museum led to a high appreciation and relevance of the own-developed games and enhanced the self-confidence of the participants in their own skills. The exhibition is a concept opening up the opportunity for the participants' self-presentation.

The researchers as well as the student mentors observed that all groups presented and discussed their projects in a highly self-confident manner.

13.4 Lessons Learned

In the project, the evaluation is still ongoing. In the following, we sum up the first findings which will be underpinned by single quotes of the participating actors such as young people and student mentors. All quoted comments are translated from the qualitative group interviews.

The workshops were perceived very positively by the participants. This was also reflected and visible through their high motivation, their regular presence and high commitment. Most of the participants would like the workshop to be repeated and the workshop duration to be extended as we came up with in the interviews:

Participant: *'Well, if I had had one or two weeks more [in the workshop], I would have developed something more complex'.*

The pedagogical approach with its open definition of the task and the free creative and experimental work along the own-developed idea was rated highly positively by the participants who are used to more instructed learning situations in a teacher-centred classroom. The participants stressed in the interview that they perceived their usual school learning as predetermined. They used the metaphor of 'labyrinth' to describe it as opposed to the learning happening in the workshop:

Interviewer: *'Would you prefer to work that free [and self-determined]?'*

Participant 1: *'Yes, […]. It is more fun than to work only in one direction. One can say … like in a labyrinth if you have more narrow-instructed tasks. But if you can work free, then you have more fun, you can use your own things. […] it is like you are captured in a labyrinth. You can't get out. And if you can do what you want, then you have more fun. You can decide and make another decision [on your own] …if it [the project] is not working like that, then we [the team] make it in a different way… […] I like that [freedom of decision]'.*

Participant 2: *'Generally, I like to work free [because] it opens up more opportunities for my work as the usual tasks [given and perceived in different education contexts]. Normally, the working tasks are very trivial, [for example], you have to do things that look useless to you if you do it according to the instructed manner [given by the teacher] or to realize it [the task] at all. [If the task is more open], then it is possible to work more creative and to put a lot into it and you are involved differently'.*

The exhibition and presentation of the games enhanced the self-confidence and self-esteem of the participants. In this way, they were given the opportunity to train their appearance and presentation skills:

Mentor: *'[I]t was K. (participant) […] as it was visible on the presentation [at the exhibition]. He is 100 % proud of what we [the group] have had developed … […] he was completely enthusiastic and […] he got self-confidence from the game [development]. For example, he [the participant]*

said: "This is mine [game]. I have worked on it in the team". […] He presented the game and its functionality at the exhibition on his own to a group of people, without me being around. I kept an eye on him from distance. And I think it is great what he has achieved. It is […]. I only know him from the first day of this workshop and then he wasn't like that. And … I think all the three guys of the group [participants] developed especially self-confidence'.

The participants are not necessarily aware of what they experience during the workshop and which competencies were trained and applied. Furthermore, they have little experience in managing working tasks and time frames. They quickly invent a variety of complex game ideas, but they are rather not used in dealing with realistic project planning according to the given time. This is where the mentor comes in. He/she plays an important role to provide support when participants reflect the workshop and especially their own working manner and capacities:

Mentor: *'In my group, one [mentor] had to tell it to them. […] That was during the feedback session … then I have told it to them. It was like "Oh, really?" [They reacted rather surprised]. I had to point it out to all the three of them, in what they were good at'.*

The mentor is also required in the phase of free project work, which initially overstrains the participants if they work on their own. As soon as a structure has been defined, the mentors can withdraw:

Mentor: *'At the beginning, when the participants have to find an idea, well, I think, if you don't guide them a little bit and if you don't take care that they get to the point to have an idea, and everyone agreed with this idea, and it is mainly a realizable idea. If [the mentor doesn't intervene], I think they would simply sit there and discuss the whole day what was possible to do. And they would become obsessed [e.g.] into dimensions with up to 20 levels and who knows what else. This is a real task of the mentor, to intervene and to say: "We only have three days, play it cool"'.*

Interviewer: *'You mean the feasibility?'*

Mentor: *'Yes, a little bit simpler, so that it is producible. And if this is done, one can add something more, something more difficult'.*

As we found, portfolio practice often is perceived by the participants as an additional task to be fulfilled in the workshops. That's especially the case when they develop artefacts such as interactive light object (Reimann and Bekk 2014a, b) or robots (Reimann 2014) which attract attention rather than the portfolio work. Usually, portfolio work is introduced in long-term scenarios rather than in 3-day workshops. However, single cases have shown that the participants who have participated for the second time self-initiatedly developed the portfolio without any requests:

Mentor: *'Because J. [participant] already knew [the portfolio procedure because he already participated in the previous workshop] […] we designed the Portfolio [of the game workshop] like in the other light installation workshop, that is, one has described what one had thought about, how the idea was developed'.*

If the portfolio is perceived reasonable and useful by the participants, then the portfolio is carried out accurate and is taken seriously:

Interviewer: *'That is very similar to the compulsory 'apprenticeship report portfolio'*[5] *in an apprenticeship'.*

Participant 1: *'Exactly, that is supposed to simulate this, like in an apprenticeship'.*

Interviewer: *'But you don't like it [to fill it in]?'*

Participant 1: *'It is useless'.*

Interviewer: *'And what about this portfolio in this workshop? How have you designed it? […] Why have you designed it?'*

Participant 2: *'Because in this workshop, it makes sense [to me]'.*

Participant 1: *'Because we work on something in the workshop and create something. And you [the researcher] want to see what we have done'.*

Participant 2: *'Also that we have a reference point for us, what we have worked on'.*

Participant 2: *'Of course. There are some differences. […] That is a different story as if one says [to you]: "You have to write it down, so that if you are controlled by us [the teacher of the vocational preparation provider] […], you can prove it". Because of this reason, they [the vocational preparation measures] request us to do it. [For example], then even things are filled in which they have never happened'.*

Interviewer: *'[…] And in this case [in the game workshop]? What do you think is the reason for you having to do it? You just said before: 'In this workshop it makes sense.'[…]'.*

Participant 2: *'The portfolio has the this very sense, that […] one can illustrate what one has done, one can explain it, one has examples. One really can explain it to people, who did not attend the whole process, who are just interested [in the project] or who want to know what really [had happened]. […] It works well. … It's descriptive. And these are the reasons why one actually works with it [the portfolio]'.*

In order to initiate a portfolio culture on the long run which is reasonable for the participants, it has not only to be embedded into the didactic concept of the workshop, but it also has to be integrated into the project planning and realization process from the very beginning.

[5] In Germany, the 'Berichtsheft' is a compulsory regular task in the framework of the dual system of vocational education and training and has to be controlled by the trainer.

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