Observe and explore: empirical studies about learning in creative writing and the visual arts

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Chapter 4

THE EFFECTS OF OBSERVATIONAL LEARNING ON STUDENTS' DESIGN PRODUCTS AND PROCESSES

Previous research has shown that observation is an effective learning activity in various domains, e.g. argumentative writing and mathematics. The question in this paper is whether observational learning can also be beneficial when learning to be creative. We hypothesized that observation has a positive effect on creativity measured in the product and the divergent activities in the designing process. 61 Dutch students (ninth grade, 14 years old) participated in an experiment with a pre- post-test control group design. The students were randomly assigned to one of two conditions: observational learning versus a direct strategy instruction condition with process guidance and practice. Students in the observational learning condition watched videos of peers doing design tasks while thinking aloud. The students were pre- and post-tested on a design task. We included process measures as well as a measure for perceptions of learning experiences. On average, the designs of the experimental group were rated as more creative at post-test than the designs of the control group. Besides, the students in the experimental group reported to have brainstormed more at post-test than the students in the control group and they reported more process learning experiences. Results indicated that observation had beneficial effects on students' design products and processes compared to the direct strategy instruction. We conclude that observational learning enhances creativity in design products and processes and that students are more process oriented after observation.
Keywords: observational learning, cognitive modelling, art education, creativity, creative process

1. INTRODUCTION

Great Renaissance artists such as Leonardo da Vinci and Michelangelo were educated as apprentices in the workshops of their masters. They acquired the art and craft of painting and sculpture through apprenticeship. Apprenticeship includes modelling: an expert demonstrates his work process to an observing apprentice. Observational learning, as examined in the present study, is also triggered by a form of modelling; students learn by watching, interpreting and evaluating peers carrying out a task. Observational learning proved to be an effective learning activity in various domains, such as mathematics (e.g. Schunk & Hanson, 1985), reading (Couzijn & Rijlaarsdam, 2004), argumentative writing (Braaksma, Rijlaarsdam, & Van den

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Bergh, 2002; Couzijn, 1999; Raedts, Rijlaarsdam, Van Waes, & Daems, 2007; Rijlaarsdam, Braaksma, Couzijn, Janssen, Raedts, Van Steendam, Toorenaar, & Van den Bergh, 2007; Van Steendam, Rijlaarsdam, Sercu, & Van den Bergh, 2010; Zimmerman & Kitsantas, 2002), learning to collaborate (Rummel & Spada, 2005) and learning argumentation skills (Schworm & Renkl, 2007).

It is generally believed that creative skill should be nurtured in the classroom. We expect secondary school students to display creative and independent thinking when working on projects, writing papers, or participating in classroom discussions. In art education, teachers aim at stimulating students' creative processes. There are few experimental studies that examine the effectiveness of interventions which aim at enhancing creative processes in secondary art education (e.g. Groenendijk, Janssen, Rijlaarsdam, & Van den Bergh, 2011). Implementing observational learning tasks may be an effective approach for stimulating students' creative processes and improving their creative products. In the following sections, we will describe the potential for learning from observation for creative tasks.

1.1 Observational learning

The rationale of observational learning is based on Bandura's (1986) social learning theory. It explains learning as a continuous interaction between cognitive, behavioural and environmental influences. For effective modelling, several conditions need to be fulfilled: students need to pay attention to relevant elements in the learning environment, to store and transform information in memory, to be able to translate mental conceptions into actions and be motivated to do so. Schunk and Zimmerman (1997) elaborated Bandura's theory into a social cognitive model of self-regulation in reading and writing. According to this model, the learning of a new task occurs in four phases: observation, emulation, self control and self regulation. Observation is a first step in this sequence. Then the learner emulates the model's general style. Encouraged by feedback, the learner can internalize the skill and finally use the strategy independently and in various contexts. Here we focus on the first phase: observation.

Observational learning is closely related to cognitive apprenticeship. In cognitive apprenticeship, an expert model verbalizes thought processes. Collins, Brown, and Newman (1989) describe how observation, as an element of cognitive apprenticeship, provides strategic knowledge to the learner and changes students' understanding of the modelled skill. For example, in writing students may not realize that experts organize their ideas, elaborate their goals and think about their audience. Observation may enhance this awareness about the task. Couzijn (1999), Braaksma et al. (2002), and Raedts et al. (2007) found that observation is effective for writing argumentative or synthesis texts. In these studies a multimedia learning environment was used; students watched videos of peer models performing a writing task while thinking aloud. Students who observed peer models performing a learning-to-write task wrote better texts afterwards than students who practised this learning-to-write task themselves, without observation. Rummel and Spada (2005) proved the effectiveness of observation for learning to collaborate in computer mediated settings, Schworm and Renkl (2007) found beneficial effects in the domain of argumentation, and Van Steendam et al. (2010) for cooperative revision tasks. It seems that modelling is beneficial for various types of tasks.

Several elements may influence the effectiveness of observational learning, such as the competence level of the models. Zimmerman and Kitsantas (2002) found that college students who observed a coping model, a model who gradually improves her writing technique, did better than students who had observed a mastery model; a model who already masters the skill. Braaksma et al. (2002) found that when confronted with a new task, weaker writers learn more from focusing on the weaker model of a pair, while better writers learn more from focusing on the more competent model. Thus, it seems important to include models of different competence levels in observational learning arrangements.

Observation should include evaluation. Braaksma, Rijlaarsdam, Van den Bergh, and Van Hout-Wolters (2006) analysed students' observation processes and found that evaluation and elaboration are essential for the effectiveness of learning from observation. Sonnenschein and Whitehurst (1984) studied the effect of observation and evaluation compared to observation only for preschool children who acquire communication skills. The observation-evaluation condition performed better on speaking and listening tasks than the observation only condition. The additional evaluation task explains the transfer effects on listening and speaking according to Sonnenschein and Whitehurst. They describe evaluation skills as 'superordinate' skills since these skills transferred to speaking and listening, whereas increased performance on speaking and listening tasks did not transfer to evaluation skills. It seems advisable then to stimulate students to evaluate models and to elaborate on the models' behaviour after observation.

All in all it appears that observational learning is an effective approach in various domains. Attributes of the model (such as initial performance level) and students' thinking activities (evaluation and elaboration during and after observation) may mediate the effect of observational learning.

1.2 Creative tasks and modelling

The question arises whether observational learning can be effective for creative tasks. Creative tasks are 'ill-defined', because they are not entirely formulated and, consequently, there are many possible solutions. This means that the problem space is large, especially since high performance on creative tasks requires novelty and originality. Artists even have to discover their own task (artistic problem), before they can start solving it (for example, finding out what to draw) (Getzels & Csikszentmihalyi, 1976). Therefore, creative tasks in the artistic domain are extremely ill-defined. Students need strategies to deal with this large problem space. Can observation be effective for solving creative tasks?

Few studies have focused on modelling in the domain of creativity. One explanation may be that using observation of models to enhance students' creativity seems paradoxical. Creative work involves the generation of original ideas, while observing models may lead to imitation of products (the 'conformity effect'; Finke, Ward, & Smith, 1992). However, observation of cognitive models is directed at developing a clear idea of how a task can be performed as demonstrated by Braaksma, Rijlaarsdam, Van den Bergh, and Van Hout-Wolters (2004). They found that observation of peer models affected students' writing processes; students who had learned to write by observing engaged in metacognitive activities during writing, such as planning, analysing and goal-orientation more often than students who had learned by practising writing. Therefore, we expect that the observation of someone who is thinking aloud while engaged in creative work affects the observer's future activities.

Studies in the area of worked examples have examined the effect of examples for learning in ill-defined domains (e.g. Rourke & Sweller, 2009; Van Gog, Paas, & Van Merriënboer, 2004; 2006; 2008). Worked examples differ from modelling examples (e.g. observational learning) in that they involve 'ideal' problem solution steps presented as text. The underlying mechanisms, however, are similar: students learn new procedures for problem solving and abstract general rules from the examples (Van Gog & Rummel, 2010). Rourke and Sweller (2009) found that students who studied worked examples of a task about recognizing designers' styles perform better than students who practised this task themselves. They concluded that process examples are as effective in ill-defined domains as they are in well-structured domains.

But what kind of knowledge should students acquire from observing and evaluating models in ill-defined domains? Hilbert, Renkl, Kessler, and Reiss (2008) introduced heuristic (worked) examples for ill-defined tasks, which demonstrate heuristic steps towards a solution. They studied the effect of these examples on mathematical proving skills, which include discovery behaviour. Heuristic knowledge was presented explicitly and self explanation prompts were directed at the heuristic level. This approach proved to foster learning. Van Gog et al. (2004, 2006, 2008) argue that experts' 'how' and 'why' process information enables students to deepen their understanding of solution procedures in ill-structured domains. For tasks with large problem spaces, learners need strategies to narrow the search space and select the most promising solution procedures. Therefore, students need to know why certain solution steps are taken. Van Gog et al. (2008) show that process information is indeed effective in the first phase of learning in electrical circuit troubleshooting.

A few studies examined the effect of modelling examples and artistic creative tasks (Anderson & Yates, 1999; Groenendijk et al., 2011; Teyken, 1988). Anderson and Yates (1999) examined the effect of modelling on young children's clay works. They found that the quality of the clay works produced after modelling was higher than the quality of the clay works produced under regular conditions. Teyken (1988) examined the effects of focused reflection on creative design. He incorporated observational learning tasks in an experimental curriculum for student art teachers.

They watched videos of designers at work. Teyken found that the students' design processes changed as a result of focused reflection, although the quality of the design products did not improve. In this study observation was part of an experimental curriculum, therefore it remains unclear which learning activity in the curriculum caused the effects measured.

Groenendijk et al. (2011) examined the effect of observational learning for poetry writing and collage making. A positive effect on the creativity of products was found for collage making, but not for poetry writing. However, positive effects were found on students' processes in poetry writing. In the current study we would like to gain more insight into the effect of observation on processes in the visual domain by using a different type of process measure and an intervention more strongly focused at creative processes. Videos were used to demonstrate the processes. In the next section we will elaborate on the processes modelled in observational learning videos.

1.3 Creative processes

The creative process – the sequence of thoughts and actions that leads to novel, adaptive productions – is traditionally described as consisting of four stages: preparation, incubation, illumination and verification (Wallas, 1926). During preparation the creator absorbs information and engages in problem finding and definition. During incubation the person is taking a step away from the creative process. During illumination a solution or great idea suddenly comes to mind and during verification, the final product is created and edited.

From recent research on artists and designers at work, it appears that creative processes co-occur throughout the work recursively. Several studies have been conducted to describe the creative process (e.g. Fayena-Tawil, Kozbelt, & Sitaras, 2011; Getzels & Csikszentmihalyi, 1976; Ward & Mace, 2002; Yokochi & Okada, 2005), which resulted in several process models (e.g. Finke, Ward, & Smith, 1992; Ward & Mace, 2002).

Similar studies were carried out in the area of design; designers at work were studied (Cardella, Atmans, & Adams, 2006; Christiaans, 1992; Jaarsveld & Van Leeuwen, 2005; Goldschmidt 1994; Kavakli, Suwa, Gero, & Purcell, 1999; Kokotovich, 2002; Teyken, 1988). Much research on design processes has focused on the role of sketching in design (e.g. Jaarsveld & Van Leeuwen, 2005; Goldschmidt 1994; Kavakli et al., 1999; Kokotovich, 2002). Sketches are generally seen as products of divergence (Jaarsveld & Van Leeuwen, 2005), enhancing the creative process. By externalizing ideas, new aspects of the problem and new ideas can be found (Goldschmidt 1994). Therefore, sketches are regarded, not only as externalizing preexisting ideas, but as a way of generating ideas. Some researchers see sketches as an external working memory. Kokovic (2002) demonstrated that it is important to consider what types of sketches are made in what part of the process. Sketches made in the beginning of the design process are different from sketches made towards the end. Other researchers have examined the differences between sketches made by experts and sketches made by novices. The former are more frequent and more detailed (Teyken, 1988). Cardella, Atmans, and Adams (2006) demonstrated that senior designers employ more design activities than 1st- year students and that a high scoring 1st-year student employs more design activities than a low scoring 1st-year student. In general, research on design processes has focused on experts and students in higher education. There is not much research about designing by secondary school students.

To integrate all phases and activities in a model, based on several models of the creative process, Sapp (1995) designed a model for the creative process in art making and adapted it to art and design education (Table 1).

Table 1. Model for creative problem solving in art education based on Sapp (1995)

	Stages	Description	
1	Problem parameter exploration	Start problem finding	Divergent
2	Transition 1	Problem definition	Convergent
3	Associative exploration	Free flow of ideas based on association is produced and explored within the boundaries of the task parameters	Divergent
4	Transition 2	Decision making	Convergent
5	Multiple focus exploration	Many image clusters are explored simultaneously or in succession	Divergent
6	Transition 3	Decision making	Convergent
7	Primary focus exploration	Divergent process centred around one idea cluster generated during transition 2	Divergent
8	Transition 4	Decision making; 'aha' may occur	Convergent
9	Refinement	Work is refined and finished	Divergent
10	Final image	Evaluation	Convergent

Table 1 shows that divergent and convergent processes alternate. In the original model, it is shown visually that the process starts with a broad problem space, converging into a single solution. Usually, an artist starts with associative exploration. During associative exploration, a free flow of ideas based on association is produced and explored. In art education, problem parameter exploration precedes explorative exploration. During the Problem Parameter Exploration stage, the student explores the task. Associative exploration in art education takes place within the boundaries of the task parameters. Transition stages represent convergent stages of conscious decision making, alternating with divergent stages. The problem parameters narrow in focus and become more defined as the process proceeds. During multiple focus exploration, many image clusters are explored simultaneously or in succession, usually by the production of several sketches or models. Primary focus exploration is a divergent process centred around one idea cluster selected during transition 2. Often this happens in the selected medium (for example paint) and results in several sketches or models representing several alternatives for one idea. During transition 3, an 'aha' moment may occur: one of the explored alternatives seems to be the ultimate solution. Finally the work is refined and finished.

The Sapp (1995) model describes an ideal process and may therefore be used in education as a prescriptive, instructional model. For students the divergent phases are most crucial; they often face difficulties exploring alternatives (Van de Kamp, 2010). They often produce one idea that directly becomes the final work of art without considering any alternatives.

In the present study we used Sapp's model to select and structure the content of observational learning materials. Students' approaches in each of the stages are shown in the observational learning videos. We elaborate on the content of the videos in the method section.

1.4 Research question and hypotheses

The aim of the study was to develop and test a learning arrangement for creative design tasks based on the principles of observational learning. The students in the experimental group watched videos of peer-designers at work while thinking aloud and a comparison group practised a design task via a direct instruction of strategies (carrying out the task with step wise process guidance). Our research question was:
Is observational learning more effective than learning by practising accompanied by process guidance with regard to creative design products and design processes?
Firstly, we expected observational learning to be more effective than learning through guided practice. We expected an effect on the creativity of the students' designs, not on technical qualities, since the observational learning videos were intended to improve creative ability and not the techniques. Concerning the students' products, we expected that:

- participants in the observational learning condition will create more creative designs at post-test than students in the comparison condition, but the two learning conditions will not differ with respect to the technical quality of the final products.

Secondly, we assumed that observation leads to more divergent activities than practising with process guidance. As we have shown in the previous section, an ideal creative process in art consists of both divergent and convergent processes (Sapp, 1995). Students are generally thought to have difficulties with the divergent stages. So we expected that:

- participants in the observational learning condition will spend more time on divergent activities (such as brainstorming and sketching) and report more process learning than students in the comparison condition.

Thirdly, Amabile (1996) considers intrinsic motivation an essential component of creative performance. Therefore it seemed important to take this variable into account. We aimed at comparing learning conditions that are equally motivating. Therefore, we measured attitudinal variables (intrinsic motivation, task value and self-efficacy) as implementation measures. We expected that:

- the observational learning condition and the comparison condition are both equally motivating for students, resulting in high scores for motivation.

Possibly the effectiveness of the condition is influenced by student characteristics such as prior knowledge and divergent thinking abilities. While we do not hold firm hypotheses on these variables we decided to take these variables into account.

2. METHOD

2.1 Research design

We conducted an experiment with a pre- post-test control group design and two conditions: learning by observation and learning by direct strategy instruction (with extensive process guidance and practice). Students in the observation condition observed videos of peers performing a design task.

2.2 Participants

Participants in the experiments were 61 secondary school students (9^{th} grade, on average 14 years old, pre university and higher general secondary education). To select the students, about 250 students were invited to volunteer in the experiment during their holidays in return for a small reward. 70 students volunteered to participate and also received parental permission. 9 students cancelled for various reasons during the weeks before the start of the experiment. Among the remaining 61 students there were 13 boys and 48 girls. The group was diverse with regard to prior knowledge. 45 students chose visual arts as a subject in school, and as a result, had more knowledge and experience. 16 students did not follow visual arts classes. We assigned all students randomly to conditions.

2.3 Observational learning intervention

We selected 17 observational learning videos based on the Sapp (1995) model. The material for the videos consisted of videotaped authentic student practice that we edited. In the videos, the work-in-progress and the model's hands were visible on the screen, while learners heard the model who was thinking aloud as a voice over. In Table 2, we present the content of the observational learning videos. As shown in the table, the videos contained heuristic information (for example, brainstorming and sketching strategies), process information ('how' and 'why' information) and attitudinal information (for example, explorative attitude, motivation, confidence).

Table 2. Content and duration (in minutes) of observational learning videos based on Sapp (1995)

Stages	Video	Min.	Different approaches in the videos
Problem parameter exploration	1	1.5	Different approaches to explore the task: Reading assignment and marking important parameters vs. reading assignment.
Transition 1	2	3	Different approaches to deal with problem parameters: Recognizing important problem parameters vs. already thinking about solutions.
Associative exploration	3	2	Different approaches in association: Mind mapping vs. drawing pictures vs. drawing letters.
	4	5	Different approaches in association: Free association combined with drawing of preliminary ideas, including feelings/emotion vs. generating only one cliché idea.
Transition 2	5	2	Different approaching in selecting areas of interest: Selecting areas of interest vs. choosing a fixed final idea.
Multiple focus exploration	6	5	Different approaches in the sketching stage: Sketching many different ideas without thinking about what the final product will be vs. sketching one final product idea.
	7	2	Different approaches in the sketching stage: Quick sketching vs. very neat and detailed sketching.
Transition 3	8		Different approaches in choosing an idea: Selecting ideas based on criteria derived from briefing vs. random decision.
	9	1	Different approaches in choosing an idea: Going back to previous stage in process vs. proceeding while unhappy with current ideas.
Primary focus exploration	10	2	Different approaches in developing alternatives: Starting to draw the frame of the design (2 models) vs. drawing without taking frame into account.
	11	.75	Adding frame and discovering something.
	12	6	Different approaches in developing alternatives: Trying many different options by manipulating composition, colour, style etc. vs. drawing the same thing twice.
	13	5.5	Different approaches in developing alternatives: Two different aha moments and the preceding steps
	14	1	Different approaches in developing alternatives: Perceived lack of drawing skill vs. dealing with lack of drawing skill.
Transition 4	15	3.5	Different approaches in making a final decision: Choosing an idea vs. combining two ideas into something new.
Refinement	16	2	Different approaches in the finishing touch: Adding new elements vs. removing elements.
Final image	17	3	Reflection by reporting to external client.

During the intervention, the students in the observation condition did not engage in design work themselves; instead we asked them to watch the videos and to evaluate the processes shown. To direct the students' attention to the relevant processes and evoke a comparison process, we showed, where possible, contrasting approaches (rather weak and rather strong performances) or very different approaches. The models in the videos were not labelled as 'competent' or 'weak', but after the students had watched each video, we asked them to answer a question by evaluating or elaborating on the behaviour of the models in the video. Examples of these questions are*: 'Which student did better in your opinion? Explain: what did this student do so well? or: 'Which student did less well in your opinion? Explain: what did this student do not so well?'* Sometimes, we asked students to compare the behaviour of the video model to their own approach when performing a creative design task. The students could replay the videos if they wanted.

2.4 Comparison condition: direct strategy instruction

In the comparison condition, students practised a design task, without watching models. The tasks were the same as shown in the observational learning videos: designing a mouse pad for War Child, a hood for Greenpeace or a shopping bag for the Dutch Foundation for Cardiovascular Diseases. The students were guided step wise through the stages in the Sapp (1995) model. So, students in this condition received an extensive process guidance and were supported to demonstrate an 'ideal process', producing many ideas and sketches, as in regular art education. We made sure that the total amount of time spent remained the same in both conditions.

2.5 Measures

The pretest and post-test tasks were designed to provide room for creativity and therefore variety, but also to allow for comparison and rating (as the products needed to be compared in order to assign creativity scores). The students were asked to design a product based on a simulated briefing from a client: a pair of bath slippers (at pre-test) and a T-shirt (at post-test). We provided identical drawing materials for all the students (pencils, erasers, colour pencils, paper for sketching) and a 'final design sheet' with a frame for the final design. The students had 60 minutes to complete their designs. (See appendix A for the briefings as they were presented to the students.)

Three raters, students from the Amsterdam School of the Arts, rated the products on creativity and technical quality in two rounds on a 0-200 scale with the support of anchor products. This procedure worked well in a previous study (Groenendijk et al., 2011). The anchors were selected from a different sample, from a similar population, and illustrated degrees of performance with fixed scores of 50, 100 and 150 (see Appendix B and C). The anchor products are solutions to different design tasks and were intended as task independent anchors, so raters could rate students' pre- and post-test products on the same scale. The raters did not know which of the tasks was pre-test or post-test. Technical quality of the designs was defined as neatness and drawing skills. Creativity was defined as novelty (originality) and appropriateness (Amabile, 1982). The raters studied the tasks, criteria, anchor products and rating procedure. Then they discussed the degree of creativity/technique of the anchor products, a discussion led by the researcher. Subsequently, raters spread the products over three piles (low, medium and high creativity/technique) using the anchor products. The raters went through each pile separately, assigning a score to each product. Jury reliability was sufficient for creativity (Cronbach's alpha=.76) as well as for technique (Cronbach's alpha= .73).

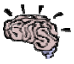
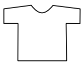
Creativity and technique were found to correlate significantly but not strongly (r=.501), which suggests that creativity and technique are different qualities. In other studies much higher correlations between creativity and technique were found (Amabile, 182; Fayena-Tawil et al., 2011). The pre-test and post-test ratings correlated significantly for creativity (r=.340, p=.007) and for technique (r=.609, p<.000).

To gain insight into the creative processes of the students, we used a self-report instrument that we adapted from Torrance, Thomas, and Robinson (1999) and Torrance, Fidalgo, and Garcia (2007). It consists of a list of activities which students may employ during their work process. We adapted this list to a visual design task (see Table 3).

Subsequently, we asked students to indicate which of the activities they were engaged in at randomly selected moments. An electronic bleep produced by a computer and available audio system cued the students to report on their activity. The bleeps occurred on average every 90 seconds, but they were distributed randomly over time intervals between 30 and 150 seconds. The students had record sheets with the activities described and accompanied by a pictogram and empty boxes for each of the bleeps. At the moment of a bleep the students simply had to tick the box representing the activity they were engaged in at that moment. The activities were listed in a random order to avoid suggesting a particular order. To ensure that the students understood the activities well, we trained the students by asking them to fill in an example process consisting of verbalized activities, which was discussed in a plenary session. The students seemed to have little difficulty identifying the accurate activity.

To measure the students' motivation, task value and self-efficacy we administered a questionnaire based on the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1991), at pre-test and post-test. We adapted it to graphic design tasks. The questionnaire consisted of 19 items: Likert scales for the students' perceptions on their intrinsic motivation (7 items), task value (5 items) and self-efficacy (7 items) were used. The reliability of the scales varied between .67 (intrinsic motivation, pre-test) and .86 (task value, post-test). As an indicator of prior knowledge, we asked the students whether they attended art classes, which is an optional course in their school. The variable did not seem to be related to score or attitudinal variables.

Table 3. Process measurement tool (based on Torrance, Fidalgo & Garcia, 2007)

	Categories	Pictures	What are you doing?
1.	I am reading the assignment		You are reading the assignment as presented on your instruction sheets or you are reading the accompanying information.
2.	I am thinking about the assignment		You are thinking about the assignment: 'what do I have to do?'
3.	I am brainstorming		Brainstorming or gathering ideas; you are thinking about what are you going to do. Maybe you write or draw. There is no complete idea yet.
4.	I am sketching		You are drawing an idea on paper
5.	I am choosing		You are choosing between ideas; which one do you want to develop further? or you choose between sketches.
6.	I am improving		You are thinking about how to improve your sketch
7.	I am working on my final design		You are working on your final product (design).
8.	I am finished		You have finished your design
9.	Other		You are doing something else or thinking about something else (for example about what you will do tonight)

Additionally, we measured initial differences between the students in divergent thinking ability. A divergent thinking test (verbal and visual), based on Torrance (1974) was adapted to a six minutes task. Students were asked to list as many as possible unusual uses for a match box and they were asked to finish as many drawings as possible of a diamond shape and give it a title. Verbal and visual fluency and originality scores were treated as items of one divergent thinking scale. The reliability of the scale was alpha .75. The divergent thinking score correlated significantly with the post-test score on creativity (r=.267, p=.037), but not with the technique score (r=-.021, p=.872). This demonstrates that divergent thinking is indeed a relevant covariate for creativity, but unrelated to technique.

To acquire some information about the students' perceptions of their learning experiences, we asked the students to report these in a learner report (De Groot, 1980). The questions in the learner report are presented in appendix D as well as the coding scheme. The students' statements were coded twice: first, for the categories we induced from the data (learning experiences about product, process, own skills, graphic design, subject visual arts in school, other) and then for the difference between general learning experiences and learning experiences about the self. Two independent coders reached a reliability of .94 and .91 (Cohen's kappa). About six percent of the statements were classified as 'other' and were excluded from the analysis, since these statements were no answers to the questions about learning experiences.

2.6 Procedure

The students were asked to come to the research institute for three 150 minutes sessions: pre-test, treatment and post-test. The group was split into four sub groups: two experimental groups and two comparison groups. During the pre-test and the post-test sessions, one experimental group and one comparison group were put together, working in the same room. During the first session, the students completed the divergent thinking test and the MLSQ questionnaire, they were trained for the drawing log instrument and they completed the pre-test design task. During the second session we presented an introductory Powerpoint presentation containing examples of designs to all students in order to establish a common background knowledge. Then students received the treatment and during the third session, the students completed the post-test assignment, MLSQ questionnaire and learner report.

The learning materials were largely self explanatory and the tasks were carried out individually, after the researcher (the first author of this paper) had introduced the materials; she also led the sessions. The students in the observational learning condition watched the observational learning videos individually on their computers in a class with 25 computers.

2.7 Analyses

First, we analysed the results of the MLSQ questionnaire as an implementation check. We used the same instrument at pre-test and post-test, therefore repeated measures analyses were applied. We entered the divergent thinking score into the model as a covariate; condition and prior knowledge (whether or not students attended art classes in school) were entered as between subject factors.

For the product and process analyses we applied univariate analyses with pre-test score and divergent thinking score as covariates, post-test score as a dependent variable and condition and prior knowledge as fixed factors. The learner reports were analysed in the same way, although there was, of course, no pre-test variable as it can only be administered afterwards.

3. RESULTS

3.1 Preliminary analyses

In Table 4 we present the pre- and post-test scores for intrinsic motivation, task value and self-efficacy. We aimed at having conditions that were sufficiently and equally motivating for the students, therefore we expected no significant interaction of time (from pre-test to post-test) and condition.

For intrinsic motivation no significant result was found for the development over time ($F(1,56)=.877$, $p=.353$), nor for the interaction of time and condition ($F(1,56)=.038$, $p=.847$), or the interaction between time, condition and prior knowledge ($F(1,56)=.098$, $p=.756$). In general, the high level of motivation (mean of 5.3, SD= .7, on a 7 point scale) was not affected by any of the factors. The mean self-efficacy score was 4.8 on a 7 point scale (SD=. 9). For self-efficacy we found similar results as for intrinsic motivation: no significant change over time ($F(1,56)=3.248$, $p=.077$), no condition effect ($F(1,56)=.463$, $p=.499$) and no difference for students with more or less prior knowledge ($F(1,56)=.078$, $p=.675$).

In general, task value was also high (5.4, SD=.8, on a 7 point scale). For task value there was no significant change over time either ($F(1,56)=.235$, $p=.630$), nor was the interaction with condition significant ($F(1,56)=2.386$, $p=.128$). So, overall task value did not increase and there was no difference between the conditions in task value. However, the effect differed for prior knowledge ($F(1,56)=6.341$, $p=.015$, $\eta^2=.102$): the students with little prior knowledge had higher task value scores after observation than after guided practice (Figure 1).

While randomly assigned to conditions, multivariate analyses reveal a significant difference between the conditions at pre-test in favour of the experimental condition (Wilks' Lambda: $F(3,57)=3.214$, $p=.029$). This difference is significant for intrinsic motivation towards the visual arts subject ($F(1,59)=8.515$, $p=.005$)[5], but not for task value ($F(1,59)=.063$, $p=.802$), or self-efficacy ($F(1,59)=1.304$, $p=.258$).

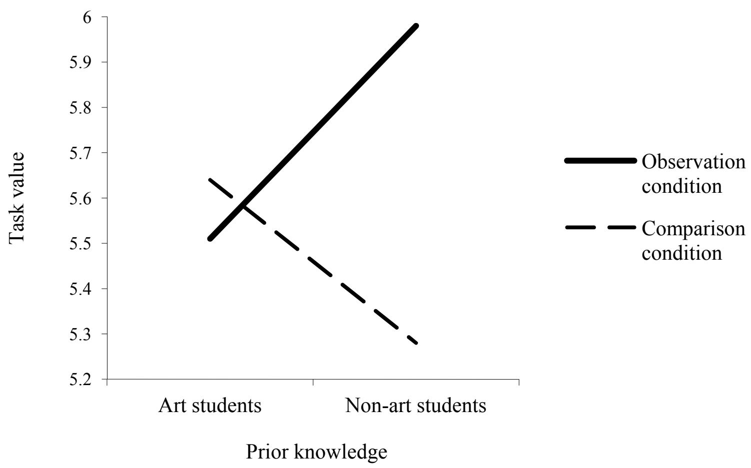
In sum, the conditions were fair as the students in both conditions were equally motivated by the conditions. The experiment did not affect the students' intrinsic motivation for visual art making or self-efficacy. However, we demonstrated that task value is higher for students with less prior knowledge who observed and students with more prior knowledge who practised. The effect we observed is medium in size.

[5] *Intrinsic motivation was not a significant covariate in any of the subsequent analyses, therefore, we did not include it.*

Table 4. Observed pre-test and post-test means : intrinsic motivation (IM), task value (TV) and self-efficacy (SE) (7-point scale: 1 = strongly disagree, 7 = strongly agree)

		Experimental condition						Comparison condition					
				Prior knowledge						Prior knowledge			
		Total		High		Low		Total		High		Low	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pre-test	IM	5.5	.5	5.5	.6	5.5	.3	5.0	.7	5.0	.7	5.0	.8
	SE	4.9	1.0	5.0	1.0	4.6	1.1	4.6	.8	4.6	.9	4.6	.8
	TV	5.5	.8	5.4	.9	5.6	.7	5.4	.7	5.3	.7	5.6	.7
Post-test	IM	5.6	.7	5.7	.8	5.6	.3	5.1	.7	5.1	.7	5.1	.5
	SE	5.2	1.0	5.3	1.0	4.9	1.0	4.8	.9	4.9	.9	4.7	1.1
	TV	5.6	.9	5.5	1.0	6.0	.6	5.5	.9	5.6	.9	5.3	.9

Figure 1. Task value scores at post-test for students with more or less prior knowledge.



3.2 *Creativity and technical quality of the products*

In Table 5 the creativity and technique scores of the students are presented for both conditions and for pre- and post-test. The difference between pre-test and post-test is significant for creativity (*t*(60)=7.869, *p*<.001, *d*=1.157), but not for technique (*t*(60)=-1.821, *p*=.074). This means that overall the creativity of the products improved from pre-test to post-test, but not the technical quality.

Table 5. Mean scores creativity and technique (rating scale 0-200)

	Creativity				Technique			
	Pre-test		Post-test		Pre-test		Post-test	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
All students	92.1	25.3	121.1	24.7	107.6	28.7	113.0	23.2
Experimental condition	97.8	23.7	127.9	22.1	112.7	30.2	116.9	24.7
Comparison condition	85.9	25.9	113.5	25.5	102.0	26.3	108.8	20.9

At pre-test, the difference in creativity and technique between the conditions was not significant (Wilks' Lambda: *F*(2,58)=1,932, *p*=.154). In a model with pre-test score and divergent thinking score as covariates and condition and prior knowledge as between factors, prior knowledge did not contribute significantly, nor as between factor, nor as interaction component with condition. Therefore, we eliminated prior knowledge from the model. Univariate analysis revealed a significant effect of condition for creativity (*F*(1,57)=5.311 *p*=.025, η^2=.085). Pre-test creativity and divergent thinking scores are significant covariates (*F*(1,57)=4.621, *p*=.036 and *F*(1,57)=6.247, *p*=.015). For technique, condition did not have an effect at post-test (*F*(1,57)=.349, *p*=.557). As expected, students in the observational learning condition scored significantly higher on creativity than students in the comparison condition, but the learning conditions did not result in an effect on technique. The effect size for the effect of observational learning on creativity is medium (Cohen, 1988).

3.3 Creative processes

In Table 6 the process data for all students are shown. Students spent most of their time on their final designs (about 60% of the time). A considerable amount of time was also spent on sketching (about 24%). Less time was spent on the other activities such as reading the assignment, thinking about the assignment, brainstorming, choosing, improving and other. On average students worked for about 30 bleeps, which is about 45 minutes.

T-tests reveal that for the percentage of time spent on brainstorming, sketching and final product, the difference between pre-test and post-test is significant (Brainstorming: *t*(60)=2.0, *p*=.049, *d*=.283; Sketching: *t*(60)= 3.7, *p*<.001, *d*=.431; Final product: *t*(60)=3.0, *p*=.004, *d*=.300). On average the students brainstormed and sketched more after the intervention, and spent less time on their final products.

Table 6. Process results: mean percentage of time spent on activities at pre-test and post-test

	Experimental condition						Comparison condition					
			Prior knowledge						Prior knowledge			
	Total		High N=24		Low N=8		Total		High N=21		Low N=8	
Pre-test	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Read	4.1	2.1	4.4	1.9	3.0	2.5	4.2	2.1	4.4	2.3	3.6	.8
Think	2.3	3.7	2.4	4.2	2.0	2.2	2.6	4.8	2.7	5.1	2.3	4.2
Brainstorm	3.4	4.4	3.2	3.9	3.8	5.8	3.2	3.8	3.4	4.1	1.3	1.8
Sketch	24.1	16.1	25.1	17.6	21.2	10.8	23.2	13.8	25.3	14.5	17.4	10.0
Choose	1.7	2.9	1.0	2.1	3.8	4.1	1.3	1.9	1.5	2.1	.8	1.5
Improve	3.5	4.2	2.8	4.0	5.8	4.1	6.1	6.7	6.4	7.2	5.4	5.4
Final work	59.1	20.0	59.2	21.4	58.8	18.6	56.7	17.0	53.6	16.6	65.0	16.3
Other	1.8	4.3	1.9	4.6	1.6	3.7	2.6	4.5	2.0	3.6	4.3	6.2
Duration	31.8	6.8	32.3	6.2	30.0	8.4	29.7	6.8	30.0	7.0	29.0	6.3
Post-test												
Read	3.5	2.7	3.1	2.1	4.6	3.9	3.7	2.3	3.6	2.7	3.9	.6
Think	1.5	2.4	1.6	2.4	1.2	2.6	1.5	2.7	2.0	3.0	0.0	0.0
Brainstorm	5.9	6.1	5.6	5.0	6.6	8.9	3.2	4.0	3.7	4.4	1.8	2.6
Sketch	30.3	17.3	31.9	18.6	25.3	12.3	30.5	15.2	27.8	12.7	37.5	19.8
Choose	1.4	2.5	1.4	2.5	1.4	2.7	.8	1.5	1.0	1.7	0.0	0.0
Improve	3.4	3.8	3.8	4.0	3.0	3.3	4.1	6.3	4.6	7.0	2.7	4.1
Final work	51.8	18.3	50.4	18.3	56.2	18.6	53.3	16.3	53.4	13.6	53.2	23.2
Other	1.9	2.6	2.0	2.2	1.7	3.8	2.9	6.8	3.7	7.8	1.0	1.8
Duration	29.8	5.8	29.9	5.2	29.5	7.9	27.3	5.7	27.8	6.3	26.3	4.0

The scores for the majority of the activities are not normally distributed. We chose to apply univariate analyses of variance to estimate condition effect although it underestimates the effect as a consequence of the overestimation of the variance. Univariate analyses with the post-test activity as a dependent variable and the corresponding pre-test variable and divergent thinking score as covariates, and condition and prior knowledge as fixed factors showed significant main effects of condition on brainstorming ($F(1,55)=4.550$, $p=.037$, $\eta^2=.076$) and on sketching (interaction between prior knowledge and condition $F(1,55)=6.609$, $p=.013$, $\eta^2=.107$).

Students who observed performed significantly more brainstorming activities at the post-test than students who practised. In Figure 2 we present this result visually. For sketching the interaction effect means that students with more prior knowledge were encouraged to sketch more after observation than after practice. However, the students with less prior knowledge were encouraged more by practice and explicit instructions to sketch. This is shown in Figure 3. The effects are medium in size.

Figure 2. Percentage of time spent on brainstorming at post-test for students with more or less prior knowledge.

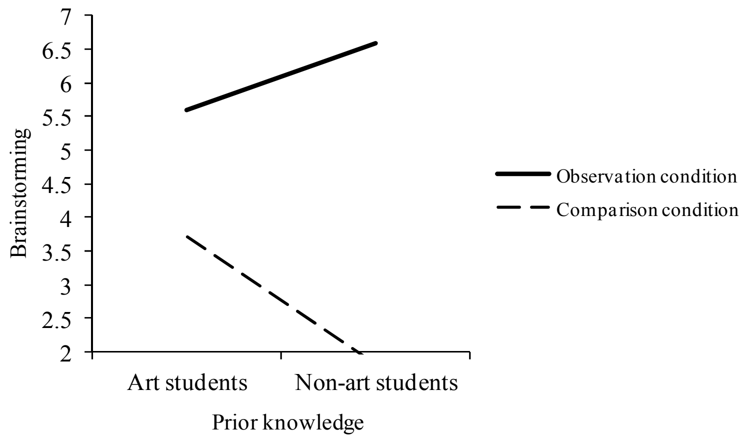
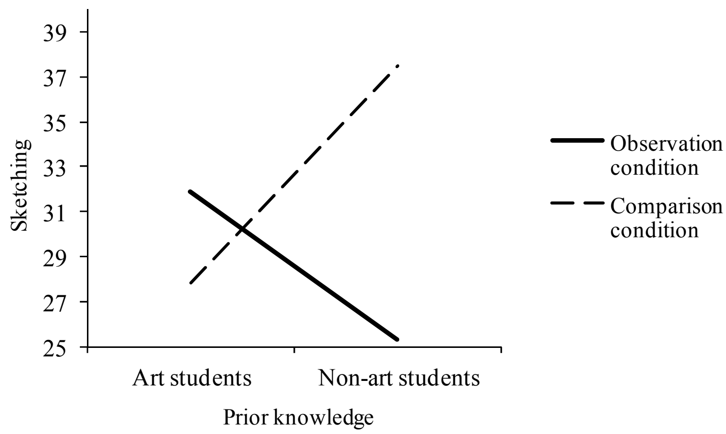


Figure 3. Percentage of time spent on sketching at post-test for students with more or less prior knowledge.



3.4 Students' learning experiences

Table 7 shows the results from the learner reports. We report proportions of the total number of student statements, since the conditions differed slightly in number of statements reported.

Table 7. Results from learner reports: mean percentage and standard deviation of statements per condition and category

	Experimental condition		Comparison condition	
	M%	*SD*	*M%*	*SD*
Mean number of statements per student	4.2	1.9	4.9	1.5
Mean % statements				
Process knowledge	60.2	25.9	41.3	21.6
Product knowledge	12.2	17.5	30.3	22.9
Knowledge about graphic design	4.3	11.4	8.2	13.1
Knowledge about own skills	11.4	16.4	11.2	15.0
Knowledge about the subject visual art	8.7	15.2	9.0	13.4
About the world	62.2	26.2	64.0	19.9
About the self	34.7	24.4	36.0	19.9

About 51% of the students' statements are about process learning experiences:

> 'I learned not to be too fast and take details into account'
>
> 'I did not know how to start a design task, now I know I start sketching'
>
> 'I learned that you have to think very well about the target group'.

21% of the statements deal with learning about products:

> 'I learned how many things you can do with fonts'

Students reported less about learning of design concepts (6%), their own skills (11%) or about the subject visual arts in general (9%).

> 'I learned about myself that I should not think that I cannot draw, because if you do what you are good at, the result will be nice'

About 35% of students' statements deal with learning experiences about the self (characterised by first person use), the other statements deal with more general learning experiences about the world (about 63%).

We used univariate analyses to examine differences between the conditions and possible influence of students' prior knowledge. A significant result was observed for process and product learning. The students in the experimental group reported significantly more process learning experiences than the students in the comparison condition ($F(1,56)=5.706$, $p=.020$, $\eta^2=.092$). The students in the comparison group reported significantly more product learning experiences than the students in the experimental condition ($F(1,56)=4.776$, $p=.033$, $\eta^2=.079$). There seems to be no influence of prior knowledge. We conclude that the students in the experimental group are more process oriented and the students in the comparison group are more product oriented after the experiment.

3.5 Additional analyses: process-product relations

At pre-test, the creativity scores correlate significantly with process length ($r=.285$, $p=.026$) and time spent on the final product ($r=.267$, $p=.038$). At post-test, creativity scores were correlated negatively with time spent on improving ($r=-.262$, $p=.042$).

At the pre-test, scores for technique correlate positively with process length ($r=.498$, $p=.00$) and time on final product ($r=.321$, $p=.012$). They correlate negatively to time spent on sketching ($r=-.292$, $p=.023$) and time spent on improving ($r=-.283$, $p=.027$). Scores for technique at the post-test correlate significantly with process length ($r=.291$, $p=.023$).

These results indicate that the relationship between process and product has changed considerably from pre-test to post-test. Therefore, we conclude that the learning conditions changed underlying processes that affect product creativity and technique. Unfortunately, we cannot examine the differences between the conditions for process-product correlations because the sample size is too small.

4. DISCUSSION

We examined the effects of observational learning on creative products and processes. First we checked whether the two interventions we implemented motivated the students to the same extent. We measured several attitudinal variables: intrinsic motivation, self-efficacy and task value. There was no effect of the interaction of condition and time on intrinsic motivation and self-efficacy. We conclude that we ran a fair experiment with two competing conditions.

In general, the creativity of the students' products was higher at post-test than at pre-test. Since the pre-test and post-test tasks were different, we have to be cautious with this conclusion. More importantly, at post-test the designs produced by the students in the observational learning condition were more creative than those of the students in the comparison condition. For technical quality of the design, no differences between pre-test and post-test or between the conditions were found. We conclude that observation enhances creativity and that technical quality was not affected, as expected.

Concerning the creative processes, we found that the students in both conditions brainstormed and sketched more after the intervention, while they spent less time on the final product. Here again, task effect may interfere with the learning effect. Subsequently, we have shown a main effect of condition on time spent on brainstorming: the students in the observation condition brainstormed significantly more than the students in the comparison condition. For sketching the effect seemed to differ for students with more or less prior knowledge. The students with more prior knowledge were more encouraged to sketch by observation, while the students with less prior knowledge were more encouraged to sketch by practising the design task through explicit stepwise process instructions.

From the students' learner reports, we learned that the students in the observational learning conditions reported significantly more process learning experiences than the students in the comparison condition, whereas students in the comparison condition reported significantly more product learning experiences. One may think this result is a product of the manipulation, but this is not the case as the learning content was exactly the same for both conditions. We conclude that our hypotheses were largely confirmed for both product and process results. It appears that prior knowledge is an interesting variable, which explains different effects for different groups of students.

Finally, the relationship between process and product was examined. We have shown that for the pre-test, time spent on the final product and process length are related to creativity and even more strongly to technical quality. Divergent processes such as sketching and improving are negatively related to technical quality. It seems that because of the time limit, the students who employed many divergent activities did not have enough time for working on their final products. Therefore, their final products were technically less neat. In that sense there seems to be a trade-off between divergent exploration and technical quality. At the post-test there was no negative correlation between sketching and technical quality. Possibly, the students sketched differently at post-test: different types of sketches or sketches with different purposes. Time spent on improving correlated negatively with creativity scores at the post-test. Possibly students who were not satisfied with their products, because these were in fact weak products, applied this process more regularly. All in all, we managed to change process-product relations, which suggests that we changed underlying processes, but we cannot be completely certain about the effect of the task. The relationship between process variables and product scores makes us reconsider the intervention. The intervention was based on literature that promotes divergent activities for enhancing creativity. But we found that other variables were related to creativity of the product, at least at pre-test. Time spent on the final product and process length seem to be related to creativity and technique. Secondary school students seem to make better products while spending much time on their final products. Perhaps, students tend to explore while working on their final products rather than during sketching stages.

Another point for consideration is the participation at the research institute. Since participation was voluntary, we expected relatively motivated students to apply. However, we offered a small reward, which may have attracted other students to apply as well. About 25 % of the students who were informed about the experiment applied for participation. It is possible that these students were the most motivated students. This means that we cannot generalize our findings to all students. At pre-test the students who participated in the experiment were already quite motivated (mean=5.3 on a 7 point scale) and they already engaged in making sketches quite often (24 percent of their time).

We found a significant pre-test difference for intrinsic motivation towards visual arts in favour of the observation condition. Therefore we have to be careful with our conclusions. However, the correlation between initial intrinsic motivation and post-test score was low (r=. 308, p=.016). Besides, intrinsic motivation was measured in relation to the subject visual arts in school in general, not to the specific task (graphic design) taught in the intervention. We measured task value to examine the attitude towards this specific task and we have shown that at the pre-test the conditions were not different in this respect at all.

Another limitation of this study is that, to satisfy internal validity constraints, the setting in the current study posed threats to external validity. The students had little freedom; they had to finish their creative products in one session, within a time limit, at the research institute. In a more realistic context, they might have opportunities to leave their products for some time and return to them for further elaboration at later moments. The students did not seem to be bothered by the bleeps during the tests; at least they did not say so. However, we cannot be completely sure that this instrument did not influence the processes. Since the students already sketched much at pre-test, it is possible that the instrument itself encouraged the students, for example, to sketch. We are aware of this lack of external validity, but at least both conditions dealt with the same circumstances.

All in all, the results suggest that it is worthwhile to implement observational learning in art education. We demonstrated positive effects on students' design products and processes. We certainly do not suggest replacing artistic practice by observation in art classes. Instead, we recommend enriching the art classes with observational learning. From a theoretical perspective, it can be concluded that observational learning is an effective learning tool, also for ill-defined creative tasks in art education. Even when students are asked to produce original work, modelling examples may support them. In addition, we think that this study shows a new direction of studying interventions which foster creativity, taking both effects on processes and products into account.

ACKNOWLEDGEMENTS

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APPENDIX A: PRE-TEST AND POST-TEST TASK

The organization Sun4you*th* orders a design (Pre-test).

Who? Sun4you*th* helps youth with a winter depression. Many young people seem to have problems with a lack of daylight, they have problems with the rain, the cold and the grey skies in Dutch winters. These young people are tired, have little energy and have problems to get up in the morning. This can even make them depressed, which results in bad performance in school. One week of sun can be sufficient for them to 'survive' the winter. Therefore, sun4you*th* aims to provide free sun holidays for young people with a winter depression.

What? Sun4you*th* wants to design bath slippers as publicity for their organization. The only text on the slippers will be 'Sun4you*th*'. The designer is free to add pictures or images. The design has to be original and attractive!

Why? Sun4you*th* wants to be known among youth. Distributing slippers seems a good way to acquire this brand awareness. If Sun4you*th* manages to get known among youth, commercial companies will be more inclined to fund holidays for depressed youngsters and accordingly invest in the future.

For whom? The slippers are meant for young people. They have to wear the slippers and in that way, provide brand awareness for Sun4you*th*. So, the slippers have to be attractive to youth.

How? Sun4you*th* wants an original and attractive design. It will not get unnoticed! It should be absolutely clear that it is meant especially for youth.

The organization '*Special Guests'* orders a design (Post-test).

Who? *Special Guests* is an organization which helps smuggled animals at the customs at Schiphol Airport. There exists an enormous illegal trade in exotic and often rare animals like tropical birds, fishes, turtles, snakes, monkeys and even crocodiles. Many of these animals are smuggled into the country through Schiphol Airport. Criminals carry the animals in suitcases, under their clothes, inside books or among dirty laundry. If these animals are discovered at the customs, the animals end up in cages at the airport. The circumstances are far from ideal and these animals suffered from a terrible journey. The organization *Special Guests* aims to find a new home for these animals in this cold little country as soon as possible. Sometimes they can even arrange a journey back home.

What? *Special Guests* wants to order a t-shirt design. The only text on the shirt will be the name of the organization: Special Guests. The designer is free to use images. It has to be an attractive and original t-shirt!

Why? *Special Guests wants* a happy and funny t-shirt to sell it to passengers on Schiphol Airport. The profits from this sale will be spent on providing hosting for the animals which are caught at the customs.

For whom? *Special Guests* focuses on young people who go on holidays. Young people often choose for tropical destinations, where the smuggled animals come from. Therefore, young people may be interested in supporting these animals.

How? *Special Guests* wants a happy and funny t-shirt that people are willing to buy.

APPENDIX B: ANCHOR PRODUCTS: CREATIVITY

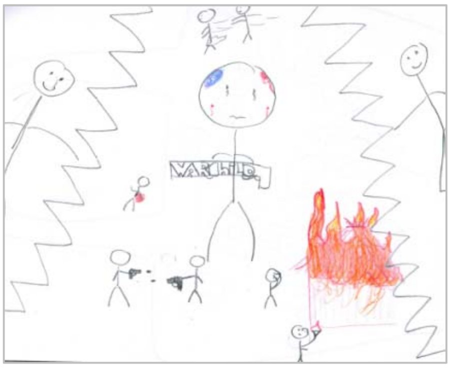
Score 50

Score 100

Score 150

APPENDIX C: ANCHOR PRODUCTS: TECHNICAL QUALITY

Score 50



Score 100

Score 150

APPENDIX D: LEARNER REPORTS

What did you learn during the past lessons? It can be anything. Maybe you were surprised about certain things. Write this down in full sentences. Try to make as many sentences as possible about what you learned or what surprised you. Write down only what you really learned.

Examples of how to start a sentence:

General	Surprises/exceptions
I learned that…. (something is like..) I learned that…. (something works like..) I learned how ..(to do something) I learned…	I learned that it is not always like… Etc.

The second question was formulated in the same way, but there we asked students what they learned *about themselves* during the lessons.

Coding scheme

Category	Content	Example
Product learning	Learning about product features: colour, composition, relation between text and image	*I learned to combine text and image.*
Process learning	Learning about the process: how to approach a design task, learning about different approaches, sub processes, consciousness about the own approach, learning about the own attitude towards the process	*I learned that through writing many ideas or drawing, a nice design will develop.*
Learning about own skills	Learning about what one is good at, not so good at	*I noticed that I have nice ideas.*
Learning about graphic design	Learning about graphic design (concepts, profession)	*I learned that designing things is more difficult than you may think.*
Learning about the subject visual arts	Learning about content of the subject visual arts, attitude towards the subject	*I learned that I am very interested in visual arts. It is very interesting and nice.*
Other	Evaluative remarks about the course or about the tests, all other remarks	*I liked to see how others were designing. Some things I liked, other things I would have done differently.*
Learning about the world	Learning something (general)	*I learned how to approach a design task.*
Learning about the self	Learning something about the self (recognized by use of first person after 'I learned')	*I learned that I usually use a lot of colours.*