GRADING EFFICIENCY IN DESIGN

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ABSTRACT
The academic world is constantly under pressure to deliver maximum output for a minimum of (public) costs. For Design education this is important, because doing Design cannot be learned from a book. As teaching costs are mainly driven by the costs of supervisors, the amount of time invested in organizing a meaningful teaching experience determines the efficiency. Grading design is complex, because design assignments are open ended, and design tasks have no 'right' solution that can be easily validated. An efficient grading method therefore has to provide insight in both design result *and* design process in a short period of supervising time. In 2009 we set up the multidisciplinary course human-product relations as a part of the second year of the bachelor. The design work in this course is graded in an interactive session where the students present their results in a combined poster/sketch/model-presentation of approximately five minutes, following five minutes of question and answer. We call this the "Design Fair". In 2010 we also introduced a design course on aesthetics and meaning. In this course the students have to hand in their results in the form of a visual essay of maximum 50 slides. Both ways of grading suit particularly well with the intended learning experience, and experience showed that they provide insight in the students' results in an efficient way. A short quantitative evaluation of the visual essay method also showed that the objectivity of the grading method was sufficient.

Keywords: Design, grading, individual assessment, efficiency, visual essay, design fair

1   INTRODUCTION

The academic world is constantly under pressure to deliver maximum output for a minimum of (public) costs. Especially in Design education this is a major topic, because doing Design is not something that can be learned from a book. Many matured design schools have shown that experience in designing is an important education principle to be able to achieve the end terms of a design educational program. This 'learning by doing' is most fruitful when it is supported by regular reflection and feedback with supervisors. In the Netherlands, the average remuneration for teaching activities in technology curricula is roughly 112 Euro per Student per European Credit. As teaching costs are mainly driven by the costs of supervisors, the amount of time invested in organizing a meaningful teaching experience is therefore very important.

In our bachelor program Industrial Design Engineering (IDE) of the University of Twente, we have been facing a strong increase of student enrolment from approximately thirty in 2001, to more than hundred since 2009. Our education system includes a project-oriented curriculum and an integrated education means. The project oriented education focuses explicitly on the development of the students and their competencies by placing the students in a realistic engineering environment [1]. The latter is aimed at activating students during plenary sessions and a regular alternation of providing theory, practicing and feedback. Both types of education initially require a high student-staff ratio. For most design projects we implemented group work to increase efficiency, but for the individual development and monitoring of the students design skills it was also necessary to issue individual assignments. To control the corresponding high level of individual supervising load, we present two efficient grading methods for individual assignments in this paper.

Grading is an important part of design education, since it is used to assess if students have achieved the learning goals of a certain design assignment. Grading design is complex, because design assignments are open ended, and even a specific design task has no 'right' solution that can be easily validated. The grading method has to provide insight in both design result *and* process, and for a

meaningful learning experience, providing feedback also has to be incorporated. In our Bachelor curriculum of Industrial Design Engineering (IDE) we implemented two forms of grading procedures that incorporate these aspects, combined with the intention to reduce supervising time. This paper will present the details of the grading approaches within their design context, together with a qualitative and quantitative evaluation of their efficiency. We will also discuss and evaluate the benefits and limitations of the methods.

2   DESIGN CONTEXT HUMAN PRODUCT RELATIONS

The first grading procedure is part of the multidisciplinary course human-product relations, which is finalized with an individual design assignment. The first run of the course was in 2009, as a part of the second year of the bachelor IDE. The course considers different types of relations between humans and products and how this can be applied to design [2]. We believe that hands-on experience is essential to achieve the learning goals of the course. Therefore we developed and applied a number of efficient means to reach this goal. Firstly we developed several techniques to activate the large group of students during the plenary sessions. These sessions included six half-day workshops, all focusing on a different human-product relations topic, following the interdisciplinary character of the course. In this integrated education setting we switched regularly between theory and exercises [3].

Secondly we applied an efficient assessment and feedback protocol for the individual design assignment. The students had to apply the theory of the different workshops to a design of street furniture. Figure 1 shows an example of student results for this assignment. The essence of the human-product relation is reflected in the different social interactions between different users. This was achieved by creating sitting elements that can easily be reconfigured.

Figure 1. Example of a result of the street furniture assignment: the 'Tetris' sitting object is easily adjustable to varying desired social interactions

Ideally, within the course, we would have liked to provide students with regular one-on-one feedback sessions. To reduce workload we worked with go-no go sessions in which students had to present their preliminary results to two supervisors in groups of six students. Within these sessions, students got direct feedback from their supervisors, and seeing the work of the other students allowed for extra reflection. The go-no go character also forced students to carefully prepare for the sessions. A drawback of the go-no go set up is that the sessions have to be held with two supervisors to have a minimum of objectivity. However, selecting the underperforming students saves time with the final assessment and the feedback for the students that perform well is more divers.

3   DESIGN FAIR

At the end of the course students had to present their results in a five minute presentation session during which their work was assessed. This made time-consuming assessment of reports unnecessary, and forced the students to tell a good story about their designs. Because of the market-place connotation of these interactive sessions we called this form of assessment the 'design fair'. Figure 2 shows a typical setting where a student is presenting his work by means of a poster, drawings and models.

Figure 2. Example of the Design Fair setting: presenting the design project to supervisors and fellow students

The design fair fits particularly well into the project-oriented education concept because it mimics a real commissioner-contractor setting, and the students were asked to explain their designs "as if you are visiting your client". The students were then questioned by the supervisors, where they had to defend their design with use of the theory, treated within the course. The limited timeframe also forces the students to think about what the most important aspects of the design result and the project are, and how to communicate them efficiently. In a typical setup the students use mood boards and concept boards to show the context and analysis of the projects. Scale models and mock-ups, or drawings and CAD-models are often used to show the actual designs (Figure 3). Sometimes movie-clips or toy dolls are used to demonstrate specific human-product interaction.

Figure 3. Examples of presentation material for the design fair: mood-boards or concept-boards in combination with drawings or models, and eventually a laptop to show a movie-clip

The supervisor grading time consumption per student can be calculated from the setup of the sessions. A typical session with four students, including presentation, question and answer, and sufficient time for discussion and feedback lasts for one hour. Hosted by two supervisors this grading method costs half an hour per student per grader, for a design task with a total study load of 3.0 European Credits.

4 DESIGN CONTEXT DESIGNING PLEASURABLE PRODUCTS

In 2010 we introduced a course in designing pleasurable products, in order to provide the next generation of designers with some skills to implement positive values in their designs. This course is situated in the 3rd year of the Bachelor IDE and adopts the pleasure in product design theory of Peter Jordan [4]. In this framework, based on the work of Lionel Tiger, four categories of product evoked pleasure are discerned: Physical, Psychological, Social, and pleasure derived from the identification with Ideological values. This theory has an advantage in this context, because it breaks with the normal paradigm of (especially human factors) dealing with "problems" and "problem solving". The very nature of the pleasure framework provides a positive foundation, fitting an approach based on "providing opportunities". This course adopted the same project oriented approach for the plenary sessions as the course on human-product relations, and also incorporates a final design assignment that is executed individually.

The central assignment in this course is the redesign of an existing product category (a music player, a bicycle, a micro-wave or a lawn-mower), where the students have to provide concepts that provoke pleasurable experiences on each of the four levels of the theoretical framework. Total study load of the course is 2.5 European Credit and the assessment is entirely based on the results of the design assignment.
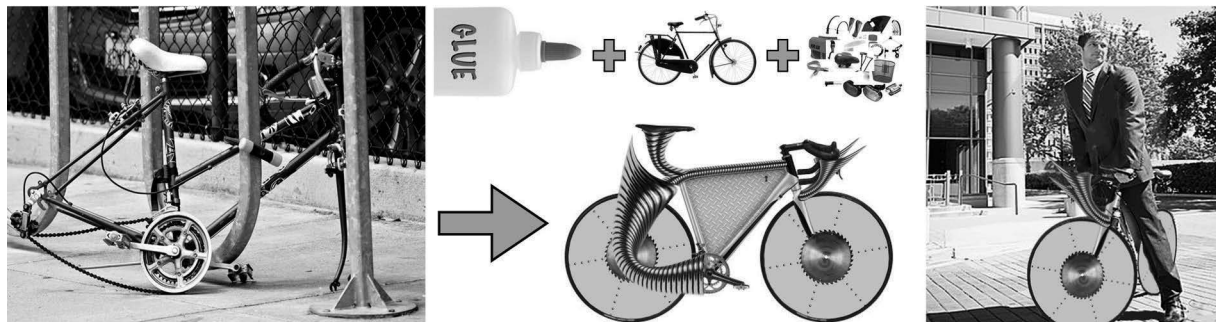

Figure 4. A series of images, forming an argument: to prevent vandalism, all the loose parts of the bike are solidified in an aggressive style; the result is someone not to be messed with

5 VISUAL ESSAY

To complete the course, the students have to present their design work by means of a 'visual essay'. This consists of a series of images with limited text, forming an argument (Figure 4). This was inspired by the idea of the visual essay as a form of academic writing, by Leslie Arthur and Phillipa Martin [5]. This method of grading was implemented to minimize the assessment workload, but also to add up with the positive approach of the course. There is ample complain about writing capabilities of recent generations, so why not conform to the skills they do master (and will need) more and more in our highly visually oriented society? We also had positive experiences with the application of the visual essay concept within design tasks in other courses, where it showed that making visual essays stimulated creative solutions and improved the communication of abstract ideas [6]. To emphasize the importance of the image stationery and force the students to really tell their story visually, the use of words was limited to a maximum of six words for each slide. Figure 5 shows a (little) part of a typical example of student results. The three slides depict the analysis, inspiration and design concept for a microwave targeted on pleasure at the social level.

Figure 5. Part of a visual essay; three slides depicting results of the redesign of a microwave

Evaluating these visual essays can be done very quickly because of the limitation to six words per slide. Viewing and reading times are even shorter while most students did not use the maximum of all fifty slides to tell their story. With some practicing the viewing time reduced to less than five minutes, and combined with the time to prepare written feedback (approximately 250 words), average supervisor grading time per student was fifteen minutes.

6 EVALUATION

To be efficient, the grading methods have to provide good quality grading, in a minimum amount of time. The efficiency is considered high, when the amount of time invested is low, and the quality of both learning experience and grading results is high. In other words: efficiency = (reliability + learning experience) / time. As stated earlier the grading method has to provide objective insight in both design result *and* process, has to provide feedback to the students and preferably has to be a valuable learning

experience in itself for the students. The quality of the grading is then to what extent these demands are met. Within the design fair, the objectivity of the procedure is incorporated by assessing all students by two supervisors. Experience with three cohorts of approximately 80 students (some 20 percent fails the go no-go assessment) prove that there is little discussion among the supervising couples on the given grades. Because of the direct feedback, the question and answer session and the benchmark with the other students in one session, the students themselves also have a good insight in their own performance and almost all feel comfortable with their grades. Within the written student evaluations (98 respondents), there was just complaint about the preparation for the design fair sessions. Students indicated that they did not know what to expect precisely, or what was expected from them. This can of course be improved by providing more information beforehand. However, one must be aware that giving examples always has the drawback that students copy the examples too much, without thinking for themselves what they want to tell and what suits their own design project the most.

So with a satisfactory quality of the grading results and an average grading time consumption of half an hour and feedback well-incorporated, this method is fairly efficient. The visual essay method could be even more efficient with an average grading time consumption of only fifteen minutes per student, for a comparable design task. However, because this is done by one supervisor, the students have no benchmark with other students and there is no question and answer, the motivation of the assessment is not an explicit part of the grading method. Therefore students can suspect a lack of objectivity in the procedure. To feel comfortable about the quality of the process, we organized a little comparative study to assess the objectivity of the grading method. The objectivity can be defined by the deviation in grading results, when performed by different supervisors. When the deviation in grading results is low, the method will arguably provide a good insight in the quality of the design work that is actually evaluated.

In the short study, six different visual essays were assessed by five different supervisors. The assigned grades were then compared with the reference grades, initially assigned by the instructor of the course. The supervisors were all instructed to assess the results in the same order and a seventh visual essay was added as a reference for the absolute level of the desired output. The learning goals and assessment criteria were given, but the actual grading procedure (using partial grades, weighing the criteria, etc.) was not prescribed. All invited supervisors were experienced teachers in our design education curriculum, but were not involved in the actual course. Table 1 shows all the assigned grades, using a ten point scale (where ten is the maximum performance, six is sufficient and five or lower is a fail). The figures in bold font in column two are the reference, assigned by the instructor of the course. These were the grades that the students actually received after finalizing the course.

Table 1. Results of the quantitative evaluation of the Visual Essay grading method

Grading performed by:	Instructor	Grader A	Grader B	Grader C	Grader D	Grader E
Student 1 Bicycle	**5**	6	5	7	5	6
Student 2 Music player	**9**	8	8,5	8	8	8
Student 3 Music player	**7**	6	7	6	6,5	7
Student 4 Microwave	**8**	7	7,5	7	8	8
Student 5 Microwave	**7**	7	6	7	7	7
Student 6 Microwave	**9**	9	6,5	7	9	9
average:	**7,50**	7,17	6,75	7,00	7,25	7,50

The results show that only three instances of the 30 assigned grades deviate more than 1 point from the reference in column 2 (Instructor). The average grades for each instructor are calculated to see whether different supervisors had different ideas on the absolute level of quality of the design work (i.e. more or less stern). The figures in the horizontal rows show a great deal of consensus, and with four of the six essays (students 2,3,4 and 5), the maximum difference in grades is one point. It is remarkable that the biggest differences in the assessment appear in the grading of the essays that received the highest and the lowest marks (students 1 and 6).

Within the written student evaluation (34 respondents) there were no complaints about the grading method, but one student commented that the preparation of the visual essay cost a lot of time. This is of course the case, and one could say that saving time in the grading procedure is traded for student learning time within the course. However, the making of the visual essay also contributes to the learning experience and making reports as an alternative is also very time-consuming.

7 DISCUSSION

The Design Fair is a powerful way of assessing design work because it provides a valuable extra learning experience and gives good insight in the design results and process. The evaluation with two supervisors also adds up to the multidisciplinary character of the course and assignment. An additional advantage is the benchmark, inspiration and discussion with other students. Students can also adapt their presentation material and means to the characteristics of their specific design project. A drawback is that the verbal feedback is transitory, but the direct contact between supervisors and students ensures a clear communication of the comments. However, supervisor time consumption is still reasonable. The visual essay is more efficient in time, but lacks the direct contact between student and supervisor and also misses the benchmark function. The visual essay can provide insight in the design process as well, but not all students manage to incorporate this in a clear way. There is also more room for different interpretations of the design work and the process, however the deviance in the assigned grades is still satisfactory. The visual essay is also a more closed format, leaving less room to adapt to the specific design task. On the other hand, the need to make all information and ideas visible, helps to guide the students' design process from abstract concepts towards a concrete design [7]. In addition, the making of a visual essay is a valuable learning experience in itself.

8 CONCLUSION

The design fair as a grading method fits particularly well into the project oriented education philosophy and shows a sufficient level of efficiency, where the quality of the grading in terms of learning experience and feedback is relatively high with respect to the supervising time that is needed. The visual essay as a new grading method has more resemblance with the traditional learning experience of making reports, but fits very well to the skills of the current generation of visually literate students. The efficiency is also high, with very low supervising time, combined with a sufficient level of objectivity of the grading results.

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