

## Development and Evaluation of a Blended Learning Course

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**Abstract**—In a pilot project, a blended-learning course “Research and Development” was developed. This course is taught according to the flipped classroom principle. To develop the course, the ADDIE-model (Analysis, Design, Development, Implementation, and Evaluation) was used. During the evaluation phase, we wanted to learn how satisfied students were with the newly developed course. More specifically, student satisfaction regarding the digital material, the lessons in the classroom, and the course as a whole, was studied. During the penultimate lecture, twelve students completed a questionnaire. During the last lecture a focus group meeting was conducted. In the case of the questionnaire, the respondents agreed, on average, mostly with the positive statements or they answered neutrally. We can conclude that the respondents were reasonably positive about the course. The teaching method was not unfamiliar to the students. However, they felt a need for a better digital infrastructure, more variety in teaching methods and a more directive teaching style.

**Keywords**—blended learning; hybrid learning; flipped classroom; research and development

### I. INTRODUCTION

Over the last decade, the educational concept of Blended Learning has drawn considerable attention in the educational literature [1][2]. In 2015, a number of pilot projects were carried out at Windesheim University of Applied Sciences in the Netherlands, to integrate this concept into Windesheim’s curricula and to gain further experience with it. In one of the pilot projects, a blended-learning course “Research and Development” was developed. This course is taught according to the flipped classroom principle [3][4].

Due to the fact that both concepts, blended learning and flipping the classroom, are relatively new at Windesheim, the teaching staff involved wished to gain insight in the learner’s satisfaction with the newly developed course. As part of this course, a survey was carried out and a focus group meeting was conducted to learn more about the students’ experiences. The work presented here is therefore initially intended as an effort by the faculty to evaluate its work in order to improve its educational skills, as well as the developed learning material. However, the lessons learned may be more widely applicable.

In Section II this paper first goes into the development of the course. After that, the evaluation method and results are presented in Sections III and IV, respectively. Finally, in Section V, conclusions are drawn, along with a number of lessons learned.

### II. DEVELOPMENT OF THE COURSE RESEARCH AND DEVELOPMENT

To develop the course Research and Development, the ADDIE-model was used [5]. This well-known model comprises five phases: Analysis, Design, Development, Implementation and Evaluation, hence its name.

In the first phase, a needs analysis, a target audience analysis as well as a task and topic analysis was carried out. This elective course aims at third and fourth year students who have already followed one of Windesheim’s Computer Science programs. During the course, they train the necessary skills by carrying out a small project of their own choice. The course takes approximately 84 hours of study.

The students are expected to carry out their research projects outside the classroom. Moreover, they are supposed to acquire the necessary knowledge by studying the e-learning material, prepared for this course, independently. This creates an opportunity to talk in class about the progress and results of the student’s projects including specific topics such as an evaluation of the (Internet) sources found by the student groups. Based on these ideas, the design phase yielded an overview of the assignments which should be carried out outside the classroom and an overview of the necessary e-learning content to support these assignments. Moreover, a detailed plan was made for the lessons.

During the development phase, the online educational resources and face-to-face lessons were prepared, including 17 instructional videos (1.5 hours in total) to which existing material, such as YouTube videos, were added. The e-learning component, available through the institution’s virtual learning environment, was developed using eXeLearning [6]. The virtual learning environment contained a forum to exchange ideas and information.

The first employment of the course took place in Autumn 2015, with 20 students attending, working together in teams of between two and five students.

### III. EVALUATION METHOD

During the evaluation phase, we wanted to learn how satisfied students were with the newly developed course and to gain further insight in the advantages and disadvantages of the applied concepts. More specifically, student satisfaction regarding the digital material, the lessons in the classroom, and the course as a whole, was studied [7][8][9].

During the penultimate lecture, twelve students completed a questionnaire with 39 Likert items, using a 5-point scale, and one open question. Each Likert item

contained a (positive) statement, the response options were: disagree much / disagree / neutral / agree / agree much.

To gain insight in the first point of interest, student satisfaction regarding the digital material, nine questions were asked about the form of the digital learning material such as the instructional videos and the assignments. Moreover, two questions were asked about the user friendliness of the realized e-learning component and the forum. Finally, six questions were added concerning the clarity of the digital material.

To learn more about the second point of interest, the students' opinions about the lessons in class, ten questions were asked about the form of the meetings in class. For instance, the opinion of the respondents about student presentations and receiving feedback in class was asked together with their opinion about organizational matters such as the timeliness of course information. Lastly, three questions were added concerning the interaction in class between students and lecturers and between students and their fellow students.

Finally, the students were asked to answer questions about the course as a whole. Three questions concerned the organization of the student teams. The teams had a certain freedom of choice regarding the way they presented their results (e.g., with a report, a paper, or a presentation). The questionnaire contained two questions about this subject. Three questions were added about the relationship between the sessions in the classroom and homework assignments. Lastly, students were asked whether they would prefer this way of teaching for other courses as well. They could also add comments if desired.

During the final lecture a focus group meeting was conducted in which notable results from the questionnaire were discussed in depth. Observations noted by faculty members during the lectures completed the collected results.

#### IV. EVALUATION RESULTS

The results of the questionnaire are collected in Table I. Twelve students filled in the questionnaire but not every student answered each question. On average, 89% of the questions were answered. The percentages in the table may not always sum up to 100% due to rounding off errors.

Table I shows that students often agreed with the statements, or they chose the neutral option. Mostly they did not disagree much, with three exceptions. The focus group meeting further clarified the results of the questionnaire.

Apart from comments on the overlap between the available videos, students were satisfied with the available learning content. Nevertheless remarks were made about the digital infrastructure. For example, students regretted the fact that videos could not be downloaded from the institute's media portal. A number of websites was embedded in the digital material. However, students preferred links to these websites. The percentages for user friendliness in Table I reflect these results. Moreover, the available forum was considered superfluous. Some students preferred alternatives, such as Dropbox.

TABLE I. QUESTIONNAIRE RESULTS

Respondents are satisfied with:	Disagree much (%)	Disagree (%)	Neutral (%)	Agree (%)	Agree much (%)
Form of study material	0	6	36	52	6
User friendliness of digital material	5	14	38	38	5
Clarity of digital material	0	0	36	53	11
Form of meetings in class	1	10	13	65	12
Interaction in class	0	6	18	73	3
Organization of student teams	8	6	33	47	6
Freedom regarding products	0	8	13	50	29
Relation work in class / assignments	0	3	21	76	0
Preferred for other courses	0	18	45	36	0

Students welcomed the opportunity to present their work and to receive feedback in class. They considered attending presentations of their fellow students as less meaningful because the discussions in class were not always beneficial for their own work. Assignments in class were also not favorable because of lack of depth due to the short time available in class. Students would prefer to discuss more examples of excellent or poor research projects.

Sometimes it appeared to be difficult for students to organize necessary team meetings due to scheduling problems. A number of students, for instance, had internships at the same time as they were following the course Research and Development. Generally, they were reasonably satisfied with the course, but they would appreciate suggestions and instructions regarding planning and papers. The students would rather favour a mix of the flipped-classroom model with a more traditional teaching style. In contrast to our expectation they appeared to be rather familiar with the applied teaching methods.

#### V. CONCLUSIONS AND LESSONS LEARNED

In this paper we treated the development of a blended course together with an evaluation in which the teaching staff studied student satisfaction regarding the digital material, the lessons in the classroom, and the course as a whole.

From the results, we may conclude that the respondents were reasonably positive about the course. However, they felt a need for a better digital infrastructure, more variety in teaching methods and a more directive teaching style. The teaching method was not unfamiliar to the students.

The evaluation presented in this paper has its limitations. Although all the students who took part in the first deployment of the course were invited to fill in the questionnaire, eventually only 12 of the 20 students took part in the evaluation. This number is too limited to draw general conclusions. Moreover, the staff developing the course also taught and evaluated the course. Therefore, some biases may have influenced the results.

Despite these limitations a number of lessons learned may be identified. We acquired experience in developing a

blended-learning course. We experienced the value of a model such as the ADDIE-model for creating instructional materials. We also benefitted from Richard Mayer's guidelines for developing e-learning materials [10]. Finally, we experienced the (extra) amount of time necessary to develop these materials, which can be substantial.

Teaching the course, we learned that the quality of the digital infrastructure is a key factor for students. User friendliness, reliability and the possibility to download materials (for use off line, for instance in public transport) are important factors. The flipped classroom principle was applied strictly: students were expected to acquire all the necessary knowledge outside the classroom. During discussions in class and while grading the student products the impression arose that not every student was sufficiently acquainted with the theory. Therefore, a mix of the traditional knowledge transfer together with training, exchanging experiences and providing feedback in class may prove beneficial.

In our evaluation we focused on learner's satisfaction, which corresponds to the first level (Reaction) of Kirkpatrick's Four-Level Model [11]. An obvious next step would be to evaluate the increase in knowledge and skills, corresponding to the second level (Learning) of Kirkpatrick's model. Future work may therefore focus on the role blended learning plays in acquiring knowledge and skills which are relevant in the course Research and Development.

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