

A qualitative evaluation of a learning dashboard to support advisor-student dialogues

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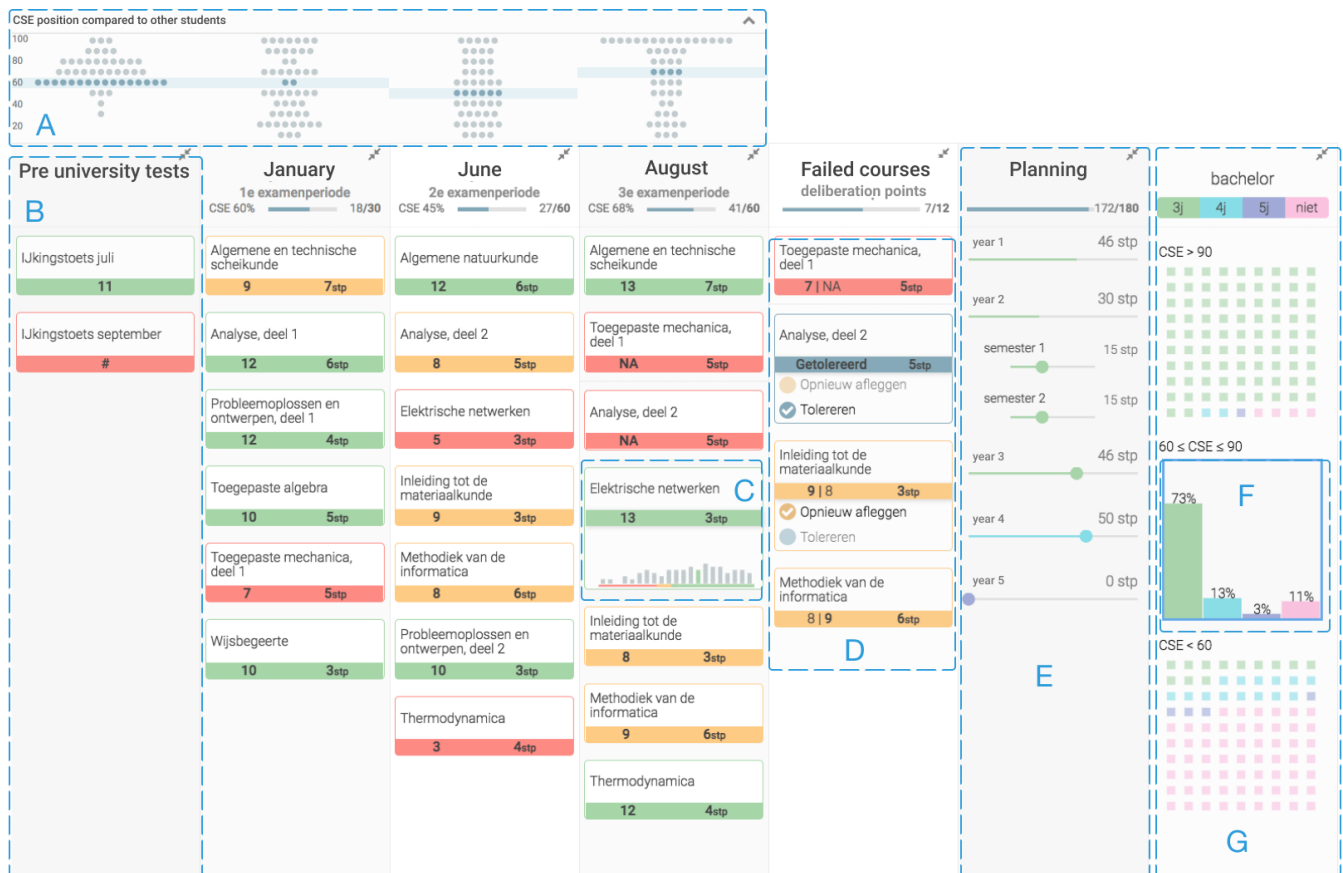


Figure 1: Final design of the dashboard in September. From left to right: (A) Histogram showing performance of peers for each key moment. (B) Column for a key moment with all courses of that moment. (C) Histogram of peer performance for a course. (D) Column for all failed courses and the option to deliberate. (E) Planning module to plan your bachelor. (F) Histogram of study trajectory of previous students with a similar profile. (G) Overview of study trajectories for different profiles

ABSTRACT

This paper presents an evaluation of a learning dashboard that supports the dialogue between a student and a study advisor. The dashboard was designed, developed, and evaluated in collaboration with study advisers. To ensure scalability to other contexts, the dashboard uses data that is commonly available at any higher education institute. It visualizes the grades of the student, an overview of the progress through the year, his/her position in comparison with peers, sliders to plan the next years and a prediction of the length of the bachelor program for this student in years based on historic data. The dashboard was deployed at a large university in Europe, and used in September 2017 to support 224 sessions between students and study advisers. We observed twenty of these conversations. After 101 conversations, we collected feedback from students with questionnaires. Results of our observations indicate that the dashboard primarily triggers insights at the beginning of a conversation. The number of insights and the level of these insights (factual, interpretative and reflective) depends on the context of the conversation. Most insights were triggered in conversations with students doubting to continue the program, indicating that our dashboard is useful to support difficult decision-making processes.

CCS CONCEPTS

• **Information systems** → *Data analytics*; • **Human-centered computing** → *Information visualization*; • **Applied computing** → *Education*;

KEYWORDS

Learning Technologies, Information Visualization, Insights, Learning Analytics Dashboards

ACM Reference format:

Martijn Millecamp, Francisco Gutiérrez, Sven Charleer, Katrien Verbert, and Tinne De Laet. 2017. A qualitative evaluation of a learning dashboard to support advisor-student dialogues. In *Proceedings of 8th LAK Conference, Sydney, NSW, Australia*, 8th LAK Conference, Sydney, NSW, Australia 8th LAK Conference, Sydney, NSW, Australia (8th LAK Conference, Sydney, NSW, Australia), 6 pages. <https://doi.org/>

1 INTRODUCTION

After receiving academic grades from an examination period, students typically want to reflect upon their progress, plan resits, or plan their future study trajectory. This reflection can take place at home or they can schedule a meeting with a study advisor (SA) who can support them during this reflection [3]. We designed a learning dashboard that supports such meetings. In September, the dashboard is deployed in 10 different programs at a large European university. Until now, the dashboard was used in 224 different meetings between SAs and students. The dashboard has two main goals: triggering insights, and supporting the dialogue between a first-year student and the SA. In this paper, we focus on the conversation with a first-year engineering student at the end of the

year. Together with students, SAs are the main stakeholders so they were involved in the entire design, development, and evaluation process. SAs are members of the educational staff who are experts in the content of the first-year courses as well as university-wide regulations [4].

The other stakeholders of the dashboard are the students. Most students scheduling a meeting with SAs do not have a flawless study career [4]. They often failed several courses or have problems studying. Many of these students typically would benefit from an individual study program.

In our study, we divided the students in different groups based on the advice they were seeking. We researched whether there is difference between the number of triggered insights, the levels of insights, and the time the dashboard is a catalyst for the conversation. The research contribution of this paper is two-fold:

- (1) We present evaluation results of the use of the dashboard in 224 sessions between students and SAs. Twenty of these sessions were observed and analysed. Many students (N=101) also filled out a questionnaire about perceived usefulness. Results of our evaluation indicate that the dashboard triggers insights at the start of the conversation.
- (2) We researched different contexts in which the dashboard was used, divided into three groups: students doubting to continue the program, students doubting which courses to take the next academic year and students doubting which courses to deliberate (defined in Section 3). We observed that the dashboard is most useful for the first group, triggering the most insights to support difficult decision-making tasks.

2 RELATED WORK

Learning analytics dashboards (LADs) have been researched extensively over the past decade. A recent survey of Bodily and Verbert [2] indicates that, although many LADs have been developed and deployed in recent years, there is a lack of knowledge of the effect of dashboards on student behaviour. Different stages to achieve behaviour change have been presented by Verbert et al. [9], with sensemaking and insight as one of the key elements to ultimately trigger behaviour change. Work of Claes and Vande Moere [5] has defined useful subcategories of different insight depth. We rely on these categories in our study to identify the utility of LADs and the effect that these LADs have in supporting students.

In addition, most of these LADs are used to facilitate blended learning, face to face learning or group work [10]. Little work has been done so far to assess the utility and effect of LADs in sessions with SAs to guide first-year students [4]. As “*the first year of college is arguably the most critical with regard to the retention of students into subsequent years of study*” [1], such research is, nevertheless, of crucial importance to the LAK field. In our literature review, we found a few dashboards that have been designed to help study advisers support at risk students [6], but little is known about the effect on learning, as well as requirements of different universities, faculties, and departments [8].

Based on the work of Charleer et al [4], this paper digs deeper into how LADs can support the conversation between first year students and SAs and the level of insights that can be supported in different contexts, as a basis to assess their utility.

3 CONTEXT

3.1 SAs

One of the core tasks of SAs is to help students at the end of the first year to plan their second year based on their expertise of the study program and university wide regulations. With their extensive knowledge about courses, they can guide the student developing a good, individualised, study program. SAs are key-actors in advising students, both on their current academic performance and on their future study pathway. At the end of the first year, most students that schedule a meeting with the SA failed one or more courses. These meetings take place in the office of the SA and are private. If students consent, parents join this conversation.

3.2 Regulations

After re-sits, there are three different outcomes possible for each course at our university:

- (1) *Passed*: the student scored 10 or more out of 20.
- (2) *Tolerable*: the student scored 8 or 9 out of 20
- (3) *Failed*: the student scored 7 or less out of 20

If students pass a course, they do not need to retake the course. If students obtain a *tolerable* grade, they have two options: to retake the course again next year or to deliberate the course. Every student can deliberate 18 credits in his/her bachelor program provided that they already earned half of the credits. When students deliberate a course, they no longer have to re-do the course. A failed or non-deliberated course, on the other hand, has to be retaken the next year. During the academic year there are four, or five different key evaluation moments depending on the program. The end of the year is one of the key moments of all programs at our university. The other key-moments are the positioning tests, the exams in January, and in June.

3.3 Data

SAs have two different data sources at their disposal: the "*study progress file*" lists all the courses of the student together with his/her obtained grades, the number of credits of each course, as well as an indication of the position with respect to grades of peers.

The second data source is the Bachelor feedback website ¹. This website provides information to position students with respect to their peers, relative to the expectations of the program. Additionally, the website provides information about the impact of the student's current academic position on his/her future study path. This information is given in both a textual and a graphical representation, based on flowchart. The flowchart divides the students in four different groups based on the number of failed and tolerable courses (see Figure 2). There is a different textual feedback for each of the groups.

Analysing these data sources for each student and combining them is time consuming and error-prone. In this paper, we present a personalised dashboard that integrates and presents these data sources to support different levels of insights. The dashboard also helps the SA to support and to give weight to his/her arguments [4]. We discuss the design of the dashboard in Section 4.

¹anonymous

4 DESIGN

To design the dashboard, we followed a user-centred design methodology. The dashboard went through several small iterations, each focusing on a particular aspect of the dashboard. A first version of the dashboard was designed and evaluated during the past academic year [4]. In this paper, we report on design improvements to support better decision-making at the end of the academic year, as well as an elaborate user study that assesses the utility of the dashboard for this key moment. The design improvements are based on feedback of an SA, the head of the educational staff, and a visualisation expert in different iterations. The dashboard is available on Github ².

The final design is shown in Figure 1: the different parts of the dashboard are highlighted and labelled. In part (A), peers are divided into ten categories based on their CSE. This results in a dotted histogram where each dot represents two percent of the peers. The performance of the student is indicated in blue. In (B), for each positioning test, the grade of the student is shown. The green colour of the first test shows he/she passed this test, whereas the red colour of the second test indicates that he/she failed this test. When the SA clicks on a course, a histogram of grades of all students is shown, as shown in (C). Grades of peers are represented by grey bars. The grade of the student is represented red, yellow or

²<https://github.com/svencharleer/stbd>

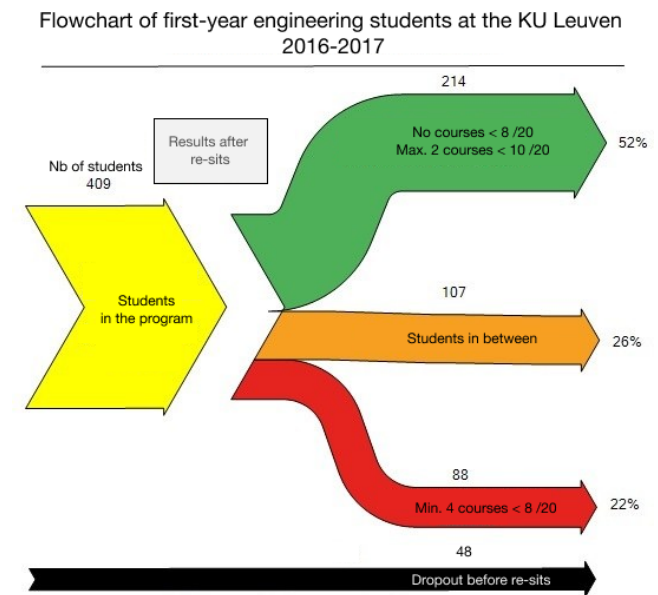


Figure 2: Graphical feedback on the Bachelor feedback page. The yellow flow contains all students still taking the program. The black flow contains students started the program, but already stopped. This yellow flow is divided into a green, an orange and a red flow. The green flow contains students without failed grades and maximal two tolerable grades. The red flow contains students with more than three failed grades and the orange flow contains students in between.

green (red = failed; yellow = tolerable; green = passed). Columns (D) and (E) are very specific for the end of the academic year. Column D lists all courses the student failed. If the student earned 50% of the credits, the SA can deliberate courses. If the student agrees with this decision, and the SA clicks on "tolereren", the colour of the course changes to blue. A progress bar on top of this column indicates the number of remaining tolerance credits. In column E, the SA can use sliders to plan the number of credits a student books the next few years to obtain his/her bachelor degree.

In the rightmost column (G), students are divided in three different groups based on the number of credits they earned. For each of these groups, this column provides an overview of the study trajectory of previous students in this group. If the SA hovers over this overview, a histogram is shown. In the example presented in Figure 1, 73, 13 and three percentage of similar students succeeds their bachelor in respectively 3, 4 and 5 years. Eleven percent of the students do not obtain the bachelor degree.

Because students tend to make an unrealistic planning with too many credits each year, the SA can use the last two columns to convince students to take up a realistic amount of credits.

5 USER STUDY DESIGN

In September 2017, the dashboard was deployed in ten different programs, but in our research we focused on conversations between an engineering student and a SA.

The typical setting is that the student and SA are both on opposing sides of a table, with a monitor displaying the dashboard in between. At the end of every meeting, student anonymously complete a questionnaire with 14 questions to gauge the experience and perception of the dashboard. The questionnaire questions were adopted from work of Charleer et al. [4] and from Scheffel et al. [7]. In addition, we observed 20 out of the 224 conversations. During these observations, timed notes were registered when the dashboard was a catalyst for the dialogue and to register when an insight was triggered.

During the conversation the dashboard triggers questions and statements by the SA and by the student. We categorise these statements in three different levels as defined by [5]: factual insight (L1), interpretative insight (L2), and reflective insight (L3). A **factual insight** is defined as a description of data already available at the dashboard: *"I had a seven on Mechanics"*, *"I failed two courses"*, *"I succeeded 42 credits."*

An **interpretative insight** is defined by Claes & Van de Moere as the synthesis of data. In the context of our research, statements in these category can be: *"I improved over the year"*, *"I did better in the re-sits than in June"*, *"My study efficiency has increased over the semesters"*.

The last category of insights are **reflective insights**. These insights are similar to the interpretative insights, but they contain some subjective or emotional connotation: *"I failed that exam, but I studied not hard enough"*, *"I failed a lot of courses in June because my girlfriend broke up"*.

Table 1: Percentage of time dashboard is catalyst

	Group 1	Group 2	Group 3
Catalyst	0.58	0.43	0.43

Table 2: Insights for each category of students

	Nb	Total	IPM	L1	L2	L3
Group 1	6	13.8	0.50	4.67	3.33	5.83
Group 2	10	10.1	0.42	3.9	3	3.2
Group 3	3	3.67	0.27	0.33	1.33	2

6 RESULTS AND DISCUSSION

6.1 Categorisation of the students

While observing the dialogues between the student and the SA, we noticed that all students are scheduling an appointment with one big question in mind. Based on this question, we categorised the students in three different groups: Students doubting to continue the program (group 1), students doubting which courses to take next year (group 2), and students doubting to deliberate a course (group 3).

Because students wanting feedback on a specific exam usually go to the instructor of the course and not to the SA, we do not report on these students. In our research one such student was observed.

6.2 Results

In Table 1 and Table 2, the results of the observed sessions are shown. Table 1 shows for each group the average percentage of time the dashboard is a catalyst for the dialogue. Table 2 lists for each group how many students we observed (Nb), the average number of insights during a session (total), the number of insights per minute (IPM) and the average number of of factual insights (L1), interpretative insights (L2), and reflective insights (L3).

The distribution of the insights over the time of the session is shown in 3. The sessions are normalised over time. Insights of L1, L2, and L3 are indicated in the figure with -, +, and !. The background colour indicates the group of the student. Student sessions of group 1, 2 and 3 are represented respectively with orange, green and red.

After each meeting, students were asked to fill in a questionnaire. Figure 4 shows for each question the results of the questionnaire. They could answer each question on a 5-points Likert scale going from *"Strongly disagree"* to *"Strongly agree"*. In this figure can be seen that in general students are responding very positive to the dashboard.

6.3 Discussion

As can be observed in Table 2, the number of insights in total, the insights per minute, and the number of insights for each group is higher for students doubting to continue the program (group 1) than for the other two categories. Students doubting if they want to deliberate one or more courses (group 3) have the lowest number of insights, both in total as for each category. A possible explanation

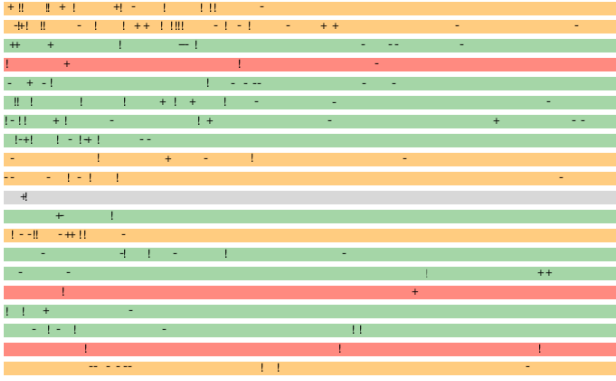


Figure 3: Insights during the observed conversations. Insights of L1, L2 and L3 are respectively indicated with -, + and !. Student sessions of group 1, 2 and 3 are represented respectively with orange, green and red.

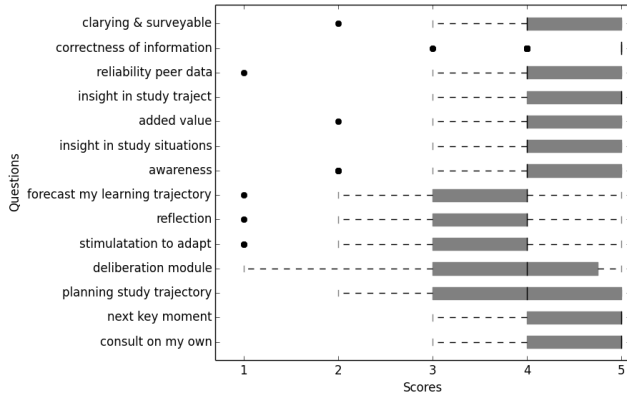


Figure 4: Results of the questionnaire, filled out by 101 students.

for this observation is that the kind of questions the SA is asking differs for each group of students.

If students are doubting to continue the program, the SA uses the dashboard to get a deep insight in their scores, their evolution over the semester, and the reason they have doubts. This results in a higher number of insights, and in a higher percentage of time the dashboard is a catalyst of the dialogue than for the other two groups.

For students doubting which courses to take next year, the SA uses the dashboard first to see which courses the student failed, which mostly results in factual insights. Then he/she looks into these courses and the reason the student failed, triggering interpretative and reflective insights. But in contrast to students doubting to continue the program, the SA usually plans the next year without the dashboard.

As can be seen in Table 1, the dashboard is used 43% of the time for both the students doubting which course they want to deliberate (group 3) and for students doubting which courses they

want to follow next year (group 2). But even though the dashboard is a catalyst for the same amount of time, the number of insights differ. In case the student wants to deliberate some course, we observed the SA uses the dashboard to get an overview of the students performance and uses the deliberate module. He/she then starts comparing a plan for the second year for the case the student deliberates the course or not, but he/she typically is not asking many questions. As a result, fewer insights are triggered.

In general, the time the dashboard is used is high in all groups, and indicates that the dashboard is supporting the dialogue between the student and the SA. SAs expect from the dashboard that it gives a personal experience and supports the dialogue. In a more personal dialogue, they expect more insights than in a dialogue with a students asking for regulation information. Table 2 shows that the dashboard meets these expectations of the SAs. For students of group 2 and 3 that are looking to regulation info, the dashboard can be modified to better support decision-making.

SAs are indicating that the dashboard should provide the most insights at the beginning of a dialogue. At the beginning of the dialogue, they are looking for the problem of the student by asking questions. This should result in triggering insights. As seen in Figure 3, the dashboard succeeds in providing these insights. This figure also confirms our observations about the story-line for the different groups of students. Similar to the observations of Charleer et al. [4], the observed dialogues are following a plot-twist-ending story-line: Understanding the problem of the student by asking questions, giving advice to the student, and informing the student about deadlines or possible next steps.

The results of the questionnaires in Figure 4 show that students are agreeing that the dashboard is clear, trustworthy, provides an added value, gives them insight in their current study situation and in their future study trajectory, and makes them aware of their learning situation. They also want to be able to consult the dashboard at home and for every key moment. Even though the dashboard was only implemented to support the dialogue, students indicate that the dashboard helps them to reflect, to adapt their situation or to forecast their future learning situation.

7 CONCLUSIONS AND FUTURE WORK

The dashboard supports the dialogue between a student and a SA. From our observations, we learned that it primarily triggers insights at the beginning of the dialogue and that the amount of triggered insights is directly proportional to the individuality of the question of the student.

Future research could compare the difference in usage of the dashboard between programs or universities, or research the impact of the dashboard on the decisions of the student.

The dashboard uses assessment data that is commonly available at every university, so it can easily be deployed at other universities as well. Although the approach is less advanced than many other learning dashboard applications that take into account a wide range of data sources, including time spent, resource use and social interactions, our results indicate that assessment data is useful to support reflective insights and decision-making. Our dashboard has been deployed at ten programs of our university. We are convinced that this insight triggering dashboard, as well as positive evaluation

outcomes, could help to promote the uptake of real-life dashboards on a university-wide or nation-wide scale.

ACKNOWLEDGEMENTS

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