Student Perception of a Learner Dashboard in MOOCs to Encourage Self-Regulated Learning

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***Abstract*—In online learning environments like Massive Open Online Courses (MOOCs), where teachers cannot provide individual support and guidance for thousands of students, self-regulated learning (SRL) is a critical metacognitive skillset for students' achievement. However, not every student intuitively self-regulates its learning and therefore technical solutions can help to apply SRL strategies. Learner dashboards with visualizations about the learner's progress and behavior are able to create awareness, encourage self-reflection, and perhaps motivate students to plan and adjust their learning behavior to achieve their learning objectives. Hence, such Learning Analytics tools can support the SRL strategies self-evaluation and strategic planning. To examine this potential, a learner dashboard was integrated into the HPI MOOC platform. This work presents the design process, the concept, and an evaluation of the first dashboard iteration. The perceived usefulness and usability are investigated, and in addition, the question will be considered whether the dashboard encourages students to apply self-regulated learning. The positive results pave the way for future research and a next iteration of the learner dashboard.**

Keywords—Learning Analytics, Learner Dashboard, MOOCs, Self-Regulated Learning, Technology-Enhanced Learning

I. Introduction

Students in Massive Open Online Courses (MOOCs) must continuously plan, evaluate, and adapt their learning behavior by themselves to successfully participate in a course and achieve their learning objective since no human teacher can provide individual guidance and support for thousands of learners. This metacognitive skillset is defined as self-regulated learning (SRL) in the domains of education and psychology and it provides several strategies which can be applied by students [1], [2], [3]. However, not every student has these metacognitive skills to reflect the own learning behavior and adjust the own actions. Therefore, technical support for SRL in online learning environments is desired but currently rare [4].

The research field of Learning Analytics (LA) provides methodologies to understand and improve the learning behavior of students based on their generated learning data [5]. There are two main approaches to utilize LA [6]: (1) tools that provide automated recommendations and interventions, and (2) tools which report the data directly for different stakeholders to support their decision making with data-driven insights. The latter is often realized with dashboards to visualize data about the learner, its process, and context [7] to help them to reflect and evaluate their learning behavior and outcome [8]. Therefore, learner dashboards are a suitable tool to support and encourage the SRL strategies self-evaluation and strategic planning. To explore this potential benefit for students, this work presents the design and evaluation of a learner dashboard for the HPI MOOC platform. Thereby, the following research questions are studied:

Research Question 1 Is the learner dashboard perceived as useful by students?

Research Question 2 Does the learner dashboard support students in applying self-regulated learning?

First, the pedagogical rationale is explained in Section II to investigate these questions. Afterward, related work is studied in Section III. Based on the findings of these two sections, Section IV outlines the design process and concept of the implemented learner dashboard. A survey-based evaluation is presented in Section V. At last, Section VI concludes the paper.

II. Pedagogical Rationale

This section gives an overview of the pedagogical value of self-regulated learning and the derived strategies for students of strategic planning and self-evaluation, which form the theoretical basis for this work.

A. Self-Regulated Learning

Many definitions of SRL exist while the elaborations of Pintrich [1] and Zimmerman [3] are the most common. They describe learning as a proactive and constructive process, whereby learners participate through goal setting, progress monitoring, and correcting their learning behavior and actions. It refers to the learners' ability to actively and autonomously take control of their learning process, as defined by educational and cognitive psychologists [1], [3]. Also, SRL is an important factor for students' achievement in online learning [9] and especially in environments with little support and guidance like MOOCs [10], [11]. It is a skillset that can be learned and improved with experience and practice [12]. However, technical support for SRL strategies in online learning environments is rare. This is where this work starts with a focus on strategic planning and especially on self-evaluation.

B. Strategic Planning

Strategic planning addresses aspects of selecting proper tasks and how to approach them to eventually achieve a specific goal. For example, learners have to determine the order and timing of activities and select strategies for completing tasks, for instance the procedure and effort invested [1], [3]. Consequently, as part of strategic planning, time and effort management are important strategies.

C. Self-Evaluation

Self-evaluation requires to set criteria and quality standards against which the learning performance can be assessed, potentially with respect to defined learning objectives [1], [13], [14]. It further implies to monitor the learning progress and outcomes. This enables students to draw conclusions about their learning process and eventually improve their applied learning strategies.

III. Related Work

Since there is a massive number of students, personal support by course instructors is not feasible in large-scale learning environments like MOOCs. For monitoring and evaluating learning progress, dashboards are a common practice. They provide a possibility to gain valuable insights into learning behavior and outcomes [15]. However, dashboards in MOOCs so far have been mainly provided for course instructors [16], [17]. Most MOOC platforms therefore still only provide rather general feedback to the students. As an example, for the use of feedback systems in MOOCs, Davis et al. [18] created a widget for the edX MOOC platform which facilitates social comparison with peer learners with the goal of increasing course completion. They found that the feedback system improves course completion rates, but the benefit of such feedback is limited to highly educated learners. Further, a dashboard for the FutureLearn platform was introduced, which displays demographic information as well as information about a student's learning network, progress, and performance [19]. Beyond full-sized dashboards, the use of smaller widgets throughout the course to provide instant feedback to learners was suggested by several authors [20].

A learning dashboard can be defined as "a single display that aggregates different indicators about learner(s), learning process(es) and/or learning context(s) into one or multiple visualizations" [7]. According to Verbert [21], effective dashboards are characterized by (1) creating awareness, (2) triggering self-reflection, (3) allowing learners to make sense of the data, and (4) eventually having an impact, i.e., a change in the learning behavior. To move beyond the awareness step, educational concepts should be the foundation of dashboard design [22]. In order to effectively enable students to make use of dashboards throughout their entire learning process and not just during the actual learning phase, a dashboard should be adequately integrated into the overall learning design [8]. Jivet et al. [20] further define the following requirements: First, different competences, such as metacognitive, cognitive, emotional, behavioral, or self-regulative competences can be addressed. While most existing dashboards primarily support students on a metacognitive level, only a few consider cognitive and emotional aspects. To adequately support learners, different levels should be approached. Secondly, the information displayed should be selected deliberately and consider research from the educational sciences. In particular, comparison with peers, which is often intended to motivate students, was found not to be perceived positively by all participants and to even cause contradicting effects [18], [20]. Instead, other reference frames, such as the performance or the attainment of goals, should be preferred to motivate students.

Several learning dashboards and visualization approaches exist in general with each focusing on different aspects of the learning process [7], [23]. From the experiences of designing these dashboards, guidelines and best practices were suggested, such as to particularly outline the learning path to make students aware of how the invested effort translates into outcomes [8]. Last, different evaluation criteria and frameworks for learning dashboards have been proposed, which can guide their design [24], [25].

IV. Design Process and Dashboard Concept

To enable self-evaluation, it is crucial to provide students with a visualization of their learning progress, performance, and information about the learning behavior. With this feedback, they can make informed decisions to adapt the personal learning strategies and eventually improve the learning outcome. The currently available progress page of the HPI MOOC platform offers a good starting point to evaluate one's current status with regard to course achievement but is not suited for providing more profound insights into the learning process. For this reason, the platform is extended with a new learner-facing dashboard as the primary feedback tool.

A. Status Quo

In the HPI MOOC platform, students can already track their learning progress on the progress page of each course, which is shown in Fig. 1. It allows to keep track of the overall progression, to get a quick overview of the total achieved points due to the visualization with progress bars, and to identify not visited items. However, the degree to which an individual learning item has been completed is not visible and the items have to be opened consecutively to identify weak points. Further, with a course lasting several weeks and each week containing multiple items, the page easily gets fraught. The most relevant information, which is the percentage of visited items and the achieved score for the entire course, then often is not visible at a glance since the dashboard does not fit the screen. Apart from that, there is no further information available that supports students to regulate their learning.

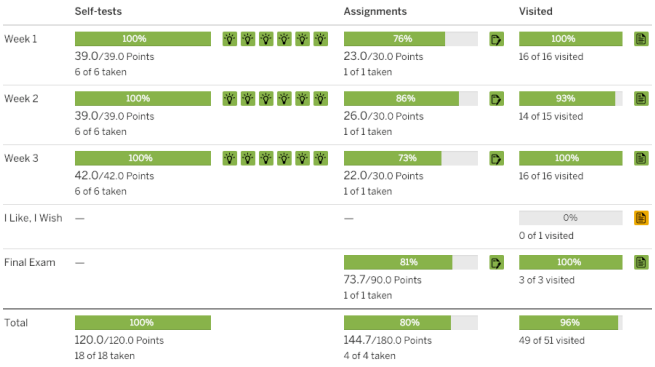

Fig. 1. Screenshot of the existing progress page of the HPI MOOC platform for a sample course.

B. Design Requirements and Challenges

Next to the best practices identified from related work, different requirements respectively challenges have to be considered for the design of the new dashboard: First, the provided information and visualizations must be applicable to all courses and not just to specific courses. Second, a previous study [26] introduced personalized learning objectives for the HPI MOOC platform to support goal-setting as an SRL strategy. Learning objectives can be defined by instructors and support course completion, course sub-topics, and course exploration. Since selecting an objective is optional for students, the learner dashboard should function similarly and add value regardless of a selected objective. Besides, the students should be motivated to accomplish their learning objective and, at best, to exceed their initial intentions. Fourth, due to the weekly release of content on this platform and the often-incomplete learning material at course start, mainly information about the past can be provided. Nevertheless, the dashboard should include forward-directed visualizations and recommendations. As the students of the HPI MOOC platform are used to the current progress overview, the former information should also be available in the new learner dashboard. Last, the dashboard concept must account for an efficient way to retrieve the required data since the learners'

data is distributed across different services due to the platform's service-oriented architecture [27].

C. Design Process

To identify desired features and presumably valuable information, metrics, and visualizations to be incorporated in the new dashboard, an ideation session was conducted. It allowed receiving input primarily targeting the learner's perspective. Seven experts of the HPI MOOC platform team, including teaching team members, researchers, developers, and platform owners, participated. All of them are in close contact with students on a daily basis or learners of the HPI MOOC platform themselves. After a brainstorming session, the resulting ideas were presented to the group, discussed to clarify questions, and clustered. Subsequently, they were rated by all participants with regard to the perceived usefulness. In the following, the six categories that emerged are summarized and sample ideas are presented.

1) Progress Overview: These ideas focus on providing a better progress overview by collapsing or aggregating less relevant information and information on already completed parts of the course in the dashboard. In contrast to the current basic progress overview, it must become clearer what learning material has not yet been finished or fully understood. Similarly, the overall progress for the course should be more prominent, e.g., visible at a glance with a one-color indicator. The dashboard should also enable learners to filter for items being part of their selected objective.

2) Invested Time vs Outcome: Making use of the time effort estimation, the dashboard should allow comparing the estimated time to the actually invested time, and the aspect of learning efficiency (versus learning performance) could be introduced. For example, the invested effort over the week can be visualized and linked to the learning outcomes, e.g., the achievement of objectives. The given information could also emphasize the most successful learning times.

3) Time Needed for Attainment: While the previous category focuses on the time spent on past learning activities, further ideas target the display of the required time for upcoming tasks, for example completing the remaining course material.

4) Performance Evaluation: As for both the completion of the course and achievement of more fine-granular objectives the acquired knowledge can be assessed with exercises, for example quizzes, a focus should be on visualizing aspects of the learners' performance. Not only the graded assignments but also the self-tests – as a preparation for the exams – could be addressed and compared using various reference frames.

5) Compare Yourself: Additionally, opportunities for social comparison were indicated. This includes the comparison to the course average and students who selected the same objective. It could target the overall course performance, quiz performance, or further aspects, for instance sociodemographic characteristics. Also, objectives or material completed by successful peers could be recommended.

6) Actions: All ideas have in common that the student should be motivated to take action. For example, learners could be encouraged to repeat self-tests, to use the recap mode, or be referred to specific learning content. Besides, discussions in the forum could be fostered by providing students with their forum usage statistics or suggesting threads of the forum that might be relevant. Concerning time management and strategic planning, the next deadlines or steps to complete the course or an objective might be valuable information.

D. Design Concept

Instead of extending the existing progress page with additional metrics, a new learner dashboard is conceptualized and built to fully integrate the concept of learning objectives and address existing weaknesses of the former progress overview. Therefore, findings of the related work, the identified requirements, and the design ideas presented in the previous section are considered. However, to entirely integrate feedback for students into their learning process, different widgets could be provided throughout the course to relate the learners' activities to the chosen objective and provide instant feedback upon completing activities. In this work, we limit the scope to the new dashboard on a separate page as this currently is the most crucial point for providing feedback to students in the HPI MOOC platform. The different components of the new dashboard, which address several competences and aspects of learning, are described hereafter. They are grouped by its intended purpose, namely progress monitoring and evaluation, a course cockpit displaying more general course-related information, the analysis of a student's performance, and the provision of learning insights. Also, the concept of utilizing empty states to make recommendations to the learners is briefly described.

1) Progress Monitoring and Evaluation: One of the most important aspects of the learner dashboard is to give an overview of the learning progress. For the general structure of the progress information, the use of a timeline-like visualization was considered first to make it a central part for navigating the course and visually outlining the learners' path through the course. However, due to the issue of limited availability of content and thus often missing material for upcoming weeks, this idea had to be discarded since only the past activities and not the prospective learning path could be depicted. For this reason, the core concept of the former progress overview, mainly visualizing the completed parts of the course, is reused and the key elements known by the learners are adopted. The revised progress overview (Component 1, abbreviated C1) is shown in Fig. 2.

Since the overall progress summary was often not visible at one sight and the students had to scroll down instead, the most relevant data is moved to the top of the page and visually distinguished from the other presented information using circular progress bars. Besides, the learning objectives are integrated into this summary as they become the main focus of learning. If no learning objective has been selected yet, a student can directly select an objective at the top of the page. Consequently, the dashboard can also support goal-setting in the forethought phase of SRL. Because the objectives for the completion and the exploration of a course do not differ from the usual course progression, in such cases only the objective details are added to raise awareness for the selected personal objective. For the objectives targeting the completion of a specific topic not all course content is relevant, and therefore two more indicators are shown: the achieved points and the percentage of items visited being part of the objective. If the material for a selected objective is finalized and the student can still achieve it, this is stated in the presented summary aiming to motivate the learner to continue with the course and

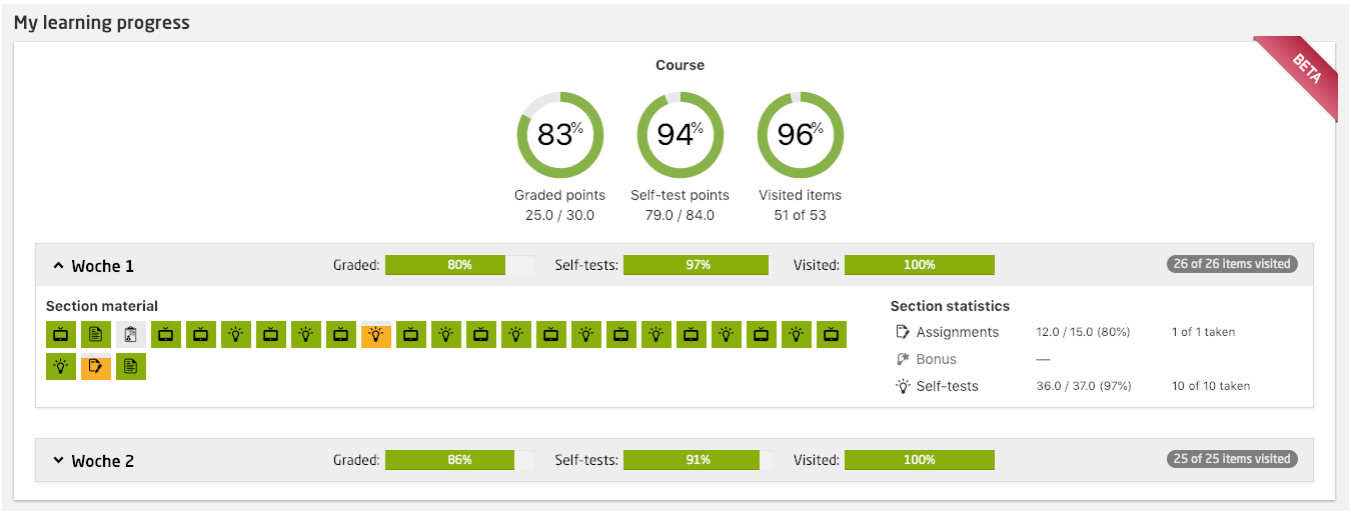

Fig. 2. Screenshot of the new progress overview (C1) on the learner dashboard.

actively work towards the achievement of the objective. To reduce the amount of information presented, the most critical performance indicators for each section are aggregated. Progress bars indicate the percentage of completed material and the achieved points for graded respectively ungraded exercises. This is complemented with the time effort information in terms of the remaining time to complete the material of a section to enable planning activities.

In contrast to the previous progress overview, the details for a section, for example the visited learning items, are not visible by default, which reduces the space for each section. With that, the progress typically does not exceed the screen size, and it is possible to skim the progress for each section. If desired, students can explore more detailed information by expanding the section details. The contained learning material (items visualized as rectangles) for each section is presented similar to the basic progress overview. It is complemented with the time effort estimation and the visualization of the percentage of completion for each item. This introduces different states distinguishing visited and completed content. The degree to which an item has been accomplished is indicated graphically facilitating students to identify items they might want to review. To offer navigation support, links are provided to directly guide students to the respective content and allowing them to take immediate action. Last, to integrate the learning objectives, the material relevant to the selected objective can be highlighted. It is shown next to the regular material to enable learners to identify the position of the learning content within the course structure (as some students may deliberately skip specific items) and to allow the exploration of additional, possibly interesting learning material. This part primarily targets the metacognitive level by raising awareness and allowing to monitor the progress. Further, it addresses the cognitive level as it aims to support goal achievement and performance improvement [20].

2) Course Cockpit: The course cockpit, shown in Fig. 3, provides an overview of aspects related to time management and the learners' participation in forum activities. First, the time needed to complete the course (C2) is visualized, which aims to facilitate time management and strategic planning. Additionally, relevant course dates (C3) are shown to raise the learners' awareness of upcoming course events. These primarily include submission deadlines and the release of new learning content. When contributing to the forum by asking or answering questions, a student more deeply engages with the content and reviews different aspects of a topic. To motivate learners to actively participate in discussions, their forum activity for the course (C4) is stated, and it is recommended to use the forum. Consequently, the focus is on metacognitive and on behavioral skills (for example motivate learners to explore the forum).

3) Performance Evaluation: The third part of the dashboard addresses the learners' performance in quizzes and other exercises as shown in Fig. 4. To support reflection on their learning habits in terms of the exercises approached and to motivate them to complete both the self-tests and the assignments, the performance with regard to these types of exercises is contrasted (C5). In addition to the overall statistics, the self-test exercises with the lowest achieved score are suggested for repetition (C6) to the learner as these may be possible weak spots. Links are provided so that the student can directly start working on the self-tests or ask questions in the forum. Also, the recap mode, which allows learners to repeat the questions in an index card manner, is suggested since this is a feature often not discovered. Besides, a diagram visualizes the accumulated achieved points compared to the maximum possible points of attempted quizzes (C7) to provide feedback on the historical development of the student's performance. Two more metrics

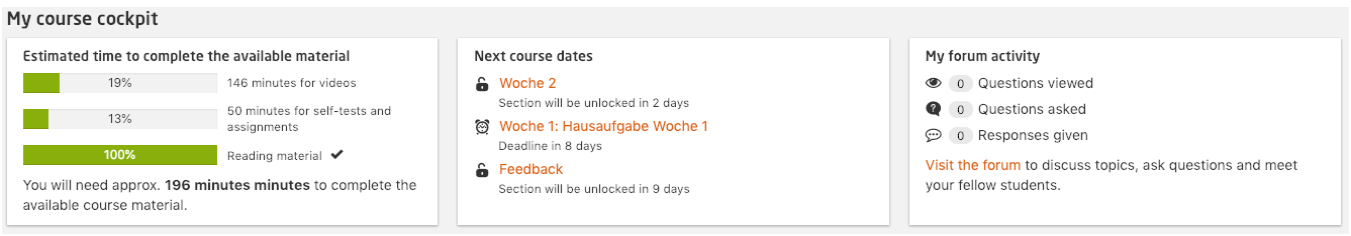

Fig. 3. Screenshot of the course cockpit on the learner dashboard. It includes the estimated time for course material (C2; left), next course dates (C3; middle), and the students' forum activity (C4; right).

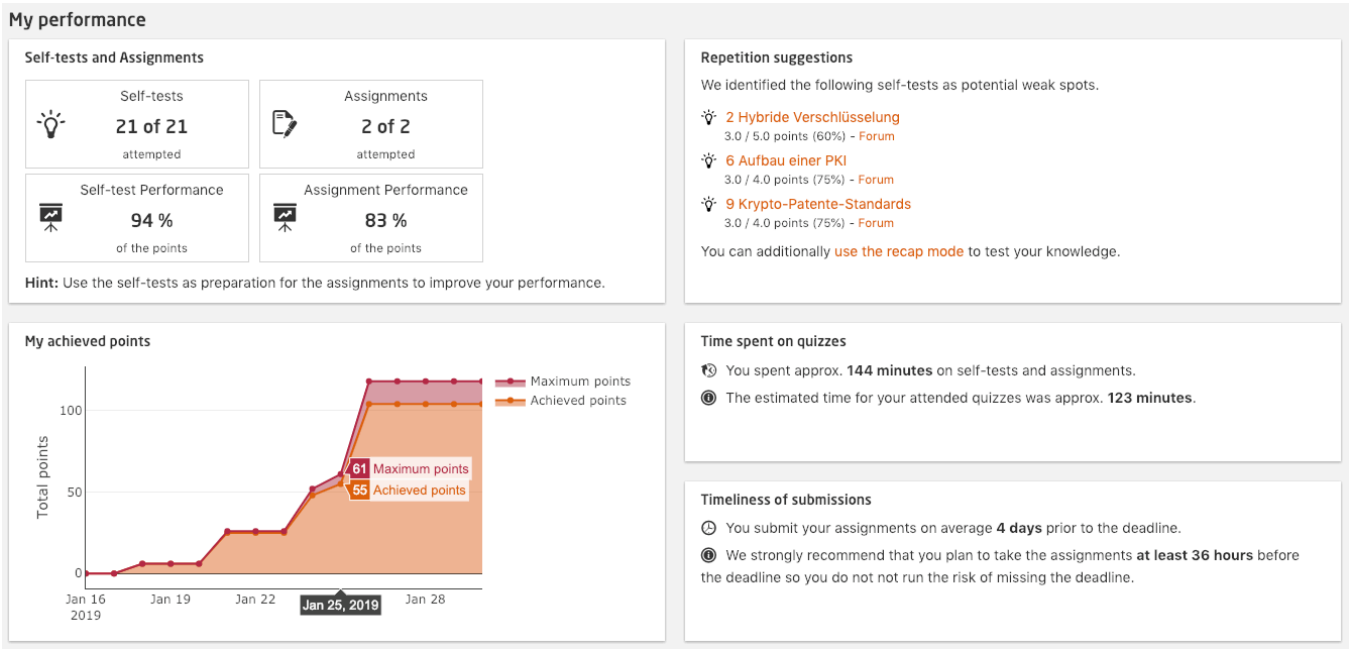

Fig. 4. Screenshot of the performance information provided on the learner dashboard. It includes information on the self-test and assignment performance (C5; top left), repetition suggestions (C6; top right), the achieved points over time (C7; bottom left), the time spent on quizzes (C8; center right), and the timeliness of submissions (C9; bottom right).

target the learning strategy in terms of time management and strategic planning skills. The time spent on quizzes (C8) is compared to the estimated time for the attempted quizzes (self-tests and assignments), which is calculated based on a time effort estimation. With that, students can determine if the time spent on these exercises relates to the learning outcome. If there is a discrepancy, a student might need to better prepare for the quizzes or adapt the applied strategies for learning. Last, the aspect of planning the learning sessions is stressed by showing the timeliness of the submissions (C9) with respect to the submission deadline. When a learner actively plans to work on assignments a certain period before the submission deadline, the risk of missing it due to unexpected personal schedule changes is reduced.

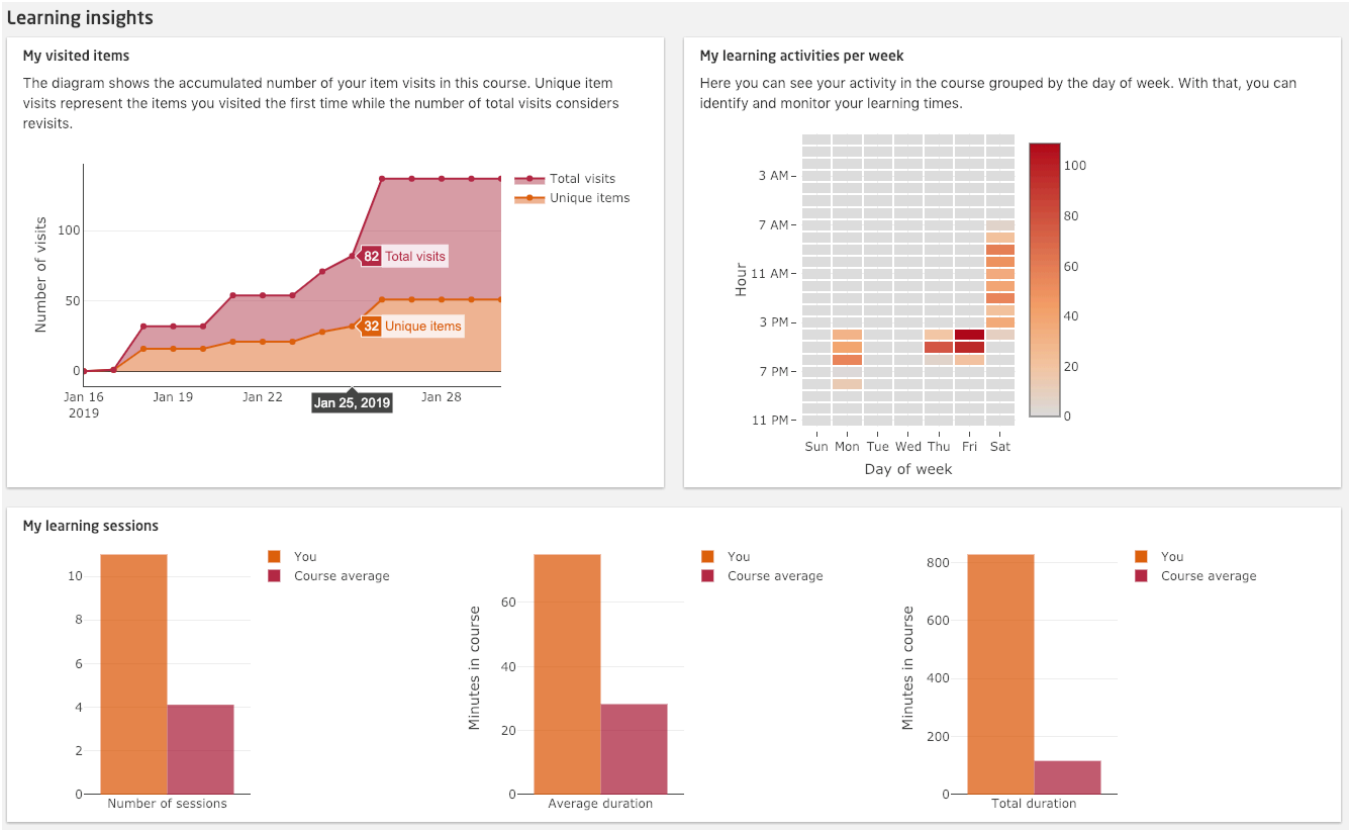

Fig. 5. Screenshot of the learning insights provided on the learner dashboard. These include a visualization of the visited items over time (C10; top left), the learning activity (C11; top right), and session statistics (C12; bottom).

4) Learning Insights: The last section provides students with further insights into their learning (Fig. 5). It is meant to help them to analyze and improve their learning process. First, a diagram visualizes a student's activity in terms of items visited over time (C10) to stress the invested efforts towards the attainment of personal goals. While one curve indicates the unique items visited, another curve displays the total number of item visits. Such visualizations of progress over time are still rare in MOOCs [23]. However, they can help students to identify peaks or patterns of learning time and productivity. A similar approach is offered by the heat map giving an overview of a student's overall course activity distributed over the days of a week (C11). Potential effective learning times can be identified, and the information can be used to allocate times for learning. Last, the students' number of learning sessions respectively average and total session lengths are depicted and compared to the course average (C12). For the other parts of the dashboard, we deliberately avoid comparison with peers as it can have a demotivating influence on learners [20]. The comparison of session time, however, is not critical since students who invest less time can successfully achieve their own goals, too.

Like for the former progress page, the option to change the objective is added. In addition to the described components, several other metrics might be valuable as well. However, since the dashboard already contains a notable amount of information in this first version, the number of metrics has been limited to the presented ones. Too much information at once might overwhelm students and thus rather discourage than support them. After evaluating the effect of the presented information, the dashboard can be extended in subsequent iterations. A focus could be on utilizing the dashboard as a learning assistant for the selected objective by providing proper recommendations to the learner fostering the achievement of the objective.

5) Empty States: To receive feedback on the submission timeliness or the time spent on quizzes, a learner must have submitted an assignment or self-test. Moreover, self-tests can be only suggested for repetition if the learner has not performed well in at least one quiz. Until then, no data is available, and thus the view for a dashboard component is empty. A concept applied for the new learner dashboard is the active use of these empty states to encourage learners to reflect and, if necessary, improve their learning strategies. Therefore, hints for learning, motivational statements, or links to tools that might be useful for the learner are provided until data is available for a component. This approach could motivate learners to persist and take action to improve their learning success. The empty state of the repetition suggestions component (C8), i.e., when no suggestions can be made for a learner, is shown in Fig. 6.

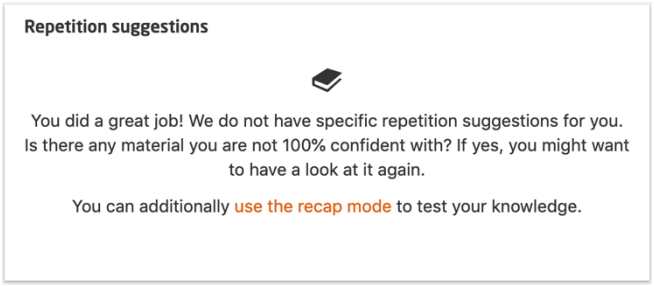

Fig. 6. Screenshot of the empty state information displayed for the repetition suggestions component (C8).

V. Evaluation

To assess the perceived usefulness of the new dashboard, a survey was carried out. It aimed to better understand which aspects of the dashboard are particularly valuable for the learners and if it can support the students in applying SRL strategies. The evaluation of the survey elaborates and answers both Research Questions 1 and 2.

A. Methodology

For this, the agreement with given statements had to be rated on the basis of a five-point Likert scale. First, six statements targeted the perceived usability and usefulness of the new learner dashboard in general. Subsequently, the students' application of SRL strategies was covered with eight statements, while additional questions examined the usefulness of the individual components of the dashboard. The students' perception of the components is evaluated as follows: the answer possibilities of the Likert scale are associated with a weight ranging from −2 for strongly disagree to +2 for strongly agree. Based on the participants' answers, the mean is calculated, resulting in a final rating where +2 is the maximum possible score. From this, a ranking of the components is created. Beyond these first three parts of the survey, two questions following the "I like, I wish" method aimed to encourage open feedback. The survey was sent to students who took part in a course on *Data Security on the Internet* on the HPI MOOC platform. Since the survey was sent after the end of the course, the results are influenced by a certain survivorship bias of the students. In total 217 learners completed the survey.

B. Analysis and Discussion

Three aspects are evaluated with the survey. First, the perceived usefulness and usability is elaborated. Second, the students' self-reported application of SRL strategies is analyzed. Third, the different components of the dashboard are ranked according to their value to learners. To start with, both the usability and usefulness of the dashboard are perceived remarkably well by the participants. Notably, the vast majority agrees or strongly agrees that it is easy to use (94.92%) and quickly apparent how it is operated (88.48%). It is considered as extremely useful by 79.26% of the learners (Research Question 1). Further, they agree that it is right for their goals (86.45%).

Concerning the pedagogical dimensions, i.e., the students' engagement in SRL strategies, first the self-evaluation capabilities were analyzed. For almost all learners, the dashboard is well suited to monitor their learning progress (81.01%) and reveals interesting insights (67.75%). Further, it helps to go beyond the awareness step as it allows to reflect on the learning behavior (63.13%) and, as a third step, to adjust the behavior accordingly (37.33%). Although the latter proportion of learners is considerably smaller, this is still a good result since triggering self-improvement processes demands higher self-regulation skills. Besides, also strategic planning and the learners' motivation was covered. While 42.39% of the participants answered that the dashboard motivated them to plan their learning, it helped 43.78% of the learners to do so. Individual feedback of several students, who particularly value the course cockpit and the time estimation as it "facilitates planning", confirms this trend. Last, the new dashboard helped 43.32% and motivated 50.23% of the students to achieve their learning objective. For example, it was mentioned that the dashboard reminds one of the selected

objectives and helps to follow it continuously. Another student reported an increase in motivation to achieve the learning objective. In sum, both the evaluation of the questions targeting the students' engagement in SRL and the individual feedback show that learners can actively engage in SRL strategies with the help of the dashboard (Research Question 2). It addresses multiple competences as defined by Jivet et al. [20]. Not only the metacognitive level (through raising awareness, supporting reflection, and enabling monitoring and planning) but also cognitive competences (e.g., facilitating goal achievement) and in particular the emotional level (e.g., increase in motivation) are affected.

The learners' rating of the dashboard's components results in the ranking shown in Fig. 7. Of all components, the students particularly appreciate the progress overview (with a rating of 1.54; C1). This was expected since providing an overview of the learning progress is the most important aspect of the learner dashboard. Interestingly, it seems that the new dashboard can provide a better and clearer overview of the learning progress for many learners compared to the basic progress overview as this was repeatedly stated. For example, one learner especially valued the circular progress bars as they provide a "quick overview of the percentage of points achieved". Second, the course dates (1.33; C3), the visualization of achieved points over time (1.31; C7), and the separately presented information on the performance in self-tests and graded exercises (1.30; C5) have almost the same rating. The repetition suggestions (1.14; C6) and the time estimation for the course material (1.02; C2) follow next. Fourth, the submission timeliness (0.87; C9), the visualization of the visited items over time (0.86; C10), and the time spent on quizzes (0.86; C8) have a decent rating as well. The items rated lowest by the participants are the heat map for the learning activities (0.65; C11), the session statistics (0.59; C12), and the forum activity overview (0.51; C4). From this ranking, future development directions and improvement possibilities for the dashboard can be derived. However, the components' value for the learners should be further examined first with additional interviews since this general ranking cannot adequately reflect the potential benefits of a component with regard to specific learning behavior. Future adaptions of the dashboard and its components should also be analyzed utilizing LA evaluation tools proposed in related work [24]. To summarize their overall satisfaction with the new dashboard, the students had to rate it with one up to five stars. 87.10% of the participants awarded four or five stars, while the average rating is 4.28 with a standard deviation of 0.89. This shows a high overall appreciation of the new dashboard by the learners.

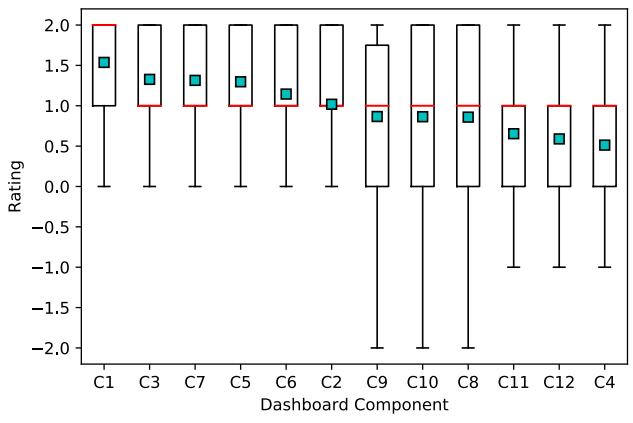

Fig. 7. Box plot diagram of the rating of the dashboard's components. The red lines are the median values, the blue squares show the mean values.

Besides, qualitative feedback has been received. The following tendencies can be identified: in general, the learners value the new visualizations of the dashboard as they provide valuable insights. Further, the participants like its overall (visual) design. Regarding the components, specifically the progress overview and the course cockpit were mentioned as being useful. These components support planning activities and can be used to navigate the course. Last, participants stressed their satisfaction with the choice of information provided and liked the clear presentation of the data resulting in a good overview. The latter aspect, however, was perceived ambivalently since several learners also mentioned that the dashboard was overloaded and difficult to comprehend. Mostly, they ask for better explanations for the visualizations presented. Learners further suggested introducing configuration options. This could benefit students who are overwhelmed by the amount of information.

To summarize this section, it can be affirmed that the dashboard is considered useful and perceived remarkably well by almost all participants of the survey. Moreover, the new dashboard supports students in applying SRL strategies and thus can positively influence their learning process. It helps to plan learning activities, enables monitoring and self-evaluation, and additionally promotes the adjustment of learning behavior. In particular, the motivational impact is reported by the learners.

VI. Conclusion

This paper introduced the design process and concept of a learner dashboard for the HPI MOOC platform to encourage self-regulated learning and in particular the strategies self-evaluation and strategic planning. This can help students to better achieve their desired learning outcome since SRL has been identified as an important topic in educational psychology because of its positive influence on learners' achievement, especially in online learning environments like MOOCs with little support and guidance. The dashboard provides a general progress overview and insights about the estimated time for course material, the next course dates, the students' forum activity, the quiz performance, repetition suggestions, the achieved points over time, the time spent on quizzes, the timeliness of submissions, the visited items over time, the learning activity, and session statistics.

Afterward, the first iteration of the learner dashboard was evaluated with a survey. In general, the usability and usefulness are perceived very well by the majority of students (Research Question 1). Also, it helps students to monitor, reflect, and adjust their learning behavior based on the displayed insights. The dashboard also motivated students to plan their learning. Thus, it can be summarized that the learner dashboard supports and engages students to apply SRL strategies (Research Question 2). The most valued components were the progress overview, the course dates, the achieved points over time, the quiz performance, and repetition suggestions. However, improvements were suggested, for example, more explanations for the displayed visualizations and configuration options to reduce the amount of visible information. These suggestions will be implemented in the next iteration of the dashboard. It is also planned to enhance the next evaluation with a larger A/B test in multiple courses to examine the learning data next to self-reported data.

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