Reconfigering Teachers´ Work Through Automated Evaluation

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***Abstract* – Over the past years, the potential benefits and risks of educational technologies (EdTech) in schools have been increasingly debated. At the same time, research has only started to develop a more nuanced understanding of the *manifold pedagogical effects* of these technologies in school and classroom practice. Within the broader context of the dtec.bw project SMASCH (Smart Schools), which aims at supporting schools in their digital transformation, this chapter focuses on concrete manifestations and effects of automated evaluation practices on teachers´ work. More specifically, the study analysed the screen recordings of ten digital tests from the moment of their creation to their archiving and is equally based on interviews with teachers about their evaluative practices. The findings of the study indicate different and ambivalent processes that reconfigure the relations between teachers and technology, which we exemplify using two cases – when teachers make digital tests for later automation, and when teachers supervise the machine´s actual grading and feedback provision practices. Our findings not only offer important conclusions regarding how automated evaluation can, and should, be more strongly framed in a pedagogical manner, but they can also inform the need for a careful response to the more recent rise of GenAI technologies.**

Keywords - Digitization of schools, teachers´ work, automated evaluation practices, grading, SMASCH (Smart Schools)

I. FRAMING THE RESEARCH: THE SMASCH PROJECT

The project SMASCH (Smart Schools) was initiated in the beginning of 2021 as part of the *Centre for Digitization and Technology Research* (dtec.bw). The aim of the project, which brings together research from education science, sociology, and organizational studies, is to support schools in their digital transformation. The project hereby seeks to overcome a technological focus on digitization (e.g. bringing tablets into schools), but instead approaches school transformation from a 'culture of digitality'-perspective [1]. This means that schools are supported in critically dealing with, and creatively responding to, wider socio-technical transformations of society in relation to their specific local context and organizational culture (see also [2]). A key part of the project and its aim to experimentally integrate digital technologies is thereforethe discussion, visualisation and transformation of organisational culture. From a research perspective, an interest in the overall organisational dynamics caused by digitization is hereby brought together with the critical investigation of EdTech design (see also [3]).

As the literature clearly shows, EdTech enactments and their ambiguous effects oftentimes stand in (sharp) contrast to hopes that are commonly associated with the technologization of education, including the enhancement of educational equality, the personalization of education, or increased accessibility to knowledge [4]. For instance, structural limitations of schools (outdated ICT infrastructures, insufficient funding, lack of time or skills to adapt products) has regularly led to a rather unreflecting EdTech usage (see also [5]). Schools have, in that regard, commonly used EdTech products that are free of charge and easily usable, but, at a closer glance, neither safe nor pedagogically sound [6], [7], [8]. Moreover, the relative absence of qualitative evidence on the efficacy and/or performativity of EdTech applications has made it increasingly hard for schools to know which EdTech products to procure [9]. Lastly, the literature clearly shows that digitization, if it is to be successfully implemented in schools, needs to be systematically tied to a comprehensive view on school leadership and school culture [10]. That is to say, when considered through a school development lens, the literature clearly shows the advantage and necessity of adopting a *whole school approach* towards digitization, instead of giving this responsibility into the hands of specific singular actors – such as ICT coordinators or principals – alone [11].

In line with this argumentation, the SMASCH project has been working with 13 schools in Germany (Hamburg) and Belgium (Flanders) over the past four years, including both primary and secondary schools, schools with diverging socioeconomic status backgrounds and locations (rural, suburban, urban), as well as different scope of experience regarding the implementation of digital technologies. Despite these differences, the focus shift from digitization as (fast) instrumental implementation and (easy) usability of technologies towards more experimental forms of digitization as ongoing and conscious reflection of school culture, values and practices, formed unfamiliar territory for most schools. Consequently, the project aimed at providing extensive support for the schools, which in both countries included co-design research and different forms of events, and – in the case of Hamburg – additional support from school development coaches, IT experts and media educators.

In fact, since the initiation of the project, the schools have not only changed significantly with regards to how they approach digitization in relation to their organisational culture, but they equally identified different transformation areas that

appeared most suitable to address their specific local needs (see for an overview [2]). The research (and wider support) team, consequently, focused in a locally specific manner on these areas, and co-designed different scenarios of experimentation together with the schools. These areas range from the (re)design of classrooms or school buildings, over the (re)design of learning management systems [12] or new apps, topic-related multimodal project weeks (e.g. a VR-supported project week around bees), to the more specific socio-technical (re)design and reflection of individual pedagogical contexts. Hereby, the research in SMASCH always integrated perspectives on governance (e.g. digitization policies) [13]. In doing so, different studies in SMASCH show how Edtech always carries pedagogical conceptions and ideas with it that are 'baked' into how applications (e.g. learning management systems) are designed, and that influences the schools´ 'world-making' and pedagogical decision-making in multiple ways [14], [15].

In what follows, we illuminate one of the many studies conducted in SMASCH over the past years, which is situated in the broader context of how teachers´ pedagogical practices and decision-making become reconfigured through platformization: automated evaluation.

II. Automated evaluation as multifaceted socio-technical practices

When digital evaluation is implemented in schools, automation most visibly manifests itself, and is being discussed, in relation to *grading*. This is especially so since grading practices have commonly been considered as one of the most labour-intensive and repetitive tasks for teachers. In this respect, EdTech promoters oftentimes argue that automation of grading can liberate teachers from this time-consuming task, so that they can concentrate on educationally more valuable activities [16]. In addition to time-efficiency, automated grading is commonly associated with the enhancement of fairness and consistency in relation to the subjective practices of humans [17].

At the same time, automated grading is always related to, and affected by, broader practices of (digital) evaluation. This means that grading in a school context is always embedded within broader "constellations of valuation" [15] that is, understandings of what is of (which) value when judging educational performance against the background of students´ individual situatedness. Shifting the form of evaluation (and grading as a key component of evaluation) into a digital form, thus, plays an important role in transforming (or reproducing) such understandings.

In close relation to the former point, automated grading and evaluation are commonly embedded within the broader environment of online learning platforms and their specific logics. In the case of the research illustrated here, the school under study used *Moodle* as their Learning Management System (LMS). As such, the features and logics according to which Moodle orders and allows certain activities (or not), substantially preconfigures automation processes around grading.

Lastly, as with other EdTech implementation contexts, digitizing and automating evaluation inevitably results in a redistribution and reconfiguration of tasks between (here) the teacher and the platform through which the automated grading is mediated. Consequently, even though these redistributions might suggest an increased efficiency in one task, such as 'faster' or 'fairer' grading, they simultaneously reorganize teachers' time and effort in other aspects of their work – as such reshuffling the time they spend on different tasks, but not necessarily freeing it up.

III. Study design

As a theme of the SMASCH project, automation of evaluation – and automated grading in particular – was brought up by one of the schools that was, at that time, implementing such automated grading for the end-of-year examination; that is, the summative assessment of students. In the study, we conducted an in-depth ethnographic investigation, tracing teachers' evaluative practices as they worked with Moodle to better understand the reconfigured socio-technical interrelations between teachers and the platform. While some teachers at that school were already using digital tests for formative assessments and keen to expand this experience to summative assessment contexts, others were more worried about how digital evaluation could impact the main summative evaluation approach of the school. For these reasons, the school decided to in the first year give teachers the choice between the digital, the paper-based, or a hybrid form of evaluation. This diversity and multimodality of different approaches towards evaluation, in turn, formed a rich and complex research basis, as multiple evaluative practices could be observed and compared.

To address the plurality of evaluative practices, we split the research into two sub studies with two different foci. In the first study, we asked ten teachers to record their screens (in case they were working digitally with the test) and fill out a diary whenever they worked on one digital test in moments of *1)* making a digital test, *2)* students taking the test, *3)* grading the test, and, ultimately, *4)* providing feedback to students. The diary was aimed to document time and place of working on a test, as well as the interruptions and the off-screen materials deployed, and activities conducted. On the one hand, these screen recordings allowed teachers to stay close to their usual work routines. On the other hand, the recordings provided detailed insights into how teachers' activities over time became redistributed whilst working with digital tests. The video recordings were afterwards annotated and were followed by a group conversation with teachers, in which we presented our analysis and further discussed, and deepened our understanding of, their practices.

In the second sub study, we interviewed ten teachers during the final examination period to focus even more explicitly on the aspect of grading. Two of the ten teachers hereby did not use digital evaluation for the summative assessment. The interviews were accompanied by ethnographic observations during the examination period. The combined methods of ethnographic presence and interviews allowed for meticulous investigation of teachers' practices, linking moments of (on-screen) grading to a broader practice of evaluation that was happening in the school at that moment [17].

IV. FINDINGS

The findings of the study can be broadly structured in two parts, both illuminating different aspects of how teachers´ work becomes reconfigured through automated evaluation and grading. While one set of findings shows how this reconfiguration happens when teachers *make tests for later automation on the platform*, the second set of findings focuses more on teachers *supervising the machine´s actual grading and feedback provision practices*.

A. *When a test becomes a data object: teachers producing tests for automation*

In order to disentangle how automation of evaluative practices (such as grading) becomes enacted, and how it impacts the work of teachers, we first scrutinized how automatable tests are being made on the Moodle platform. Analysing teachers' diaries hereby demonstrated the many implications that come with the challenge of 'datafying' test questions. This means that for tests to become automatable, teachers need to transfer individual test questions into data objects. Data objects are hereby understood as material-semiotic things that carry (relational) meanings and properties but are simultaneously bound to the material conditions in which they are being produced [18]. More specifically, in the Moodle platform, 'question data objects' must be assigned with different properties, including a visual tag indicating the *type of answers* a student can give, namely a word, a number, a text, etc. Another group of tags categorizes the *type of knowledge or competence* the question addresses, offering choices between understanding, self-reflection, analysis, etc. The data object also includes the number of times a question has been used in previous tests (if the question is completely new, that property is automatically zero), or the distribution of points (i.e. tags of grading already inscribed into the data object).

As these different examples show, the properties which teachers need to assign to questions when preparing them for automation – including significantly *pre-structuring the grading practices* – turn those questions into complex and multilayered data objects. When analysing our screen recording material, we indeed noticed that teachers dedicated an extensive amount of time to (re)tagging questions. Since (only) successfully created questions could be stored in a question pool and (re)used for future tests, the laborious work of tagging formed the precondition for test questions to move through time (e.g. being reused later) and space (e.g. being used by other teachers in other schools). Bates and colleagues (2016) denote this aspect as the *mutability of data objects*, which points to the repurposing, adaptation, and remixing of the data objects for different ends. Here, the intimate connection between teachers' data work and the mutability of questions as data objects is rendered clearly visible.

After having tagged and categorized the test question, the teachers need to add the answers to the question data object, as well as define the feedback students would receive for each answer. The following video annotation demonstrates an example of such a practice, which in this case is a teacher who is actually reusing an already existing question for her new test, for which she recodes the answers: "The question appears on the screen as a mix of codes and texts, which is due to the fact that the teacher has a specific interface view that is different from what students eventually get to see. As the question is in the editing mode, the teacher adds a sub-question: 'What is the British way of writing the date below? -31/09'. After all the tagging and categorization work, this is the first time the full text of a question appears on the screen. Responses to the questions are coded in front of the question text. The teacher searches for the formulation of the code in other questions, copies it and finally pastes and adds the correct answer for her newly added question. She then codes other possible answers to that question and attributes half points to those answers. Finally, she codes in the American style of the date as a wrong answer and adds a code which sends a feedback comment to those who wrote this response". By adding responses in form of code, the teacher again makes it possible for the question to be automatically corrected later. Moreover, in cases where answers can be written in different ways, the teacher predicts and codes *possible* answers into the platform, while equally attributing points each answer would get.

As noted above, teachers equally include templated responses – i.e. automated feedback – that students will receive immediately after the test. In doing so, however, the actual characteristic of feedback changes: while feedback in the original sense of the word is only possible after a particular student response has been given, in the automated grading case, feedback equally becomes premade and, in that sense, turns into anticipated, codable *feedforward*. For the teacher, it means that making a test not only includes creating (or adapting) automatable questions, but equally requires a reconfiguration of their own feedback practices into feedforward practices. This reshuffling simultaneously enacts a *temporal folding of making and judging the test*, condensed in the initial work of tagging and coding. This also means, however, that it is only after these time-consuming tasks that the immediacy and time-efficiency promise of automated evaluation and grading can happen. As such, the 'speed' allegedly inherent to the automatic grading mostly refers to when data objects, then, can be stored in the question pool for later reusage, and it is counterweighted by the many practices of making question data objects.

Lastly, teachers report that the intense work of data object creation strongly nudges them to reduce the number of open (not automatically gradable) questions in favour of short answers as well as multiple-choice questions. On the Moodle platform we observed, open questions cannot be fully graded automatically. The only thing teachers could do to accelerate grading of these questions, was to code in the platform the different words that they assigned as keywords to appear in the answer. These keywords, then, would be labelled correct if they were used in students' answers (see also next section). In turn, for the more sceptical teachers, it is exactly this push away from open questions that evokes them *not* to use digital evaluation altogether. As a geography teacher mentioned during the interview "If you use digital evaluation, you do it to save time, and you're mostly going to try things that the computer can correct by itself. So, I think the questions really change if you go for a full digital evaluation. You're going to automatically ask less questions in which the student needs to formulate an answer themselves from scratch, you're going to guide them much more".

In sum, we see how teachers´ grading and feedback practices are, through automation, being reshuffled and to large parts integrated into the *making of question data objects*. This does not mean, however, that teachers are afterwards passively watching the algorithmic processing. Rather, we found that teachers intensively supervise the machine during grading and feedback practices. It is this practice to which we turn next.

B. *Educating the machine: teachers supervising automated grading and feedback practices*

When it comes to the actual grading process, the Moodle interface divides questions of a test into two categories of automatically graded questions and questions that need manual grading. This way, the interface 'orders' teachers' tasks in terms of what is to be graded. For automatically gradable questions, the Moodle interface assigns question-answer-blocks with a colour coding in order to create a visual distinction between correct answers (green), partially correct answers (orange), and wrong answers (red) (see also [19]).

To begin with, all teachers of our sample unanimously reviewed all red and orange colours to make sure the system made a fair judgement. In this context, we were surprised to see how often teachers, then, *changed the judgement of the system,* for instance by unmarking spelling mistakes flagged as false answers by Moodle. In such cases of rejudging, the teachers referred to their in-depth knowledge about the students: "In this example, I gave a full point to one student, even though he wrote the wrong letter L. This is something that, for some students, I would still give a 'zero'. But with him, I made it into a 'one' point, because he is a student with another language at home, for example… and that's something that… if it's only one letter wrong and it more or less sounds the same, I still give the point". This example by the history teacher shows how the teacher's rejudging practice deliberately refrains from accuracy and objectivity, but is rather legitimized by referring to contextual, professional knowledge that the teacher has gained over time from her students, and which does not fit into the automated grading logic [20]. In turn, the next example illuminates how teachers also try to find ways to *educate the machine* about 'their way' of grading, that is, to bring more human and educational professional judgement into the system. "I can also code a lot of correct answers for example, like, [I can] code one, two, three, four, five, correct answers, and two additional answers which I grade 50% of a point. I add these right answers during the correction phase as well. Because I see that the first ten students gave a bit of a different answer than I predicted, but these answers are correct as well, I insert those answers as correct, so that the next students with same answers automatically get the point. The more the computer can do, the less I have to do".

Here, we see an interesting dynamic, namely that teachers use given students' answers that do not match the prestructured ones in order to *feed back*, yet not to the students, but to the question's data object, here by coding spelling mistakes as correct answers. On the one hand, this serves for the future use of the question in other tests; on the other hand, it educates the machine to incorporate the teachers' pedagogical ideas and their sense of professional judgement into the platform.

Related to this active correction of machine judgement, we also identified struggles about the (re)distribution of responsibility between the teacher and the platform. A math teacher expressed that "I sometimes feel a little bit guilty that I don't check every question, because I feel somehow that I should do that. I struggle between the feeling of it's a lot of work that I don't get anything out of it, and the sense of responsibility as a teacher to have to check every answer. On the one hand, I find it a lot of work to open every student's test and to look at it when it is already corrected automatically. On the other hand, I think that it's my responsibility to do that, so that's a double feeling. I feel that I am delegating my responsibility to the machine and so I am happy with the paper part [that is not automatically gradable, authors], because that's the one I really correct, and then I feel better about myself for not checking automatically graded questions once again myself".

As the quote shows, the teacher problematizes that the responsibility for the evaluation cannot be delegated to the platform. Reviewing all the partially correct and incorrect graded answers equally signifies how teachers take up the responsibility for grading according to their own pedagogical ideas and principles. Interestingly, the result is that the only part of correction that does *not* get reevaluated by the teacher is correctly marked answers. It is such correct answers that are being filtered out before the teacher's intervention comes into play. As such, even though the embeddedness of automated processes in grading students' examination suggests a distribution of responsibility from the teacher to the machine, allegedly prioritizing the automatic decisions over the professional judgement of teachers [21], we see how teachers strongly resist this prioritization by reviewing the work of the machine and by inserting their pedagogical ideas and values into it, *yet only in relation to the incorrectly marked answers*.

A last observation in the context of teacher practices during the grading process refers to those remaining open questions that teachers sometimes still put into a test, but that cannot, at least not in the used Moodle system, be graded automatically. Interestingly, we can still observe that the logic of automation affects those grading practices. More specifically, the Moodle interface allows to order answers per question, thus displaying all answers to one question on one page. The idea hereby is that teachers can scroll and comparatively grade open answers per question for all students simultaneously. While this automated reordering of answers, in the view of the teachers, appears as speeding up the grading process, the digital format simultaneously requires teachers to reconfigure how they practice grading. While in the case of paper tests, teachers commonly use spontaneous text annotations such as underlining, quick jotting down of notes in the margins, etc., they now need to laboriously insert text boxes for each response the students give. This, again, nudges teachers to use the templated, automatable feedback structure available while *making* the test, rather than the individual feedback while *correcting* the test. In other words, also in the case of open questions, the platform clearly triggers an efficiency-oriented view on feedback provision.

V. DISCUSSION AND OUTLOOK

The aim of this chapter was to provide insights into the dtec.bw project SMASCH (Smart Schools), which aim it is to approach digitization of school organisations not from a technology-centred, but rather from a more holistic (whole school approach), critical-analytical perspective. The open project design hereby facilitated to generate a broad scope of different research areas that navigate between practical problems or needs of the project schools on the one hand, and researchers´ interests on the other hand. One of these research areas has hereby emerged around matters of automated evaluation and grading.

Exemplifying this research around automated evaluation and grading in this chapter, we showed how EdTech implementation has evoked a substantial reconfiguration of teachers´ work. However, rather than diminishing teachers' workload, we argued that teachers' practices are being reshuffled in orchestration with *multiple and very specific kinds of automation* that take shape through (in our case) the Moodle platform. As a result, specific types of question-making as well as evaluative practices are favoured, whilst others are clearly discouraged. In contrast to these *substantial impacts of the technology on teachers*, the findings also clearly indicate that *teachers actively educate and influence the machine* in how to execute particular tasks [22]. In this sense, it can be argued that teacher subjectivities emerge that are not the only source of evaluation and judgement (anymore), but that (still) remain responsible for that evaluation. This, however, blurs the line between repetitive and administrative aspects of grading on the one hand, and an *educationally meaningful* practice of evaluation on the

other hand, which is based on teachers' professional judgement and sensemaking [23], [24].

We would like to conclude this chapter by reflecting on potential implications of our study with regards to the more recent upsurge of GenAI (Generative Artificial Intelligence) technologies. The recent breakthrough of applications such as ChatGPT, Google Gemini, or Microsoft Copilot, which allow to produce 'conversations' with students and teachers based on a combination of Large Language Models (LLMs) and prompting techniques, undoubtedly marks a substantial chance of educative practices, whether they take place in- or outside of schools. Over the last years, various GenAI-based applications have been adapted to, and developed further for, the education system, discursively framed by well-known promises and hopes that strongly echo the automation discourse as we have outlined in this chapter (e.g. relieving teachers´ workload, fostering personalized learning, increasing the fairness of assessment, etc.) [25]. At the same time, many critical voices have been raised that call for a careful adoption of AI in education, or even suggest abolishing it altogether [26], [27].

Against the background of our study on automated evaluation, we resonate such critical voices in the sense that 'hopes' of automation and (now) AI commonly underestimate the complex character of educational practices, which change through, and simultaneously resist, technology in multiple ways. This multidimensionality can only be understood by carefully disentangling the specific moments, processes or dimensions of automation (e.g. task making, task reusage, grading, etc.). Impacts of these changes and resistances are hereby neither good nor bad as such, but rather always carry with them positive *and* negative impacts [28]. In other words, the better we understand these manifold reconfigurations, the better we can estimate the specific demands on how GenAI systems should at all be implemented within educational practices [29]. What has already become clear, and what this paper has equally shown, is that the laborious work of reviewing technological output is unlikely to diminish, but rather seems to further increase when teachers are expected to stay responsible for educationally relevant and pedagogically meaningful judgements.

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