A Tool to Support Students-to-Teacher Feedback in Asynchronous Online Contexts

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***Abstract*— In recent years, the world of education has become increasingly Hybrid (online / on location) and Flexible (synchronous / asynchronous). One of the risks of these mixed environments is the distance between teacher and students that can make interaction, a crucial component of the teaching / learning process, more difficult. This paper introduces Evoli, a tool to support the "HyFlex model"; more specifically, the component dealing with online / asynchronous mode. Evoli enables teachers to receive precise, time-stamped feedback by their students on educational materials (typically videos). Students go through the materials and express their level of understanding as well as their questions and comments. Dashboards with the students' data allow the teacher to know, topic by topic, what is clear and what is not and thus how to organize the synchronous sessions. The tool was evaluated in a real-life setting, involving 63 graduate students in a course on Plasma Physics. The students filled in a System Usability Scale questionnaire and some questions regarding the perceived usefulness of the tool; the teacher's opinion was gathered via a semi-structured interview. Results show that students found the tool both usable and useful; the teacher's opinion was that the tool allowed prompting more reactions than a normal setting and an optimization of teaching organization.**

***Index Terms*—Asynchronous learning, learning dashboard, flipped classroom, students' feedback, HyFlex model, Video-Annotation Tool (VAT) , blended learning.**

I. INTRODUCTION

SINCE the COVID-19 era, teaching has undergone a profound change, marked by strong digitization. Face-to-face teaching was forcibly abandoned during the health emergency, moving education completely online. At the peak of the Covid-19 outburst, in March / April 2020, as many as 169 countries suppressed face-to-face teaching, shifting to online teaching [1]. Even though in most countries the health emergency has receded, the world of education appears to have become accustomed to the technologies that have enabled continuity of teaching during the pandemic and in the months that followed. Focusing particularly on higher education, many universities that were not eager to adopt online learning had to make a shift to online platforms and maintained the online mode even after the health emergency [2]. As a result, both school systems and higher education are moving toward a "HyFlex" model of teaching [3], hybrid between online and on location and flexible between synchronous and asynchronous.

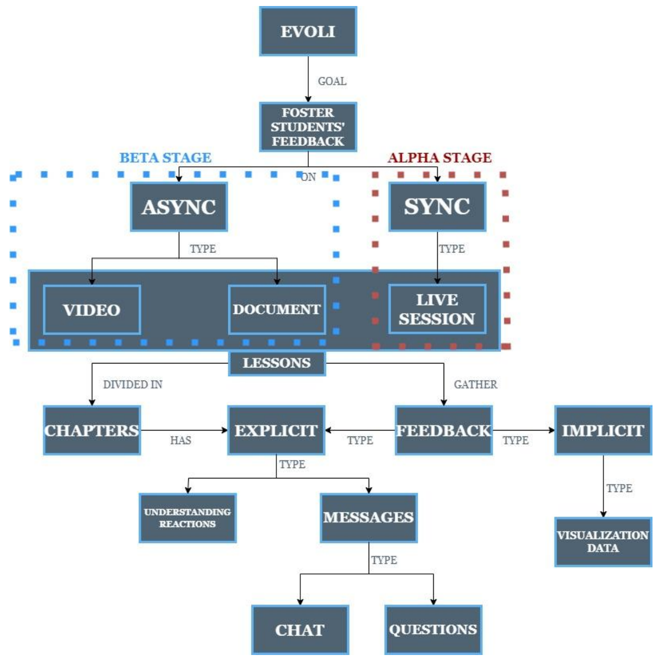

Fig. 1. High level description of Evoli

The HyFlex model, first conceptualized by Brian Beatty in 2006 [3], [4], envisions supporting three teaching modes: (1) synchronous face-to-face, (2) synchronous remote, and (3) asynchronous remote, allowing students to choose their preferred mode as the course unfolds. The commitment is to ensure equal teaching quality in all three. The model displays several advantages for the students, who can take a course even if they are sick, or away on a trip, or dealing with work commitments or experiencing overlapping with other courses, without falling behind. Indeed, this kind of delivery provides students with enormous flexibility on when and where to take a lesson, since a streamed lesson can be followed synchronously (online or on location) but also be recorded and made available for later use. Several sources show how students during the pandemic appreciated this flexibility, which allowed them to train their self-directed learning [5], [6] and self-discipline [7]. However, the model presents several challenges as well: for example, it requires the institution to deal with a non-trivial reorganization of teaching and the teacher to face a big instructional planning effort to keep the promise of being "equivalent" across the three modes. On the students' side, digital literacy, learner agency, social interaction, attendance and self-regulation have been identified as key issues in relation

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to the model [8]. In addition, a crucial aspect of the teaching / learning process is put at risk: the possibility to express feedback to the teacher. Indeed, digital tools make it possible to reach anyone anywhere at any time, but with a message that risks being one-way. The question therefore is: how can we "give a voice" to students, even in these contexts?

Evoli is a tool that aims to tackle this challenge, supporting the three scenarios of the HyFlex model: (1) synchronous face to face, (2) synchronous online, (3) asynchronous online. It aims to enable students to express their level of understanding (as well as doubts or questions) of a lecture (synchronous modes) and of any material the instructor shares with them (asynchronous mode), so that the instructor can always have the pulse of the situation (Fig. 1). The focus of this paper is the component that deals with the asynchronous mode of the HyFlex model, leaving the presentation of the whole system (which is still in alpha version) to later publications. "Evoli Async" is the component responsible for supporting student's feedback in situations where learning material, typically videos (which are becoming increasingly common), is shared with them asynchronously. The goal is to support student-teacher feedback so that the teacher can know what is clear or confusing and thus optimize the in-person sessions. The research questions this paper aims to answer therefore are: "How usable is the tool?" and "Is it perceived as useful by its intended users (students and teachers)?", considering usability and acceptance as pre-requisites for academic impact.

II. Related Work

This section presents the pedagogical background of the asynchronous uses of Evoli: feedback in higher education and the "flipped classroom" approach. It also presents the state of the art of tools being used to enable students to express their feedback on materials shared with them asynchronously, the so-called "VATs" (Video Annotation Tools).

A. Feedback

The study of feedback at the higher education level boasts a 30-year long history. It first focused on the "feedback as telling" paradigm, in which the spotlight was on the teacher, following the traditional transmissive approach. However, in recent years, there has been a shift towards a more learner-centered approach, emphasizing the dialogic concept of looping and interaction. This approach recognizes the active role of students in processing and utilizing feedback to inform their learning. As a result, there has been an increased awareness of the importance of shared responsibility between teachers and students in the feedback process. Teachers are no longer seen as the sole providers of feedback information, but rather as facilitators who work collaboratively with students to create a more active and engaging feedback process. Students are encouraged to take on a more proactive role in the process, enabling them to become more responsible for their own learning and development [9], [10]. There is general agreement among scholars on the crucial role of feedback in the teaching and learning process [11]. However, literature has focused primarily on feedback that originates from the teacher, rather than from the students: even in its more recent developments, which emphasize the agentic role of the student in the dialogic process of responding to the teachers' prompts, the student is not seen as the one who initiates the process [12]. "Students are commonly positioned as playing a passive role in feedback processes, both linguistically and conceptually" [9]. The students' feedback literacy is, in fact, defined as "the understandings, capacities and dispositions needed to make sense of information [by the teacher – author's note] and use it to enhance work or learning strategies" [11], taking it for granted that theirs is a reply to the instructor's prompt. Evoli intervenes on this gap, by reversing the paradigm and working as a tool "to give students a voice".

B. Flipped Classroom

The "Flipped Classroom" (FC) is an instructional strategy conceptualized by [13] in a seminal paper in 2012 (though there were relevant antecedents, like for example the experimentation by Mazur in 1997, reported on in [14]). FC encourages students to complete some preparatory work prior to coming to class, where they would then take a deeper dive into the topic through extension activities, hence the term "flipped" [15]. Students no longer listen to completely new content during the classroom session, but already prepare themselves at home with digital resources such as videos, documents, case studies, experiments or simulations and then proceed to discuss the content in class with their classmates and the teacher. FC represents a framework that ensures a more personalized education to the individual student [16]. Indeed, the student is at the core of this pedagogical model because the quality of the time spent in class is increased [17], [18] through a more structured and active learning [19]: the student is encouraged to engage, inquiry and train her self-regulation skills [20]. This active learning causes enhanced students' engagement, which according to [21] is a critical factor for effective teaching. As mentioned earlier, the migration to online instruction that the education system underwent during the pandemic allowed the flipped model to spread exponentially [16]. Some higher education institutions have been able to survive with only flipped content delivery, without investing funds to adopt complex pedagogical strategies [22].

The asynchronous component of Evoli allows supporting the FC approach, by letting the instructor know beforehand which topics are clear/unclear to the students in view of the organization of the in-person sessions.

C. Video Annotation Tools

Video Annotation Tools (VATs) can be defined as "online or offline programs that allow a user to mark portions of video and reflect on it by adding written, spoken or visual comments to that section of video" [23]. First of all, it must be noted that VATs cover most of the scenario of annotating tools for asynchronously shared materials, but there exist some examples of "MATs" (Media Annotation Tools) as well [24] and also some VATs have evolved into including the annotation of educational materials other than videos (as for example FeedbackFruits, which will be introduced later). VATs, at first, were used primarily for reviewing teaching practices: a teacher is filmed and his / her performance is "annotated" by a mentor, to highlight strengths and weaknesses. Later, they opened up to more purposes. [25] analyzes 32 VAT studies, which show the variety of their possible usages. Nine studies concern the development of teaching practices (teacher education / teacher training), as explained above. Eight are about the conceptual understanding of video content by students. Five revolve around the development of workplace skills, work-practices and employment skills, like for example communicating with clients or conducting a meeting. Eventually, four concern the development of clinical practices in the medical field (in a similar way with respect to the use to improve teachers' performances), and the remaining are on the self-reflection by students regarding videos on specific content. An example of this last use is recounted by [26]; it is about a group of undergraduate performing arts students using VAT to critically examine their video-recorded performances. VATs can also be used to support peer evaluation, as reported by [27] about a case of video assignment in two intermediate-level writing courses: "[the VAT] allows students to use essentially the same peer review process on video texts that they have used for written documents."

The literature shows how VATs with anchored commentary can transform video viewing from a passive to an active learning experience and thus provide opportunities for purposeful student engagement [28]. But what kind of annotations can be made to a video? According to [29], annotations can be classified as (1) isochronic: annotations linked to a specific instant in the video; (2) spatial: annotations to a particular area of the video, (3) structural: general comments to the video. The various tools implement one or the other of these modes.

Some well-known VATs (and closest to the tool that is the subject of this paper) are VideoAnt (developed and made available by the University of Minnesota), OVAL (Online Video Annotation for Learning, an open-source software), AVW-Space (Active Video Watching platform, by the University of Canterbury) and the commercial products Perusall and FeedbackFruits.

VideoAnt is a web-based VAT for mobile and desktop devices enabling students to add annotations or comments to web-hosted videos. Using VideoAnt, students can add time-marked text annotations to the video. One typical application of VideoAnt is a peer review evaluation, in which students add comments on peers' video recordings [30]. Perusall [31] is defined as a "social annotation" system [32]. With respect to VATs and VideoAnt in specific, it focuses more on collaboration among learners by supporting peer interaction / coaching, and ongoing automated grading. Moreover, it includes other media types besides video (podcasts, documents, entire books...). The main goal of the platform is to enable students to read, annotate and discuss the content uploaded by teaching staff in a collaborative way. FeedbackFruits is as suite of tools defined as an "all-in-one solution to boost student engagement and collaboration in any course setting" (from the official website). FeedbackFruits offers support in both synchronous and asynchronous learning. In the former, the teacher can create a lesson through an interactive presentation. In the latter, there are three different scenarios: the first one permits students to get feedback either from the teacher on the submitted work (assignment review) and / or on their own skills (skill review), or to get feedback from other students always on the submitted work (peer review) or on skills (group member evaluation); the second scenario enables students to share their work getting feedback either from the teacher, from the peers or having a discussion with the peers; instead in the third scenario the teacher shares content with the students, in order to let them acquire knowledge better (comprehension) or to prompt students' interaction over a piece of content. Thus, the purpose of the tool is to provide both self, peer and teacher reviews to enhance students' critical thinking [33]. In conclusion, FeedbackFruits permits to make classrooms more interactive, fostering the engagement using different resources, like slides, online discussions and online quizzes. Apart from these, there are other VATs being developed as open-source software, like for example OVAL (by the University of South Australia), a VAT offering a set of features to foster active learning in video watching, among which the two most important are the possibility to add time-stamped annotation as well as in-video quizzes [34]. Eventually, AVW-Space is a platform that promotes active learning through controlled video-watching and offers features such as note-taking, interactive visualizations, and personalized nudges. Teachers use publicly available videos from YouTube while students engage in a two-phase interaction, where they first watch and comment on videos individually in a private space, focusing on aspects defined by the teacher and then anonymously review and rate each other's comments using teacher-established rating categories [35].

This "VAT-wave" demonstrates the relevance of turning educational video watching, a typically passive activity, into an active one for the students [34]. Evoli, which is presented in this paper, differs from current VATs (and MATs, since it includes documents and slides alongside videos) under three main respects: first, its focus is on the students' level of understanding / confusion (at each step of a video, at each moment of a lesson, at each chapter of a document…). It includes, of course, the possibility to post comments and questions, but its main use, which the tool proactively solicits, is to provide teachers with an at-a-glance snapshot of the students' level of understanding as the video or document reading or lesson unfolds. Second, Evoli entails a dashboard system for the teacher to keep track of students' reactions, not only about a specific material (again, be it a video, a document, or a slides' deck...) but also about clusters of materials. It then becomes a tool not only for understanding how the class reacts to a specific piece of content, but also how students are progressing over time (e.g. "43% of John Doe's reactions in this semester are about NOT understanding content"), as well as how the materials offered are perceived (e.g. "the videos by prof. Einstein, which I shared in March, got the highest numbers of 'I don't get it' reactions, I might think of replacing them"). Eventually, although in this study the focus is specifically on

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the asynchronous component, the overall Evoli system is meant to deal with all the dimensions of the HyFlex model, i.e. synchronous, asynchronous, remote and on location, which is a unique characteristic that sets Evoli apart from the other VATs.

III. The Evoli Tool

A. Goal and requirements

Evoli is a system that supports students' feedback to the instructor in a HyFlex (hybrid and flexible) scenario: it therefore aims at allowing students to let the instructor know whether they are understanding or not the lecture (and ask questions / make comments) in real time, be it remotely or face-to-face (the two synchronous scenarios of the model), as well as to annotate educational materials (videos but also documents, decks of slides) shared with them before or after the face-to-face sessions (the asynchronous scenario of the model). The overall goal of the system is to "give students a voice", following the model's principle that all three modes should strive to provide equivalent opportunities to the students.

In this paper, the component devoted to asynchronous / remote setting (flipped classroom, consumption of lectures recordings…) is described (Fig. 2). The asynchronous / remote component allows students to express their feedback on educational materials shared with them by the teacher. This feedback can take all the three forms identified in the literature: it can be "isochronic" (linked to a specific moment of a video), "structural" (concerning the whole video or hooked to the various sections the material is divided into, which in the tool are called "chapters") or spatial (in the case of documents and slides, annotations can be attached to specific areas).

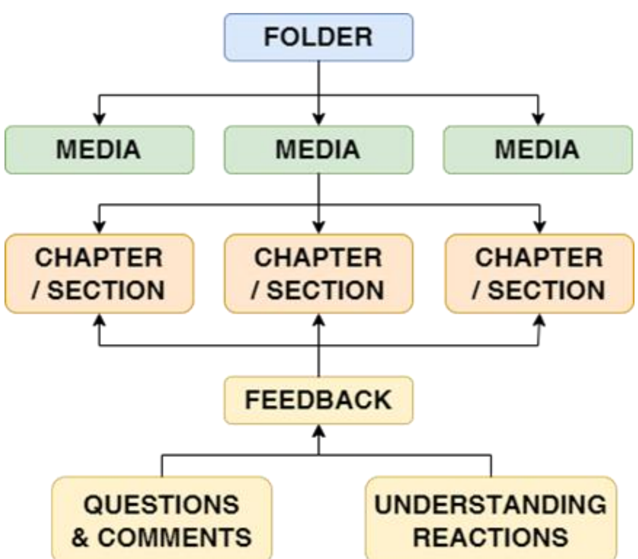

Fig. 2. Evoli's asynchronous component architecture.

Two are the intended users of the system: teachers and students. On the teachers' side, the main requirements are: the teacher needs to know how clear/unclear the topics of a lesson (conveyed through different media) are for the students and what questions/comments they have. She needs to have this data in aggregated form as well as separate (i.e. she needs to know how the class is reacting as a whole and at the same time how each single student is performing, during a specific lesson as well as over a longer period of time). On the students' side, the main requirements are: they need to be able to let the instructor know what topics are clear / unclear and to ask questions, offer comments and reflections. They must be allowed to interact with their classmates and ask / answer questions to them as well. All these actions need to be possible both in an anonymous and non-anonymous way.

To clarify how Evoli works, let's see a scenario of use. Professor Smith is starting a course on Plasma Physics. He would like to plunge directly into the topic, without spending much time on the basics of electromagnetic theory, which he considers a prerequisite. He shares with the students on the Evoli platform a video of his lecture on the basics of electromagnetic theory, from the previous year (streamed and recorded). He asks students to watch and "annotate" it before the next face-to-face session. The day before the session, he checks the teacher's dashboard and discovers that the clearest topics were "Electrostatics" and the "Lorentz force" (he therefore decides he won't go through them again), while the most obscure was "Electrodynamics", which seems to need further explanations, as confirmed by the students' questions, which he can also see on the dashboard. He takes note of all this information and prepares for the face-to-face session.

The Evoli platform provides teachers with a valuable tool for monitoring student reactions and levels of understanding or confusion in different pedagogical scenarios. While the flipped classroom is the most obvious use case, the platform can also be employed after synchronous sessions to provide students with lecture recordings as a form of recap before final exams. Through the platform, teachers can monitor students' reactions and questions and determine the most effective ways to address areas of confusion, such as creating explanatory videos, organizing additional in-person sessions, answering questions directly in the system, or providing targeted materials for specific topics. In addition, Evoli has been used in a prototypical version within the context of a Massive Online Open Course (MOOC) for assessing video quality [35]. The level of confusion among students was used to identify videos that needed improvement or parts that required reshooting. This demonstrates the versatility of the platform in different educational contexts and its potential for enhancing the learning experience by providing feedback to both teachers and students.

All feedback given by the students is aggregated in the teacher's dashboard, which allows the teacher to analyze the understanding and effectiveness of the content distributed to students. In Evoli, students' reactions are prompted (at every change of topic, the tool asks for feedback, as it will be shown in the next paragraph); moreover, a trace of all students' actions and reactions is recorded for not only allowing the teacher to prepare for the next face-to-face session, but also for further analysis and students' assessment.

B. How Evoli works

The teacher creates folders in which to insert media to share with the students. The media (e.g. a video) needs to be split into chunks, called "chapters". If a video from YouTube is used, the original chaptering, if present, is used; otherwise, Evoli allows chaptering the content from within the system. Once the content is ready, a code is generated that the teacher shares with the students. The students need to login to the Evoli system and the code gives them access to the materials their teacher has uploaded and the permission to annotate them, express their level of understanding chapter-by-chapter, ask questions and make comments. The students' interface (Fig. 3) consists of two side-by-side panels: the content panel, where the video or any other material, like for example a deck of slides, is shown, and a subpanel in which the chat, the questions, the list of participants, the data feedback, and the students' dashboard can be displayed.

Fig. 3. The student's interface, with the video on the left and a panel that can display chat, questions, participants, data feedback, on the right.

The main feedback given by the students is on their level of understanding: they are asked to self-assess their level of understanding / confusion at the end of each "chapter" (Fig. 4).

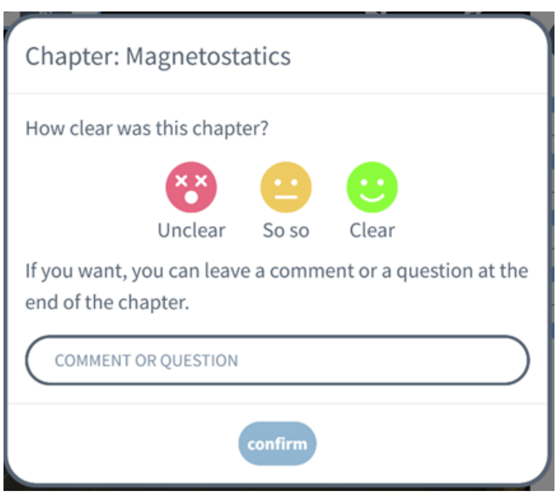

Fig. 4. Modal window prompting students' feedback at the end of each "chapter".

The student panel includes an additional feature, which the teacher may or may not enable (based on pedagogical considerations): a dashboard showing the average values of the reactions by the whole class. In other words, the teacher may give his / her students the opportunity to compare their own performance with that of the rest of the class (Fig. 5). This is distinctive from what happens in a regular distance class, where individual students are like separate "monads." Seeing the overall performance can trigger interesting considerations about one's level of preparation, gaps, etc. (e.g., "This topic is unclear to me, but I see that most of my classmates find it confusing too"). This aspect will be further investigated on the pedagogical front, in future research.

Fig. 5. The graph with an aggregated view of the students' reactions to a piece of content shared by the teacher: on the x axis, the chapters (numbered), on the y, the number of reactions (questions or rating).

More traditional features are also present in the students' part of the tool: they can post questions for the teacher and chat with their classmates, in case someone is connected at the same time.

For each content item (be it a video, a deck of slides…), the teacher will be able to access a customized dashboard where feedback given by students is aggregated and made visible. Fig. 6 shows the teacher's dashboard. On top, there are some quantitative data about access and activities, such as how many students have watched the video and how many reactions were gathered. On the left, there is the list of chapters and their ratings in terms of clarity. Filters allow re-ordering the list, for example from the least to the clearest chapter. In the middle, the graph with the reactions, organized according to the chapters, is placed: it is the same that students see on their page, if allowed by the teacher. Below the graph, the video (or any other media that might be used) is shown. The reason why the video or any other content is included in the dashboard is that all data (rating of the chapters, questions…) are linked to the exact moment / place to which they refer and therefore the teacher can immediately review the content of interest: in fact, by clicking on a question, or on a chapter name, the user is taken to that specific part of the material.

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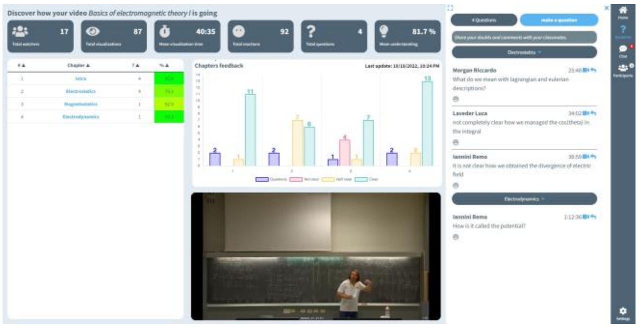

Fig. 6. The teacher's dashboard.

How the different chapters were perceived can be read at a glance from the graph (a histogram, Fig. 5), in which the feedback given by the students is shown for each chapter. More specifically: the number of reactions of value 1 (I don't get it), 2 (I'm not quite sure) or 3 (I get it) and the number of questions. The chapters can be easily sorted and compared in a table (Fig. 7), in which a percentage of comprehension *u* is associated with each chapter *c* and calculated as follows:

$$u(c) = \frac{u_3(c) + u_2(c) * 0.5}{u_3(c) + u_2(c) + u_1(c)} * 100 \quad (1)$$

Where $u_i(c)$ is the number of understanding reactions with value *i* of chapter *c*, with $i \in \{1, 2, 3\}$. A weight is associated with each understanding reaction *u*: a weight of 1 for 'I get it' reactions, half a weight for 'I'm not quite sure' reactions as they relate to partial understanding and a weight of 0 for 'I don't get it' reactions.

# ▲	Chapter ▲	? ▲	% ▲
1	Intro	4	95.8
2	Electrostatics	4	73.1
3	Magnetostatics	1	62.5
4	Electrodynamics	1	93.3

Fig. 7. The list of chapters in the teacher's dashboard.

Obviously, the chapters with a higher *u*(*c*) percentage will be those best understood by the students. The questions are organized by chapter and each one contains an anchor that allows to instantly jump to the item (e.g., the moment in the video) it is associated with (Fig. 8Fig. 7).

IV. Evaluation

In this section, the evaluation of the asynchronous / remote module of the system is presented. The module was tested in a real-life setting: a graduate course on Plasma Physics at Politecnico di Milano, the largest technical / scientific university in Italy. The focus of the evaluation was on the two steppingstones for a new tool like Evoli to take off: the overall usability and the perceived usefulness. Future work includes evaluating the actual academic impact, which needs higher numbers of users and a longer deployment.

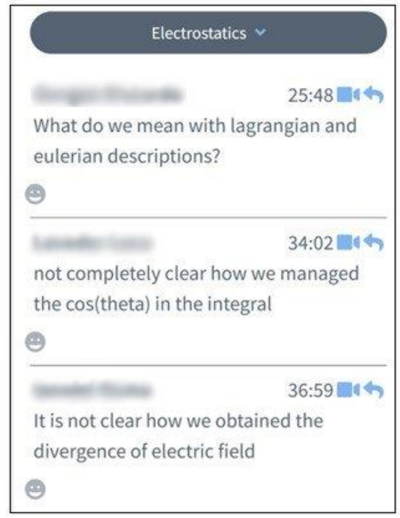

Fig. 8. Example of questions panel.

A. Method

Evoli was tested in the frame of the 'Plasma Physics I+II' course, to which 63 students were enrolled, in the first semester of the academic year 2022-23. The instructor utilized a flipped classroom approach, with videos as the primary educational material. The videos were distributed to students one week before the face-to-face sessions, with a request for feedback on their understanding and the opportunity to ask questions or make comments. Students had the option to choose whether to remain anonymous or to appear with their name and surname. In total, six videos were shared, ranging in length from 1 hour and 10 minutes (the shortest) to 2 hours and 20 minutes (the longest). Two different sessions were organized, with students being asked to watch two videos one week before the face-to-face meeting in the first session and four videos being shared two weeks before the lesson in the second session. Their feedback put the basis for the in-class meetings, in which the teacher went through the parts that were deemed less clear, answered the questions and discussed with the students, following the flipped classroom approach.

The method by which the system's usability was assessed is the System Usability Scale (SUS) instrument, a reliable usability scale that can be used for global assessment of system usability [36]. The SUS consists of 10 items, each rated on a 5-point Likert scale ranging from 'strongly agree' to 'strongly disagree.' As suggested in the ISO 3241-11, the measures of usability should cover:

- *effectiveness*: users can complete the tasks using the system; the output is of good quality;
- *efficiency*: the level of resources consumed in performing tasks is adequate;
- *satisfaction*: users' subjective reactions to using the system is positive.

To compute the SUS score, the responses to the 10 items are first converted to numerical values, with the scores ranging from 0 to 4 for each item. For items 1, 3, 5, 7, and 9, the score is equal to the response minus 1. For items 2, 4, 6, 8, and 10, the score is equal to 5 minus the response. The scores for all 10 items are then added together and multiplied by 2.5 to obtain the overall SUS score, which ranges from 0 to 100. A SUS score of 68 is considered average, while scores above 70 are generally considered good, and scores above 80 are considered excellent. The SUS is usually administered after users have tried the tool under evaluation and before any discussion takes place. This constraint was respected in the evaluation of the Evoli tool.

User-perceived usefulness of the tool was tested by asking students to rate their level of agreement with four statements, again on a scale from 1 to 5 (where 5 meant "I totally agree"). The statements were about the platform in general and its primary goal. Eventually, the point of view of the teacher was garnered as well, through a semi-structured interview with the Plasma Physics instructor.

B. The students' point of view

Here the data about the students' evaluation of the Evoli tool is presented.

TABLE I
SCORE FOR THE SUS TEST (63 RESPONDENTS)

#	Statement	Mean Score
1	I think that I would like to use this system frequently	3.286
2	I found the system unnecessarily complex	1.762
3	I thought the system was easy to use	4.175
4	I think that I would need the support of a technical person to be able to use this system	1.429
5	I found the various functions in this system were well integrated	3.540
6	I thought there was too much inconsistency in this system	1.825
7	I would imagine that most people would learn to use this system very quickly	4.159
8	I found the system very cumbersome to use	1.984
9	I felt very confident using the system	3.921
10	I needed to learn a lot of things before I could get going with this system	1.524

Table I shows the 10 questions of the SUS test and the average score for each answer. The SUS test score for Evoli amounts to 76.38, which is well above 68, the average score for usable systems reported in the literature [37]. It can therefore be concluded that Evoli is quite a usable tool.

Being usable is a good starting point, but it is not enough. Table II shows the results about the perceived usefulness.

TABLE II
SCORE FOR PERCEIVED USEFULNESS QUESTIONS (63 RESPONDENTS)

#	Statement	Mean Score
1	I think that Evoli is a useful tool	3.875
2	It is important to let the teacher know which parts are unclear	4.444
3	I find it useful to see how much my classmates have understood the lecture and what questions they ask	3.666
4	I think it would be useful to use Evoli again, in this and in other courses	3.762

The first two statements are about Evoli's core idea. The average scores are quite high: the usefulness of the tool is rated 3.875 and the agreement to the mission of the tool, which is to 'give a voice' to the students, is high, 4.444. The third statement is about whether it is useful or not for students to see how their peers are doing. Though with less "enthusiasm" with respect to the other items, students do seem to appreciate this possibility. The final question taps the overall appreciation, which is again quite high.

C. The instructor's point of view

A semi-structured interview with the instructor of the course on 'Plasma Physics' was used to gain a deeper insight into how the tool was used and its perceived pros and cons, from the point of view of the instructor. The first question investigated the reasons for deciding to adopt the tool. In this case, the main reason was organizational: due to a reduction in the number of in-person hours, the teacher was faced with maintaining the same number of topics but in a reduced amount of time. He therefore chose some topics of less relevance than others, using recorded lectures from previous years, to offer them to students in a flipped classroom format. This also allowed him to personalize the teaching: he knew that for some students those topics would be simple and probably already known, while for others not, due to different career paths. Evoli would allow the less experienced to watch the videos at their pace, returning over the difficult points. The integration of Evoli into the course involved the instructor notifying students that certain topics would be addressed through the flipped classroom approach using the platform. The instructor made the videos available in advance, with the first two being provided one week prior to the synchronous in-class sessions, and the remaining videos being shared two weeks before the sessions. The instructor allowed students to log in either anonymously or with their real names, without imposing any specific obligations such as formulating at least one question. The use of the videos was treated as any other exam-related material. Notably, almost all students accessed the platform using their real names. The instructor prepared for the in-person sessions by reviewing the statistics of understanding for the 'chapters,' which were found to be quite high, with no critical issues identified. The instructor expressed appreciation for the segmentation of materials into smaller chunks facilitated by the platform. He stated that the division into chapters and the data on their understanding

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helped to ‘flush out’ less clear aspects on small portions of an overall lesson. In class, he went through all the questions, discussing them with the students. When asked whether Evoli had raised his awareness about his students’ comprehension of the various topics, the answer was positive. In his words: “Overall, the use of Evoli has increased my awareness of my students’ understanding of the course topics. Having this awareness during the course is crucial, as it enables me to address any areas of confusion or misunderstanding in a timely and effective manner. Normally, the only way to gauge student understanding is through in-person interactions, which can be impacted by various factors such as time, mood, and personality. However, Evoli provides a different context that eliminates these factors, prompting students to engage in discussions and provide feedback without any barriers or excuses. As a result, the use of Evoli has the potential to make classroom discussions more effective and engaging.”. The instructor emphasized the importance of gaining awareness of student learning progress before the exam. He noted that obtaining a full view of student learning outcomes at the exam is often too late to implement remedial actions. Instead, he highlighted the value of monitoring student progress throughout the course to identify areas where additional support may be needed. By gaining insights into student learning as the course progresses, instructors can make timely adjustments to improve student outcomes and enhance the learning experience. Evoli did, in the teacher’s opinion, optimize the organization of the course, which had been the reason why he had decided to use the tool in the first place. In the end, he managed to cover all the course topics despite having fewer hours than in previous years. In addition, the lecturer believes that he was asked more questions than in the traditional version of his teaching, because the tool allowed even the timidest to intervene, especially when more time was allotted (two weeks, with the second set of videos). The lecturer recounted that he had, in the past, shared materials with students (video, texts, notes...) and never had the opportunity to get as much feedback from them that would allow him to steer the lessons accordingly. He sees this as one of the main advantages of Evoli. The main limitation, from his point of view, is the fact that at the moment the tool does not force students to justify their own scoring of understanding, particularly when it is negative, whereas instead he would like to receive some explanation, be it even “this topic is not clear to me and I cannot explain why.” The same lecturer intends to use Evoli again, also integrating the sharing of documents along with the videos.

V. Limitations

The whole tool is at the level of research prototype. There are, therefore, several limitations, which will be the object of future developments. First of all, it must be noted that, in its current version, the tool relies on the students’ capacity of self-reporting on their learning experience. This seems to work in a graduate course, but further experimentations with lower levels of education are required to tap into how much the tool can still report reliable data to the instructor. Moreover, Evoli currently requires students to express their level of understanding or confusion via a simple rating: “I get it”, “I’m not quite sure” or “I don’t get it”, but nothing compels students to explain the reason behind the scores. While on one side this allows for a smoother experience (otherwise the moments of stop for the feedback could be perceived as cumbersome), on the other this limited feedback could lead to misinterpretations around students’ understanding, as the interviewed instructor pointed out. This is something other tools like AVW-Space have taken into consideration, with their ‘nudging’ features [35]; future experimentations will focus on it, possibly leading to change in the tool’s feature.

Other limitations concern the present study. While the data presented can give confidence on the usability and perceived usefulness of the tool, a lot needs to be done yet to assess the tool’s impact on academic performance. Future work includes evaluating the actual academic impact, which requires higher numbers of users and a longer deployment. In particular, the questions to be explored include: does Evoli promote the students’ feedback literacy? Does it foster learning, by fostering interaction?

Furthermore, the impact of different variables needs to be examined, like for example:

- *gender*: is there any difference between female and male in the way they interact?
- *level of education*, since a significant self-regulation skill is required of the student to make a good use of Evoli: how would younger students use the tool?
- *subject area*: would there be differences between humanities and scientific / technical subjects?
- *temporal dimension*: how does being in the middle of a course vs. close to the exam make a difference?
- *being anonymous vs. having to show name and surname*: what students make more questions?
- *seeing how the other students are reacting*: realizing you are not the only one ‘not getting it’ would make a difference?

Eventually, enriching the dashboard with more data about the way students use the materials could shed light on the students’ different learning strategies and engagement goals (e.g. with videos; see [38]), thus improving understanding on this research area as well as, on the practical side, providing the instructor with further elements to monitor how her / his cohort is performing.

VI. Conclusions

This article introduced Evoli, a tool to support the HyFlex model; more specifically, it presented the module that supports the asynchronous / remote teaching scenario, in which a teacher shares teaching materials (videos, but also decks of slides, documents...) with his / her students so that they can access them in their own time. The heart of Evoli’s mission is to ‘give a voice’ to students in mixed contexts where technologies help but also create a distance. The study focused on usability and perceived usefulness gathering data in the frame of a real-life setting: a scientific graduate course on Plasma Physics, with 63 students. The students were asked to fill in a System Usability

Scale questionnaire plus additional questions on the perceived usefulness of the tool; the instructor underwent a semi-structured interview with the researchers. Data is quite positive: the students deem the tool is usable (overall SUS score:76.38) and useful. The instructor appreciated the tool as well, underlying as main advantages the fact that he gained a more granular view over the students' understanding of the various topics during the course instead of at the end, at the exam, when it's too late for a remedial action, that he got more student questions compared to his 'traditional' lessons, being even the most timid or reflexive students encouraged by the tool to speak up, and that the tool allowed him to make the most of the face-to-face sessions, optimizing the teaching organization of the whole course, in which he managed to squeeze all the topics he intended to go through even with less in-person hours than the previous rounds. In general, these initial findings appear to support the notion that 'giving students a voice' is a valuable approach, particularly in the context of remote learning environments that are becoming increasingly common.

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