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CONTENT SLICING: LOW-CODE MANAGEMENT OF VIDEO, GRAPHICS AND MORE FOR ENGAGING CLASSROOMS

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Abstract

Modern educators have access to ever-growing options for the creation of learning resources to foster engagement and comprehension. This paper describes an implemented low-code platform tailored to the needs of visualising resource deployment and development. The metaphor of horizontal and vertical "slicing" is adopted from the field of software development to motivate the use of interfaces for managing diverse content, including video, banner graphics for delivering "Q&A" responses to student feedback, and a database of classroom activities. The effective marshalling of resources can help with enhancing interactivity and responsiveness in classrooms, and efficacy of the system is discussed through evaluation results showing that classes delivered via the system are at the very top of university-wide evaluation criteria.

Keywords

Learning Environments, Digital Transformation, Engagement, Condensed Video, Content Slicing

1. Introduction

Integration of digital resources in the classroom is a transformative trend in contemporary education. In this dynamic context, low-code platforms offer powerful tools to educators.

This paper describes educational work carried out as part of a continuing project to transition face-to-face university courses (15 weeks of 90-minute lectures) into a fully online delivery format. The impetus was the 2020 Corona pandemic, but the classes have been selected each year by their host institution as being of particular value to continue online. Key to the transition has been extensive digital transformation (DX) of contents, pedagogical adaptation, and technological integration to support virtual learning environments. The courses are technical in nature (with subject matter based around AI, including autonomous agents and logic programming), but the ideas we present here are general. Especially, the system we describe is based on a general and widely affordable SaaS platform, and the framing of "content slicing" (in the dual forms of "horizontal" and "vertical" slicing) that we present is also widely applicable.

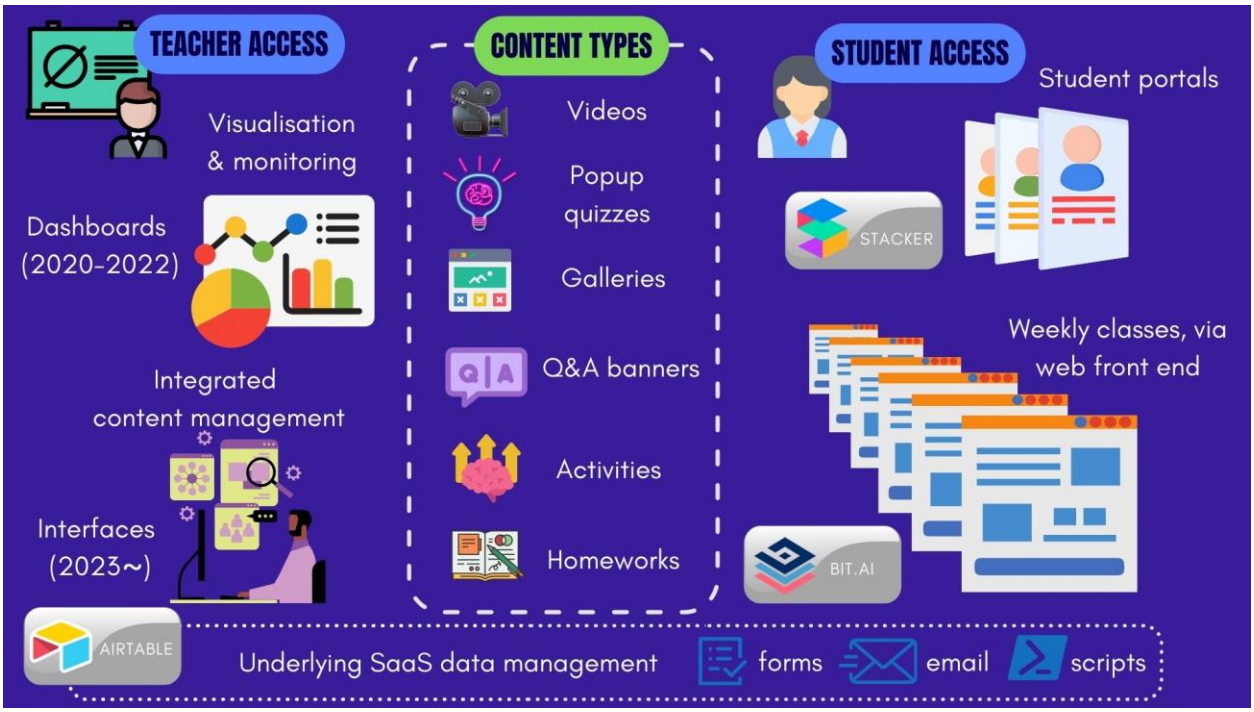
The previous iteration of our system, as explored in earlier research (Frank 2022a), utilised dashboards as the primary tool for an educator to visualise and monitor data. These dashboards, although robust, encounter space limitations when the variety of data to be visualised increases, and can be difficult to view or even to use at all on smaller devices such as tablets or phones. The version in this paper presents a more flexible and portable realisation based on "interfaces".

The main body of the paper is devoted to one extended section presenting the system, focussing on the types of class content to be managed and the overall pedagogies motivating the work. A close analogy for the system from the literature would be the "Next Generation Digital Learning Environment" (NGDLE) of (Pomerantz et. al. 2018): "a digital confederation of tools, content, and applications, dynamically connected by open standards". Section 3 then presents some screenshots of the access points for both student and educators, including graphs that demonstrate the efficacy of the approach, while Section 4 concludes with a summary and a perspective on future potentials.

2. A Multi-Dimensional System: However You Slice It

Figure 1 gives a schematic overview of the implemented information environment, showing the primary content types used to craft most classes, and the main access methods available to either educators or learners. An underlying SaaS (Software as a Service) platform is used to provide essential data management capabilities, such as database and scripting functionalities.

Figure 1: *Schematic of Information Setup of Learning Environment.*



(Source: Original Composition)

The multidimensional access to materials can be visualised through the metaphor of "vertical slices" and "horizontal slices", a concept borrowed from software development—see (Howell, 2023) for an example discussion. Coding teams often utilise vertical slicing to develop and deliver a feature or user story in its entirety, cutting through all layers of the application stack. This ensures that each slice, or increment, is a working segment that can operate independently, providing immediate value. In our educational context, a vertical "slice" of the content types in the central column is the basic way to populate a web page for one week's class, combining together a DX mix of content such as videos, quizzes, and activities that form a coherent unit. Conversely, a horizontal slice of the data will focus on the makeup of a single content type across the span of a course. Horizontal views can facilitate visualisation and deep dives into the

effectiveness and the development of a single content type—like video engagement or quiz performance—throughout the entire learning experience of a set of classes.

The pedagogical approach accompanying this framework attempts to adapt key aspects of the flipped classroom model (Bergman & Sams 2012), particularly its emphasis on video-based learning and in-class active engagement, to suit an online higher education context. At the university level, students can often be enrolled in multiple courses, each with its own set of lectures, readings, assignments, and exams. This multifaceted academic load can be intense, leaving students with limited time for additional pre-class preparation required by a standard flipped classroom approach. An expectation to absorb and understand complex material independently before each class can also be a challenge and may inadvertently contribute to increased stress and reduced overall effectiveness of learning. A modified approach was developed to address these challenges by integrating essential video content into the online class time itself. The goal was to avoid a pre-class preparation burden on students, instead using condensed video content that isolates the key class components in a very short format suitable both for viewing in one short sitting during a class and for motivating study and further thought after a class. To foster collaboration and peer learning, the viewing of videos in online classes is usually carried out in Zoom breakout rooms formed from student-selected team members. Overall, Zoom-Enhanced Active Learning (ZEAL) is a good candidate description for how each of the content types (described in more detail below) combines to align with a pedagogy that can be effective with university students who are balancing full and demanding schedules.

2.1. Videos

2.1.1. Content – Short, focused "condensed" videos that cover key concepts, designed to be watched during class. Intentionally brief to fit within a short breakout room session, so ensuring that content delivery remains concise and targeted, and freeing up time for interactive activities.

2.1.2. Pedagogy – Video allows the deployment of specific techniques, such as storytelling, problem-solving and animated exposition to convey complex concepts quickly and engagingly. Online students are already primed to expect content via a screen, and pre-prepared video allows greater exploitation of the possibilities of an HD canvas than real-time exposition. Constraining video to condensed lengths is also supported by research findings suggesting that shorter videos can significantly improve student engagement when compared to the impact of longer content (Zhu et. al. 2022).

Students can view the contents in two ways: the weekly class pages created by the instructor, or the horizontal "content slice" provided in the Student Portal, which provides quick access to video from any class week so far in the course, and also shares the video reviews written by the class. The sharing of reviews in this way is one way to contribute towards a cohort spirit (Frank, 2023).

2.2. Popup Quizzes

2.2.1. Content – Quizzes that use the condensed video content as a jumping-off point to allow students to check and deepen understanding. Designed to be completed during class, usually in the breakout room time where students can collaborate in their teams.

2.2.2. Pedagogy – These quizzes provide immediate formative assessment opportunities related to the video content. Students can submit multiple times in a "frequent, low stakes" paradigm (see Lang, 2016) that encourages ongoing engagement without significant pressure, promoting better retention and understanding. In a light "gamification" metaphor, students receive "Unlocked Content" in their Student Portal when answering a Popup, giving answers to the quiz. The intention is to promote engagement and to help solidify understanding of the video content, in addition to encouraging re-watching of videos to confirm key points or to correct misunderstandings.

2.3. Galleries

2.3.1. Content – Visual supplements to the class content, such as databases of vocabulary or graphics summarising key concepts that frequently re-occur in class, making abstract content more tangible and memorable.

2.3.2. Pedagogy – Galleries serve as visual aids to reinforce learning, allowing students to make connections between the class content and visual representations, catering to different learning styles within the classroom. Giving students access (via their Student Portal) to a horizontal slicing of gallery contents across multiple classes can help them to review and reinforce understanding. Similarly, educators can benefit from a horizontal gallery overview (e.g., via an interface) to monitor, plan and pace class content.

2.4. Q&A Banners

2.4.1. Content – Dynamic banners created (for example using design resources such as Canva) in response to student feedback from the previous class, highlighting questions on videos or Popups and any other areas of interest. Banner contents are used as a springboard for class text-based responses from the educator, as well as for live discussion during the class (an example Q&A banner is shown in Figure 2).

Figure 2: *Example Q&A Banner Presenting Student Comments, From A "Basic AI" Class.*

(Source: Original composition)

2.4.2. Pedagogy – Banners facilitate a responsive learning environment where student queries and concerns are addressed promptly, promoting a sense of community and dialogue in the classroom. Presenting banners graphically ameliorates the "wall of text" that can affect class materials, and motivational "Best Comments" awards can be given to insightful, profound, or just funny contributions. (Best comments can be celebrated on a Zoom livestream with on-screen animations such as confetti or fireworks, marked on web pages with visual icons, and compiled with a running count in Student Portals). Some students report a motivational effect of this approach, and the best comments serve as exemplars for other students, in addition to encouraging diverse contributions.

2.5. Activities

2.5.1. Content – Engaging, interactive tasks or exercises conducted during class time, directly related to class topics or video contents. Activities range from interactive simulations, such as puzzle-solving apps incorporating AI algorithms, to numbers games or "spot the odd one out" challenges that illustrate human thinking, played via digital tools such as online whiteboards.

2.5.2. Pedagogy – Active learning through in-class activities allows students to apply concepts in a practical setting, and can enhance the learning experience via the meaningful integration of contents. Successful activities can create memorable anchors for students to recall class content.

Activities are designed to be not only educational but also engaging and enjoyable, fostering a learning environment where students are enthusiastic to participate and to invest something of themselves. Student feedback is encouraged (each student has a chance to submit free-form comments on the evaluation form for every class) and comments are used to refine activities so that they may remain relevant and enjoyable.

2.6. Homeworks

2.6.1. Content – Assignments that extend learning beyond the classroom, which may include further research, reflection, or applied practice.

2.6.2. Pedagogy – Homeworks encourage students to reflect on and apply what they have learned, or prepare for or build on in-class activities, fostering independent learning and time management skills. Each course usually includes a final project-based homework that can be team-based. The SaaS level allows for real-time tracking of homework submissions and can implement some auto-grading. Both the Student Portal and the interfaces for educators offer horizontal content slices of the homework data, allowing students to quickly confirm class progress (students see an overview of all assignments, their completion status and any grades), and giving educators the ability to visualise or adjust the flow of the course and help orient the students towards up-coming directions. To personalise a learning process that otherwise takes place online, students are typically sent individual feedback emails for each homework, containing grade and also individual comments designed to be constructive. For educators, the horizontal homework slice can play an important role in planning any rotation between hand-marked and auto-graded assignments, to best balance the investment of time into maintaining a meaningful sense of connection and engagement between students and instructor.

Conversely, the instructional design choices aim to create a learning cycle that begins with real-time motivation and scene-setting by the educator (ideally, with the aid of an activity), exposure to new content through condensed video, immediate reinforcement through quizzes and visual aids, and then a follow-up of application and further exploration through homework. Starting each class with responsive dialogue through Q&A banners helps to build on the feedback and learning of previous sessions, making the classroom an evolving experience that adapts to the needs and insights of the students. This strategy aligns with motivational frameworks such as the ARCS model (Keller, 1987) by aiming to capture students' attention with stimulating activities and condensed videos, emphasising the relevance of content through

application in Popups, building confidence with immediate feedback, and aiming for satisfaction by maximising the opportunities for the educator to provide feedback to student input.

Overall, a "ZEAL" approach aims to foster student engagement, prioritise active learning, and support the various learning paces and styles that can be present in a class. The class is not "flipped", but does use video to deliver instruction in a way that increases the class time that can be used actively, and to allow students to review at any time. By leveraging multimedia resources and frequent assessments, educators can create a dynamic and responsive learning environment that encourages student participation and ownership of their learning process, even when the process is online.

For specific software, Figure 1 includes the names of the main tools that were deployed to create a realisation of this system, although the approach is general, and many other realisations are possible. Airtable was chosen for the core SaaS functionality because of its proven track record in innovation and versatility (the developers liken the software to a "Lego kit" for building workflows [1]). Airtable's dashboard functionality is useful for monitoring progress through a course, being very suited to creating vertical slices of data. A significant shift occurred towards the end of 2022, when Airtable introduced the enhanced "interface" functionalities that allow interacting with its core functionality of bases and tables in more visual and focussed ways[2]. This major upgrade transformed our data handling in the 2023 academic year, enabling the aggregation of diverse data views into a single, user-friendly web access point tailored to meet an educator's needs. The resulting system feels dynamic, responsive, and aligned with contemporary pedagogical strategies. Although constrained by limitations on space, Section 3 gives some example screenshots, focussing on the horizontal slices of video class content.

Airtable interfaces are also a candidate for creating Student Portals to access class data, but in the 2023 academic year, we stayed with an already-working implementation created using the third-party solution Stacker. This service allows individual students to access just their own course progress data (such as attendance, Unlocked Content for popups, homework status) in addition to the presentation of horizontal data slices, such as video and gallery tabs, offering a comprehensive and easily searchable view of course materials. An example of a Stacker window is also included in the screenshots of the following section.

[1] https://www.airtable.com/newsroom/product-and-technology/introducing-airtable-blocks
[2] Interfaces entered beta in Nov 2021, and came out of beta to be a part of all Airtable plans in Oct 2022.

The final software shown in Figure 1 is bit.ai, which was chosen to create class web pages because of its emphasis on a design aesthetic. In online classrooms, where visuals become a major part of the online stream and can help to maintain student engagement, bit.ai's ability to integrate diverse multimedia content into aesthetically pleasing layouts was valuable. This is somewhat in contrast to common LMS systems such as Moodle, which offer robust functionality but often do not prioritise presentation. A single bit.ai web page can be used as the main backdrop of a Zoom session, effectively showcasing graphics from galleries, embedding videos, incorporating interactive elements, and previewing content such as pdfs, helping to create a visually stimulating and cohesive learning environment. As with the other choices of Airtable and Stacker, the landscape is constantly evolving (bit.ai, for example, introduced a dark mode during 2023, which in-class online polling showed to be significantly preferred by students). A particular direction of interest in low-code systems is represented by Coda, which combines robust data management with advanced visualisation capabilities, offering a blend of functional efficiency and aesthetic appeal. Coda documents have a strong emphasis on visual design and can directly embed data from its interactive tables in customisable ways. At the time of writing, a two-way sync between Airtable and Coda is "due for release". The ever-evolving landscape suggests a dynamic future in educational technology, constantly offering educators fresh avenues to enhance and refine teaching methodologies.

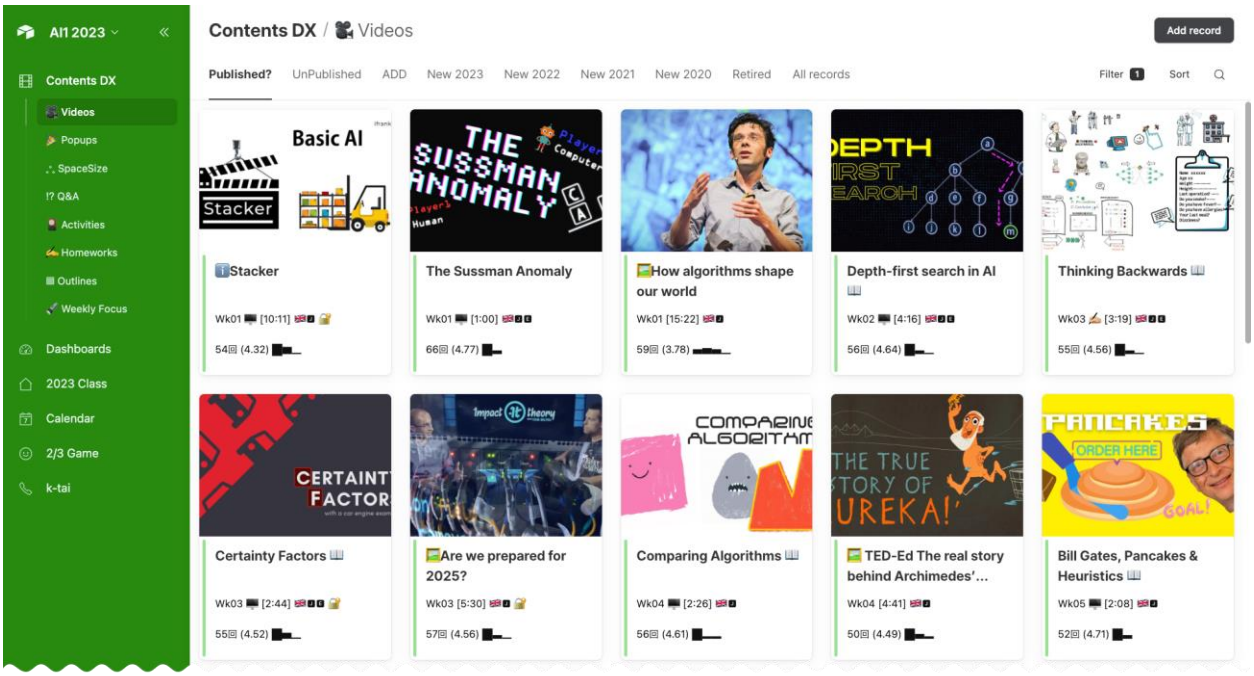
3. Screen Captures and Commentary

Figure 3 presents an interface showcasing video content[3] for a "Basic AI Course". This image is an original screenshot and incorporates graphics composed using licensed or public domain visual resources—a standard maintained in all subsequent screen capture figures in the section. The visual presentation streamlines navigation through course materials, sparing users from engaging with the more complex database views. With the intuitive tabs at the top, users can swiftly filter content—for instance, by isolating published videos, identifying topics pending addition, tracking the chronological addition of videos, or reviewing archived (retired) materials. Such a management system is especially valuable for courses that are developed over extended periods, as it allows for efficient planning and monitoring, essential when content

[3] Readers with an interest can view publicly available video examples at the author's AI-themed YouTube channel, https://www.youtube.com/@abitofintelligence.

iteratively improves across academic years and is interlinked with various resources such as PDFs, activities, or graphical summaries.

Figure 3: *Airtable Interface Showing Horizontal "Slice" Of Condensed Video Content.*



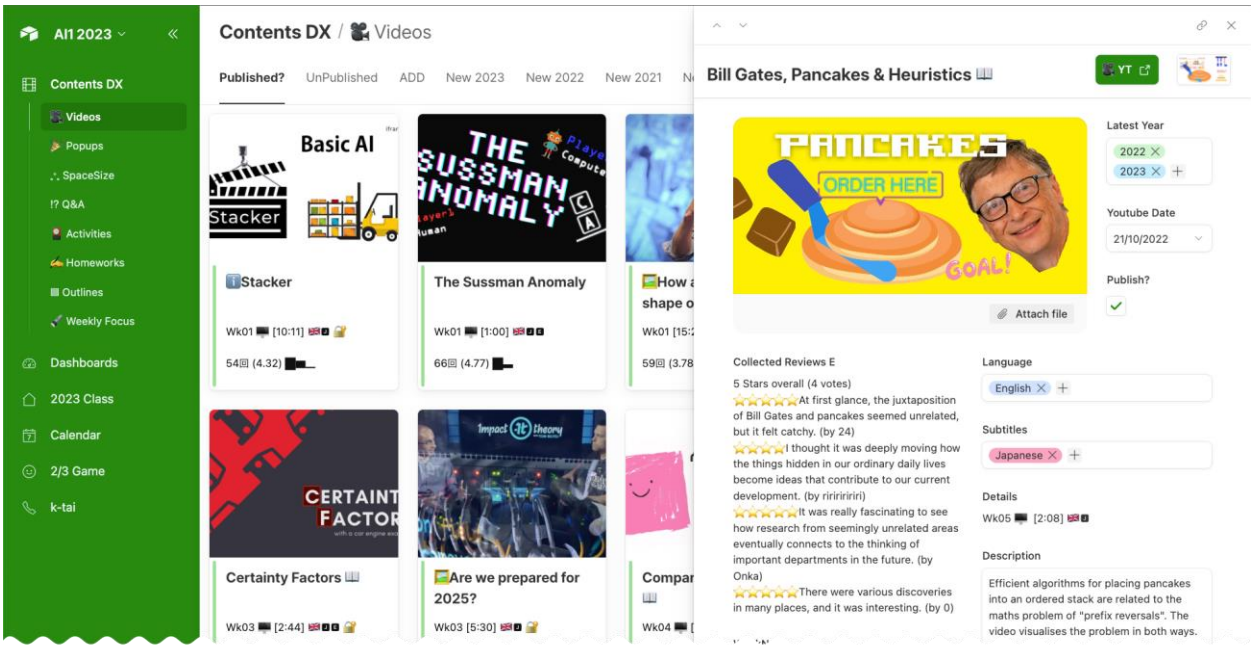
(Source: Original composition)

Figure 4 illustrates a "sidesheet", Airtable's term for an information window, which grants detailed access to specific portions of stored data. This customisable feature allows the creator to determine which fields are editable and also to dynamically pull up and exhibit data from supplementary sources. An example is the student reviews that are displayed within the sidesheet of the figure, showing how rich, actionable insights can be compiled directly within the context of a specific piece of content. A panel showing collected "best comments" can also be selected via another interface, as well as functionality for replying directly to individual reviews.

Note that the main "Contents DX" menu on the left in Figures 3 & 4 corresponds to the sequence found in the central column of Figure 1 ("SpaceSize" is a Basic AI gallery that hosts a series of graphics illustrating the algorithmic search spaces introduced in each week's classes). Each type of content has its own page that displays its specific slice of the data in the most effective format. The two final "Contents DX" menu items further help with design and maintenance: "Outlines" provides a dedicated space for compiling and reviewing class notes and

any additional graphical elements, while "Weekly Focus" automatically generates a consolidated vertical data slice, offering an educator a way to view a snapshot of any week's class content without the need to access and navigate through the web pages themselves.

Figure 4: *Sidesheet Information Panel Compiling Information on a Single Resource.*



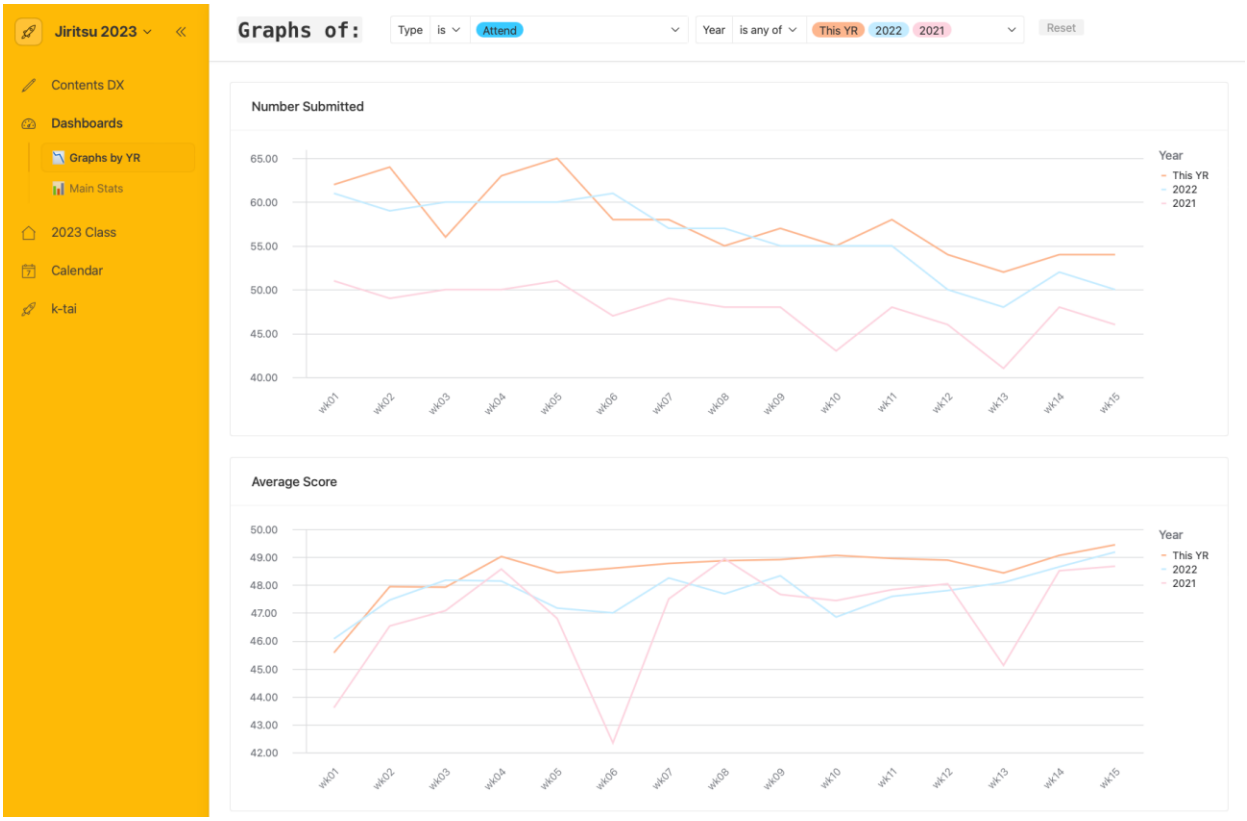
(Source: Original composition)

All the functionality of Airtable's original dashboards can also be implemented via the newer interfaces, but with the added option to filter multiple display elements simultaneously. For example, Figure 5 shows a comparative analysis of class participation and performance across different academic years for the course "Autonomous Systems" (separate courses are given different colour codings, a design choice that aids visually when administering multiple courses simultaneously and also gives each course's materials a unique "feel"). Each student submits an evaluative feedback form for every class, and the compiled multi-year data graphed in Figure 5 shows an increase in both student numbers and in weekly class feedback scores, suggesting positive developments in both course appeal and educational impact.

In addition to weekly feedback forms, the four courses utilising the system described in this paper undergo a comprehensive evaluation through a university-wide anonymous questionnaire at the end of each term. The results of the most recent compiled data year of 2022 show that the courses all place within the top ten (at ranks 1, 3, 4, and 8) in a list of classes with more than ten respondents sorted by the percentage of students indicating 'extremely satisfied'—

the highest level of satisfaction in the questionnaire. Notably, only the top nine courses of this list have an 'extremely satisfied' rate exceeding 50%. Nevertheless, in the 2023 academic year, the two completed courses delivered using the system have again surpassed this 50% benchmark of top-tier satisfaction, and the two courses now ongoing have higher weekly feedback scores than in previous years. These results demonstrate not only the system's effectiveness but also its sustained impact and ongoing relevance to enhancing the quality of educational experiences.

Figure 5: *Dashboard-Like Interface Visualising Multiple Years of Weekly Class Data.*



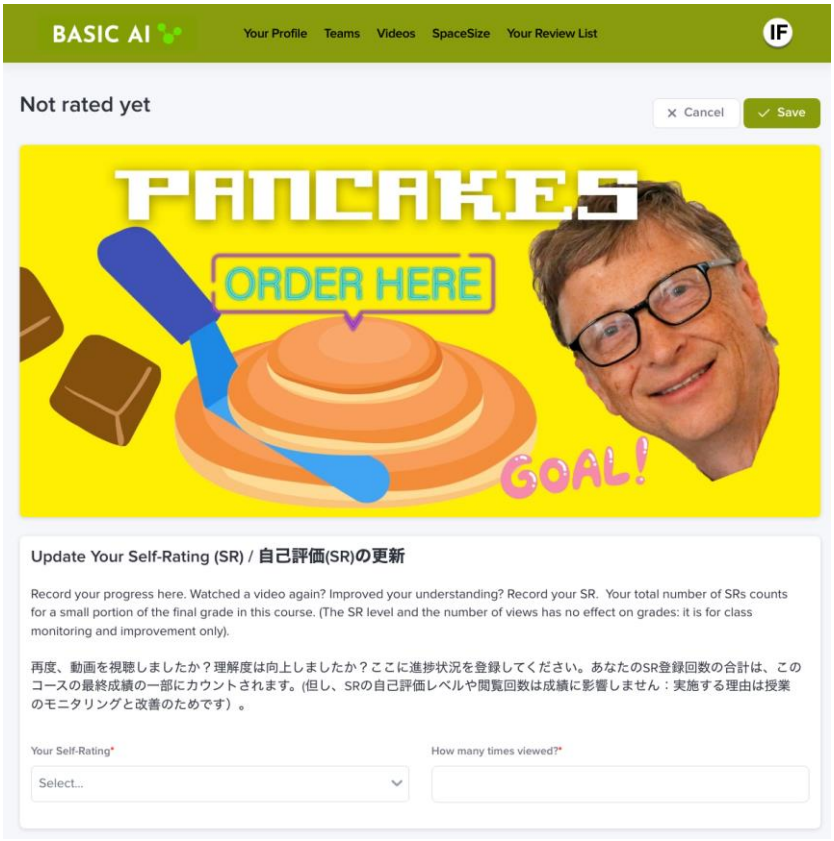
(Source: Original composition)

Figure 6 concludes this section with an illustration of the Student Portals provided by Stacker, showing an example of the "Update your Self-Rating (SR)" view that students can access for every video (further examples of Stacker screenshots can be found in (Frank, 2022b), where it was used to conduct a live conference workshop).

Part of each student's course grade is formed by confirming their declarations of having actually watched the video contents, which they provide by using Stacker to bring up the Self-Rating view for each video and choosing one of the five levels of understanding. This self-declaration process is not merely a formality; it encourages students to take ownership of their

learning and to critically assess their understanding of the material, promoting accountability and fostering a habit of self-reflection. This kind of structured approach to self-assessment aligns with the 'ZEAL' emphasis on active, student-centred learning, and offers a bridge to larger educational goals such as instilling in students a recognition of the importance of internalised reflective practices, and the import of habit in the lifelong task of personal growth.

Figure 6: *A Stacker View Showing Bilingual Instructions for Students to Record a Video "SR".*



(Source: Original composition)

4. Conclusions

This paper has used the metaphor of content slicing to motivate the use of interfaces for the effective management of digital transformation and educational resources.

The Zoom-Enhanced Active Learning (ZEAL) acronym we put forward reflects the genesis of these ideas in the disruptive online shift brought about by the pandemic—a time when the landscape of low-code development also saw prodigious change. With further acceleration in technological advancements seemingly likely due to the coding automation potentials of Generative AI, the future appears to hold the promise of learning environments that are both

customisable and user-friendly, empowering educators to fully leverage capabilities even without extensive technical knowledge.

AI systems may also prompt further transformation in educational practices, such as automating aspects of curriculum development or enhancing personalised learning.

By prioritising adaptability and teacher autonomy, educators can focus on engagement through content creation and pedagogy, navigating the complexities and opportunities of an evolving digital learning landscape. As we venture into this future, the interface between classroom leaders and technology may be pivotal in transforming learning realities.

REFERENCES

Bergmann, J., & Sams, A. (2012). Flip your classroom: reach every student in every class every day. *International Society for Technology in Education*.

Frank, I. (2022a). Learning From Events. *The Asian Conference on Education 2022: Conference Proceedings*. https://doi.org/10.22492/issn.2186-5892.2023.71

Frank, I. (2022b). Koto-tsukuri: Education at the Interface. *The Asian Conference on Education 2022: Conference Proceedings*. https://doi.org/10.22492/issn.2186-5892.2023.72

Frank, I. (2023). Cohorts & Condensed Videos. *The Higher Technology Education Agenda, THETA 2023. Conference Abstract*. http://dx.doi.org/10.13140/RG.2.2.10717.49124

Howell, M. (2023, Jun 21). What Is Vertical Slicing And Why It Is Important? *EdWorking Blog*. https://edworking.com/blog/productivity/what-is-vertical-slicing-and-why-it-is-important

Keller, J. M. (1987). Development and Use of the ARCS Model of Instructional Design. *Journal of Instructional Development*, 10, 2-10. http://dx.doi.org/10.1007/BF02905780

Lang, J. M. (2016). *Small teaching: everyday lessons from the science of learning*. First edition. San Francisco, CA, Jossey-Bass.

Pomerantz, J., Brown, M., & Brooks, D.C. (2018). *Foundations for a Next Generation Digital Learning Environment: Faculty, Students, and the LMS.* Research report. Louisville, CO: ECAR. https://www.educause.edu/ecar/research-publications/foundations-for-a-next-generation-digital-learning-environment-faculty-students-and-the-lms/introduction

Zhu, J., Yuan, H., Zhang, Q., Huang, P.-H., Wang, Y., Duan, S., Lei, M., Lim, E. G., & Song, P. (2022). The impact of short videos on student performance in an online-flipped college engineering course. *Humanities and Social Sciences Communications*, 9(1), 327. https://doi.org/10.1057/s41599-022-01355-6