Backstage: A Versatile Platform Supporting Learning and Teaching Format Composition

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ABSTRACT

Limited interaction and passivity among students are inherent to the traditional lecture teaching format when deployed in large classes. With Backstage, these challenges were tackled by introducing a backchannel coupled with an audience response system into large-class lectures. A backchannel enables students to post questions and answer to questions without the fear of speaking out; an audience response system supports quizzes that help keeping the students' attention. The first version of Backstage focussed exclusively on lectures; an updated version supports a variety of learning and teaching formats that can be conceived by composing core components.

Backstage provides a set of generic components that can be combined in order to create different formats ranging from completely asynchronous, to blended learning, to completely synchronous. Additionally, Backstage provides gamification features that go beyond run-of-the-mill solutions as points, badges, and leaderboards and learning analytics.

In the demonstration, the main components of Backstage, the collaborative annotation tool, the vertical stream, the audience response system, the gamification, and the learning analytics are introduced and their use demonstrated by means of a variety of learning and teaching formats implemented using the components.

CCS CONCEPTS

• **Human-centered computing** → **Collaborative and social computing systems and tools**; • **Applied computing** → **Computer-assisted instruction**; **Collaborative learning**; **E-learning**;

KEYWORDS

Virtual learning environments, Computer-supported collaborative learning, Learning analytics, Gamification

1 INTRODUCTION

With the goal of improving the teaching and learning in large class lectures at the author's university, the first version of Backstage – a learning and teaching platform combining a backchannel and an audience response system – was developed and evaluated successfully in a number of lectures [9]. Backstage addresses a number of problems inherent to the traditional lecture format when deployed in large classes – the fear of speaking out and asking questions is addressed by the introduction of a backchannel, the passivity and the associated loss of concentration addressed by the introduction quizzes at regular intervals using an audience response system.

An updated version enlarges the vision to not only support lectures, but a wide variety of learning and teaching formats that can be conceived by composing core components. Formats supported this way span from completely asynchronous courses, to blended learning, to completely synchronous course.

This demonstration paper introduces Backstage, its components, and combinations of those components to learning and teachings formats.

2 BACKSTAGE'S COMPONENTS

Collaborative Annotation. A collaborative annotation environment allows users to create annotations for a document, with the created annotations being automatically shared with a specific group of users which are able for example to comment, revise, or rate annotations. Collaborative annotation can be seen as an enabler of computer-supported collaborative learning and can be used in a variety of learning and teaching formats: Students working together on the understanding of a scientific article, doing peer review, or communicating on a learning backchannel. Another example for a collaborative annotation system is MyNote [1].

A backchannel is a "a secondary or background complement to an existing frontchannel" [10, p. 852]. In case of a lecture, the background complement is a communication medium for students and teachers which is available while a lecture – the frontchannel – is running. The implementation using Backstage's collaborative annotation functionality represents a special form of backchannel: a slide-centred backchannel. Each backchannel posts refers to a position on the a lecture slide, allowing students to give their questions or remark context.

Lecture Material. In Backstage, *units* are the smallest part of lecture material: They represent for example a single slide of a PDF, a video, or an image. Units can be connected with each other to form a linked list. This list determines the order in which units are presented to the students. This structure allows lecturers to

intersperse their existing lecture material with units of other types of media. The resulting lecture material is similar to lecture material created using SCORM[1]. For each unit, students and lecturers can create additional content and attach this content to the unit for everyone else in the course to see: Students can use this functionality to easily share content with their peers, whilelecturers can use this functionality to provide additional material about the unit's content to the students.

Audience Response System. An audience response system (ARS) makes quizzes possible in large classes by aggregating the students' answers and presenting them to the lecture hall. ARSs can provide a variety of quiz formats, the most common ones being multiple choice questions and fill-in-the-blank texts, but more generally, every question the answers of which can be input to a computer can be conducted as a quiz.

Backstage's ARS provides support for both, synchronous and asynchronous quizzes with a wide variety of quiz formats, including the common types of quizzes, but also more specialized types such as code editors for various programming languages with compilation and testing functionalities, editors for creating logical proofs (for resolution and natural deduction), and editors for creating automata, such as Turing machines and push-down automatons.

Gamification. The most common definition of gamification is "use of game design elements in non-game contexts" [2, p. 10]. An important part of games are teams, a view supported among others by Nicholson in his "engagement dimension" [8]. Backstage introduces social gamified quizzes combining teams and the audience response system where each student's individual quiz answers count towards a shared team score. In a first evaluation, students exhibited a positive attitude towards the team concept and students were inclined to discuss their answers with their team mates [7].

Reification is making something difficult to grasp tangible by providing a visualization that is easier to understand. Reification can be found in cars where for example eco-friendly driving is often displayed using an appropriate visualization [6] instead of only showing a number. In case of Backstage, the learner's progress in a course is visualized in form of a landscape filled with items, with each item representing something that the learner did, e.g., a sturdy tree for submitted homework as opposed to a withered tree for a homework not submitted [3].

Learning Analytics. Backstage's approach to learning analytics goes beyond simple aggregation of data. One feature are so-called *predictors* for various learning outcomes, such as examination fitness, which tries to predict a learner's final score in the examination during the term by comparing the current student's behavior with past students' behaviors for which an examination score is known. Using this data, the platform can intervene and try to bring students back to the tracks to a passing grade – trying to get its own prediction wrong [4].

3 LEARNING AND TEACHING FORMATS

Large Class Teaching. In an age of mass education, large classes are hardly avoidable. Backstage supports large classes by providing students with a backchannel for communication not inhibited by the fear of speaking out and an audience response system to provide students with an active change of medium [9]. Another example for a system combining a backchannel and an ARS is Tweeback[2].

Peer-based Teaching. Peer-based teaching is an approach in which a group of students works together on a course with only minimal intervention through the teaching staff as the majority of the work is done by the students themselves. Students collaborate on working out the lecture materials, and exercises are automatically assigned by the system and corrected using peer review [5].

Phased Classroom Instruction. Phased classroom instruction fosters students' activity in synchronous, face-to-face classes by substituting the majority of the session with group work enabled by Backstage. Having the group's submissions available on the platform makes it possible to use them later for example for peer review, teacher review, or for discussion within the whole class.

4 SUMMARY AND PERSPECTIVES

In this demo, three teaching formats enabled by Backstage's components in combination with Backstage's gamification and learning analytics are introduced. Using a modular approach to designing a learning and teaching platform allows Backstage's developers to easily adapt teaching formats and develop new learning and teaching formats.

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[1]https://scorm.com/scorm-explained/

[2]https://tweedback.de/