An Interactive Lecture System for Embedding Quizzes into Online Lectures

**Abstract**

Online lectures and virtual assessments are standard practices in distance education settings. Learners typically view pre-recorded or ‘live’ lectures before attempting an assessment task. Pre-recorded lectures present the advantage of being readily accessible, which is vital for students unable to attend live lectures. Alternatively, a ‘live’ online lecture permits educators to assess individual learners ‘on the fly’, which can enhance student engagement. We introduce an open-source Interactive Lecture System (ILS) that integrates the advantages of both approaches into a single delivery format. In a nutshell, the ILS allows users to embed highly customizable quizzes into recorded lectures. Available item types include multiple choice, true-or-false, and short-answer questions. These can be easily expanded to accommodate a lecturer’s individual circumstances. Quiz responses are compiled into JSON text files, which can be downloaded client-side (for testing) or uploaded directly to a secure server. Question banks can be generated and uploaded in JSON. Readers can extend on the ILS by forking the GitHub repository containing the full source code. Those desiring immediate deployment will find a web URL (for instant access) alongside detailed setup instructions.

*Keywords*: interactive lecture, online learning, distance education

\*Bonus\*: Includes a link to an open-source ‘video-compressor’ application that allows users to manage the size, resolution and formatting of their recorded lectures.

**Introduction**

The delivery of online lectures and virtual assessments are fundamental aspects of distance education, particularly in contexts where students face geographical isolation, socioeconomic disparities, and limited access to traditional face-to-face instruction. In such environments, online learning often serves as the primary mode of educational delivery. Lectures are typically delivered in one of two formats. Pre-recorded lectures offer advantages to lecturers and students, as they allow greater time for preparation and annual updates, and provide students with the flexibility to access lectures at their convenience. This is particularly important for those unable to attend lectures at specific times, such as students in remote locations or with work or family commitments. However, a disadvantage of this approach is the lack of student engagement and interaction with the lecture material. If assessments can be attempted without engaging with the course content, many students may choose to do so, potentially hindering their learning outcomes. Conversely, live online lectures facilitate real-time interaction between educators and students, allowing instructors to assess understanding and provide immediate feedback, thereby enhancing student engagement.

To integrate the benefits of both pre-recorded and live lectures, this paper introduces an open-source Interactive Lecture System (ILS) that combines accessibility and interactivity into a single delivery format. The ILS enables educators to embed customizable quizzes directly into recorded lectures, transforming passive viewing into an active learning experience. Available quiz formats include multiple-choice, true-or-false, and short-answer questions, which can be placed throughout the lecture to reinforce key concepts and assess comprehension. This approach maintains the accessibility of pre-recorded content while replicating the engagement of live sessions. The ILS is designed to be flexible and scalable, allowing adaptation to a lecturer's instructional needs

The ILS is designed to be flexible and scalable, allowing adaptation to a lecturer's instructional needs and enhancing student engagement in several ways. Firstly, the timed quizzes embedded within the lectures encourage active viewing, ensuring students engage with the material rather than passively listening or skipping ahead. This promotes deeper processing of information and improves knowledge retention. Secondly, the system allows lecturers to embed open-ended questions within the lecture, encouraging critical thinking and reflection without disrupting the flow of the content. The secure, client-side caching of responses ensures that all students can participate, regardless of connectivity issues, and provides a comprehensive record of student engagement for the lecturer. Thirdly, the ILS's simple and intuitive interface ensures ease of use for both lecturers and students. All quiz elements are presented on a single page, streamlining the user experience and minimizing distractions. Finally, the ILS has the potential to mitigate the use of AI tools for cheating by embedding questions that require contextual understanding of the lecture content. This encourages students to engage with the material directly rather than relying on external assistance.

From a technical standpoint, the ILS is designed to be lightweight and compatible with various learning management systems. It utilizes JavaScript Object Notation (JSON) for data handling, a widely-supported format that ensures compatibility across different platforms. The system's front-end is written in HTML, while the back-end is written in JavaScript. The back-end features a state management system, which stores information about the quiz and the user's progress through it. The front-end features a simple and intuitive interface, with all quiz elements presented on a single page. This design minimizes distractions and ensures ease-of-use for both lecturers and students. The system's open-source architecture allows for customization and extension, enabling institutions to tailor the ILS to their specific needs and integrate it seamlessly into their existing online learning infrastructure.

The remainder of this article is sectioned into four parts. First, we present readers with the ILS interface to convey the range of customizable options. Readers can access a sample lecture to interact with, which will output a JSON file client-side for easy inspection. Next, we describe the technical details of the ILS, including its back-end state management system, and how it utilizes JSON for quiz generation and transfer to a secure server using the PHP scripting language. We include detailed instructions on how to setup a secure project directory that prevents unauthorized access. Following this, we elaborate on the structure of the ILS and identify areas for potential future expansion. In the final section, we provide illustrative examples of assessment items covering various topics that can be administered through the ILS. Readers can immediately begin generating quizzes through the web-based ILS link provided in the manuscript. In our conclusion, we re-emphasize how the ILS combines the advantages of pre-recorded and live online lecture deliveries while mitigating the disadvantages associated with each. We believe this tool will be of value to educators and learners alike, enhancing interactive learning while retaining flexible accessibility.

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