Standardization of Teaching Materials with Marp and CI/CD: A Study at the Federal Institute of Sergipe

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This article presents an approach for developing simple, flexible, and multi-format educational materials using Marp, a Markdown-based presentation creation tool combined with Continuous Integration (CI) and Continuous Delivery (CD) techniques. The integration of these technologies automated the process of creating, updating, and distributing educational content in slide format. To this end, a custom theme was developed following the visual standards of the Federal Institute of Sergipe (IFS). This workflow optimized the authors' time, standardized, and improved the visual appeal and structure of the slides, enhancing the creation of high-quality educational content for the teaching and learning process.
Keywords: Marp. Educational Tools. CI/CD. Template.

Technological advancements have contributed to the current teaching model by providing tools that enhance knowledge transmission and learning. In both in-person and distance learning environments, teachers deliver educational content through presentations.

It is common for educators to use Microsoft PowerPoint, OpenOffice Impress, and Apple Keynote for content presentation [1], although alternatives exist, such as Marp.

Marp is an open-source presentation framework that enables the creation of elegant and customized slides through the simplicity and versatility of Markdown. This is because Markdown allows users to access a robust software ecosystem for rendering text into various document formats. Thus, content creators can focus on the message, eliminating the complexity of formatting and design [2]. Its lightweight and structured syntax, combined with flexible output options, allows exporting to formats such as PDF [3].

Extensions for the Command Line Interface (CLI) and Visual Studio Code further expand its capabilities, enabling presentations to be exported in multiple formats, including Hypertext Markup Language (HTML), Portable Document Format (PDF), and PowerPoint Open XML Presentation (PPTX) [2].

Marp offers various customization options, allowing authors to reflect their style and preferences by simply writing content in plain text using Markdown syntax.

Recent studies [4-7] have explored new methods for developing teaching materials focusing on simplicity and flexibility. The study by Brilhaus and colleagues [4] suggests a modular approach to creating interactive presentations in Markdown format, where users benefit from a balance between reuse and specialization without requiring complex training.

Other relevant study is by Oelen and Auer [5], which aims to make online teaching materials accessible to blind or visually impaired individuals through this markup language (Markdown).

Recent research from Grayson and colleagues [6] utilizes the R Markdown interface to create interactive classroom modules with R Markdown files. According to the study, these resources enable the creation of modules that guide students through concepts while providing areas for coding. Following a similar line of reasoning, the study by Hofert and Kohm [7] presents using LaTeX for creating scientific presentations. According to the research, the main advantage of this approach is

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that LaTeX presentation slides allow easy copying and pasting of content from other documents

According to a UNESCO study on Open Educational Resources (OER), the application of open licenses in creating educational materials offers valuable opportunities for creating, reusing, adapting, and redistributing these materials, promoting greater accessibility and inclusion [8]. By making the Markdown code openly available on GitHub, authors ensure the ease of access and adaptation of materials by other educators and follow UNESCO's guidelines for encouraging the use of open-source tools to create and share educational materials.

Given this context, the present study focuses on the application of Marp with Continuous Integration (CI) and Continuous Delivery (CD) tools to create, maintain, and share educational content in a simple, flexible, automated, and consistent manner through a system developed as part of a capstone project [9].

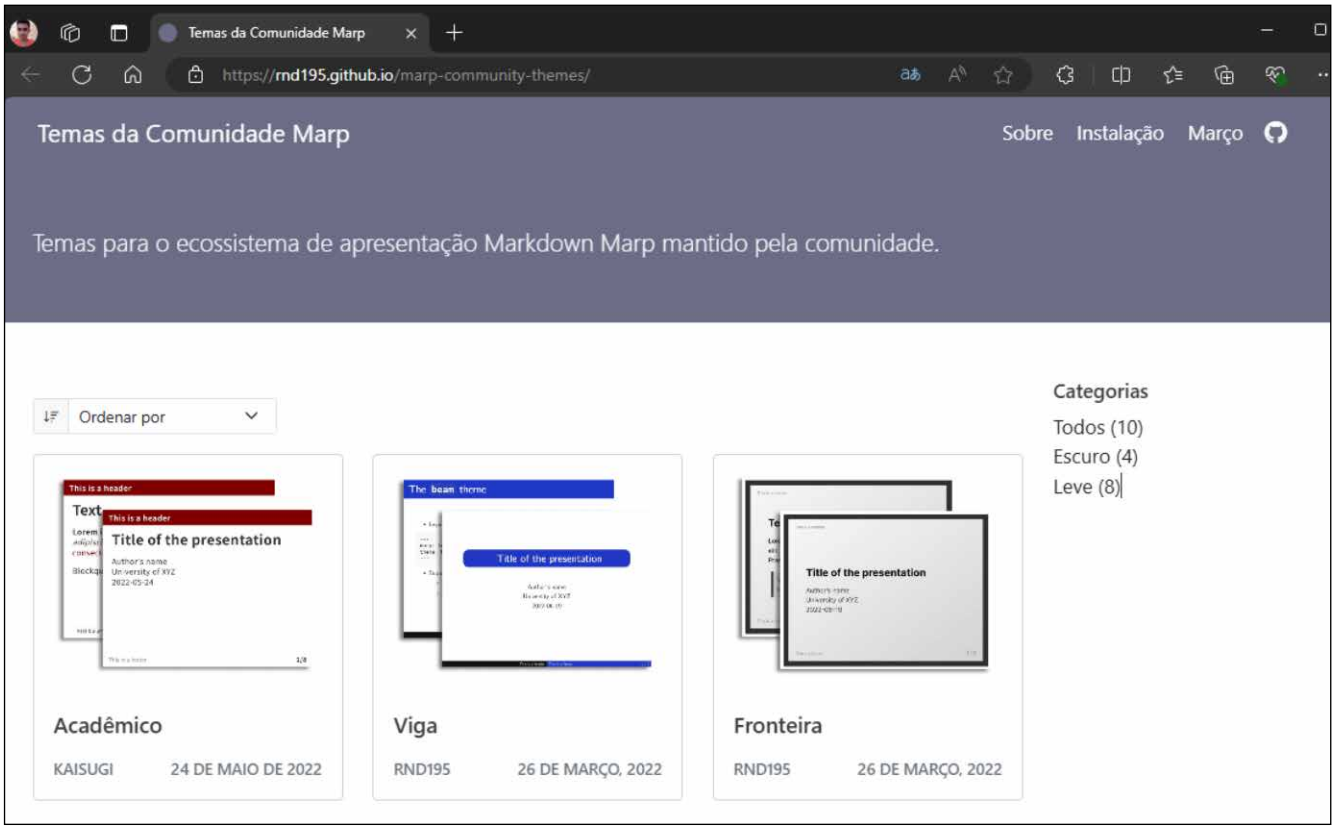
A customized theme was created as a case study to meet the formatting requirements of the Bachelor's Degree in Information Systems (BSI) at the Federal Institute of Sergipe (IFS).

Creation of the IFS Marp Academic Theme

The Marp community provides themes that can inspire or serve as a starting point for customizations and new designs. To achieve this, it is essential to familiarize oneself with the documentation to learn how to style presentations [2]. Figure 1 illustrates a community-maintained repository for sharing predefined themes for Marp presentations.

Despite the variety of themes available in the community, they often do not conform to institutional standards. For this reason, a study was conducted on the presentations used by faculty and students of the BSI program at IFS Campus Lagarto to identify the authors' visual standards and replicate them using the Marp tool.

Figure 1. Marp theme repository.



The analysis included observations of presentations made available by professors on the Integrated Academic Activities Management System (SIGAA) and thesis defenses conducted by students, both in person at IFS and via platforms such as Google Meet. During the study, common visual elements were identified in the presentations, particularly in design, including predominant colors, font size and spacing, and element alignment.

In Figure 2, we present two presentations where the color green is dominant, reflecting the visual identity of IFS. The presentation follows a consistent spacing and alignment pattern focused on clarity and readability, along with the institutional logo to indicate its origin. These visual characteristics were designed to create a harmonious and professional experience that aids students in content assimilation. Additionally, the consistent use of institutional identity reinforces the recognition of IFS in educational materials, promoting more excellent uniformity and professionalism.

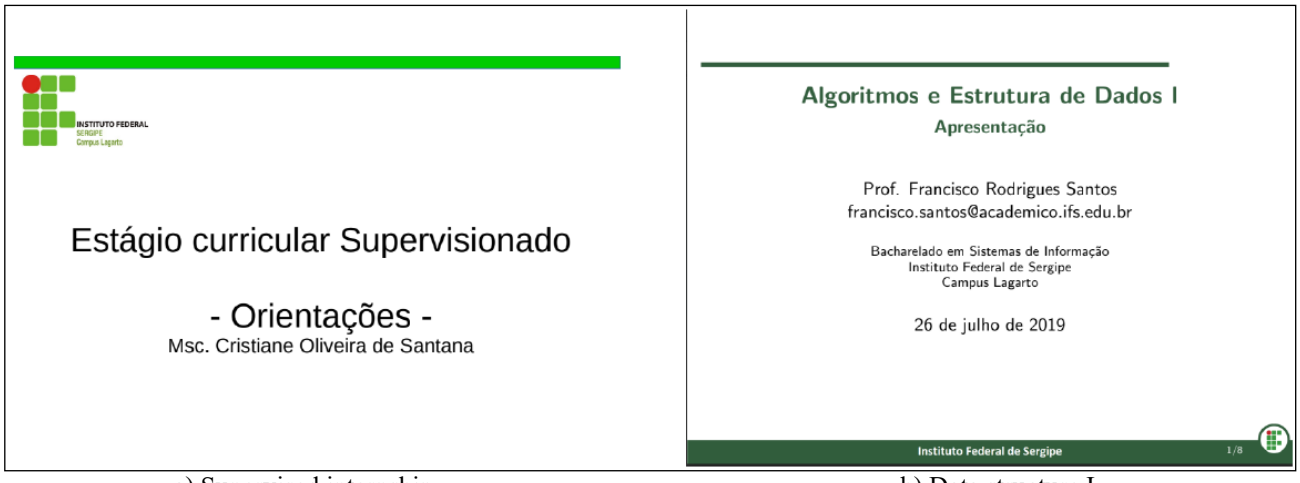
Typically, slide backgrounds have soft and neutral colors, while text colors provide strong contrast—for example, a white background with black text to ensure optimal readability. Additionally, slides should contain only essential information, allowing the presenter to effectively explain concepts, methodology, and results [10].

Another example of standardization, as seen in Figure 2, is using visual elements (such as the logo and color scheme) to create a visual identity consistent with the institutional standard. While these characteristics are not strict rules, the analysis revealed that these visual elements are recurring in the evaluated presentations. Furthermore, the study highlighted legible font sizes, typically between 14 and 16 points. Fonts that are too small hinder readability, reduce accessibility, and cause discomfort for the audience, while huge fonts may limit the space available for important content [10]. Based on these findings, the map-theme-academic theme from Marp was customized to align with the IFS visual standard, as this template includes many of the elements observed in the study. To achieve this, a fork of this theme was created on GitHub.

Figure 3 illustrates the GitHub repository created from the original theme. This repository contains the necessary customizations for IFS slide presentations. By centralizing the style rules, any modifications made to the repository will automatically apply to all projects using this theme.

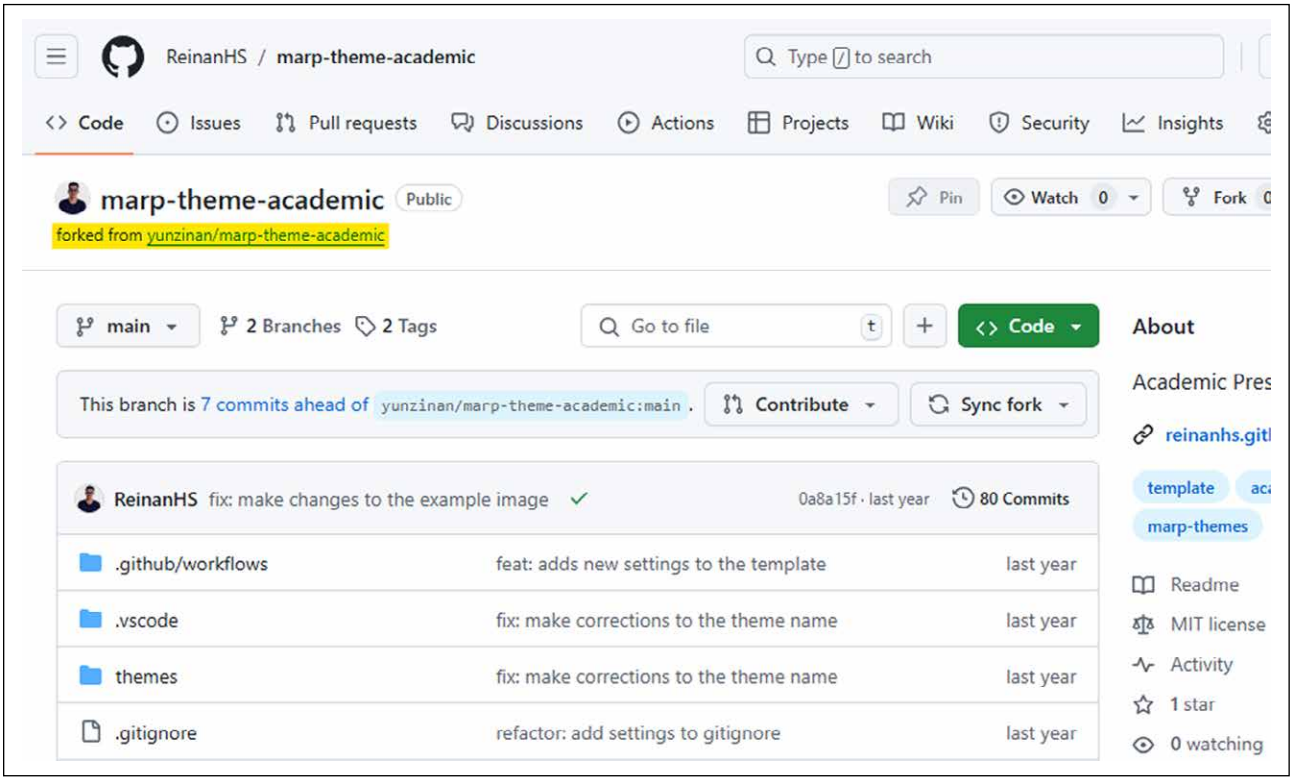
The main configuration file in this repository is themes/academic.css. This file contains all the style rules for the slides, including font size, colors, and other settings that define the theme used by

Figure 2. Examples of slides at IFS.



a) Supervised internship b) Data structure I

Figure 3. IFS Marp template repository.



the authors. It plays a crucial role, allowing Marp to identify and apply the defined configurations when generating slides. A white background was the default within this configuration file, avoiding intense colors. Additionally, only two shades were used for the text.

The development of the academic theme for Marp follows the same principles used in creating Limarka, a solution designed to standardize the formatting of academic papers according to the norms of the Brazilian Association of Technical Standards (ABNT). Similarly, the Marp academic theme was developed to ensure that presentations align with IFS institutional guidelines. This approach facilitates and streamlines the creation of slides following academic standards while promoting consistency and professionalism in materials presented by students and faculty [9].

Educational Materials with IFS Marp

The process begins with writing slide content in Markdown format using Marp. The content is then versioned locally using Git and pushed to the project's repository on GitHub. At this stage, a Pull Request is created for review, allowing for analysis and validation by other collaborators. Once approved, these modifications are merged into the principal repository, automatically triggering the CI/CD pipeline. This pipeline compiles the slides into HTML, PDF, and PPTX formats.

To complement the standardized and automated workflow described above, a GitHub repository was created containing the entire structure necessary to facilitate the adoption of the customized Marp theme. This repository includes an initial file called slide-deck.md, located in the project's root directory. This file is a base template, giving users a starting structure for developing their presentations.

The slide-deck.md incorporates IFS institutional guidelines for visual standardization. The process is intuitive: users write content in Markdown format, and Marp automatically converts the text into a visually consistent presentation. This approach reduces the technical complexity involved in

creating educational materials and ensures that presentations meet the quality and uniformity requirements established by the institution.

Figure 4 illustrates how an instructor can write their presentation using the structure provided in the slide deck file. With this configuration, changes are displayed in real-time. To enable this feature, users must activate the Markdown preview in the upper right corner of the file editing tab. Images, charts, code snippets, and even mathematical formulas are possible to include in academic presentations. To demonstrate how to utilize these resources effectively, a YouTube video has been published: [https://youtu.be/sPbBDXfdofA]. This material provides a practical demonstration of integrating these elements into Marp presentations, showcasing real-world application examples.

Additionally, the video guides users on best practices for creating visually impactful presentations and explains how to streamline the process by using CI/CD automation.

It is necessary to add a configuration in the .vscode/settings.json file so that the tool recognizes the repository link and applies the settings to the slides. This ensures that Marp correctly imports the theme customizations.

Figure 5 illustrates the configuration added to the file. It is important to note that the setup references the reinanhs/marp-theme-academic repository, which contains the entire fundamental structure required to format the slides according to the defined standards.

Slide Compilation and Publication via CI/CD

An automated pipeline was configured to compile the slides whenever changes are pushed to the main branch of the GitHub repository. This pipeline compiles the presentation into three formats: HTML, PDF, and PPTX. These formats cater to user needs and preferences, allowing the material to be viewed in browsers, printed, or edited in presentation software such as Microsoft PowerPoint.

The automated compilation process uses Marp CLI, a specialized tool for converting Markdown files into presentations. The pipeline configuration ensures that the files are generated in the desired formats. With every push to the main branch, the pipeline executes the following steps:

Figure 4. Example of using IFS Marp.

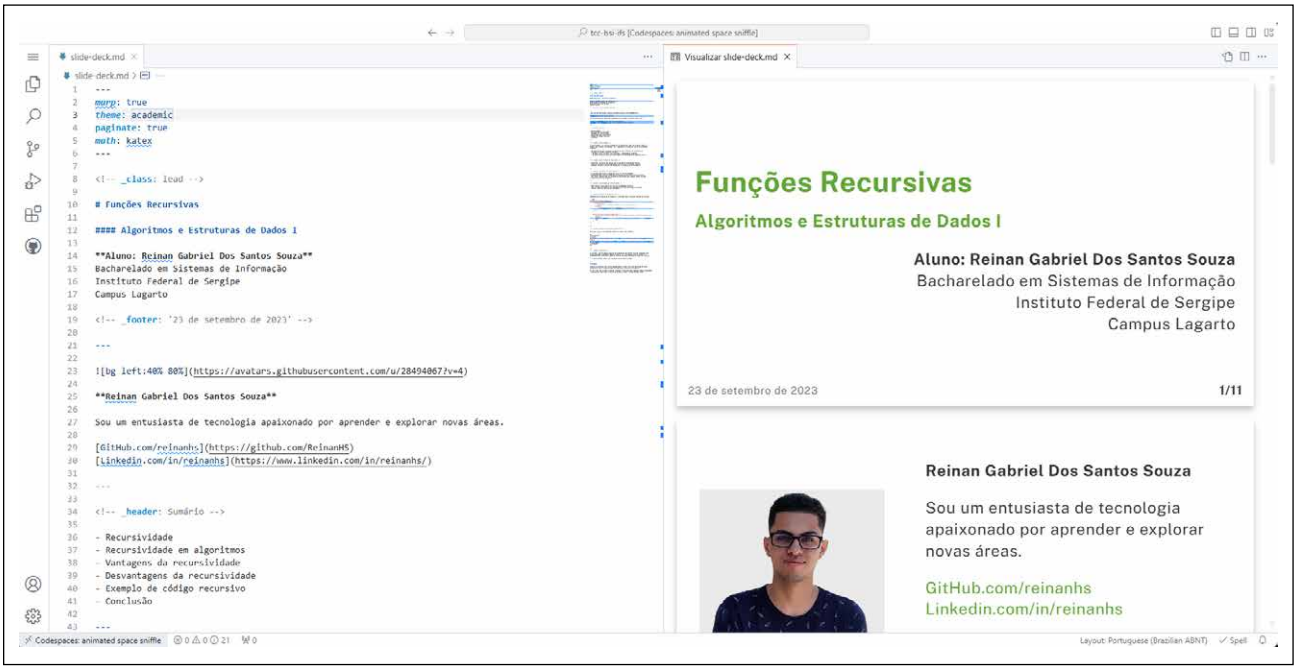
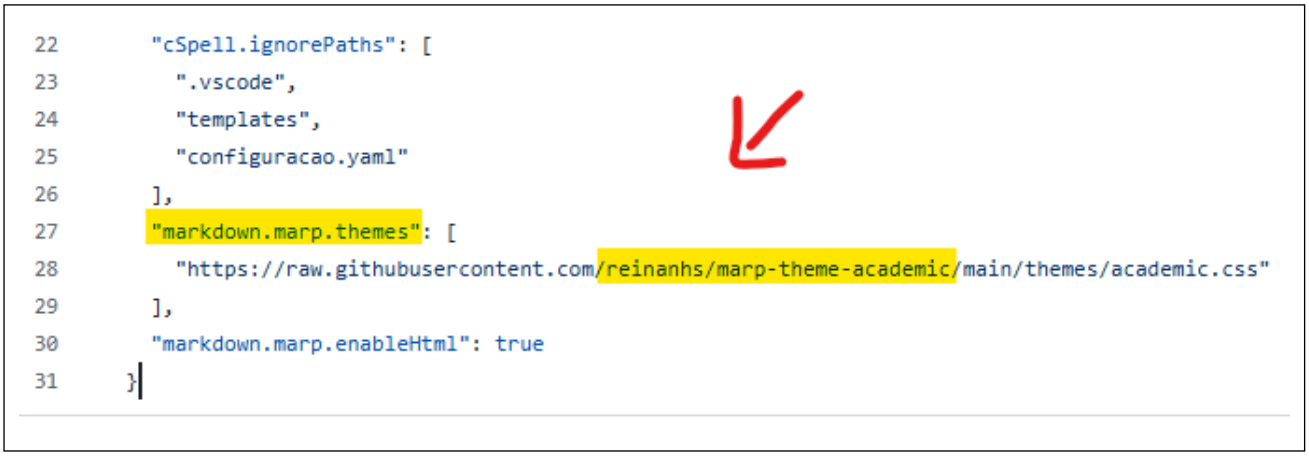


Figure 5. Configuration for IFS Marp.



- **Code Checkout**: The pipeline begins by checking out the latest code from the main branch, ensuring that all recent changes are available for compilation.
- **Creation of the dist-slide Directory**: A directory named dist-slide is created to store the compiled files.
- **Theme Download**: The custom theme is automatically downloaded to ensure the slides follow the desired visual standard.
- **Compilation to HTML**: The first compilation step converts the Markdown file (slide-deck. md) into an HTML presentation.
- **Compilation to PDF**: The pipeline generates a PDF version of the presentation, which is recommended for printing or easy sharing. Compilation to PPTX: The slide is converted into a PPTX format, which makes it compatible with Microsoft PowerPoint and allows interactive editing.
- **Publishing of Artifacts**: All generated files are stored and available for download in the repository after compilation. The files are retained for one day, ensuring students have access to the generated materials while optimizing storage usage in the repository.

Collaborative Workflow via GitHub

In addition to enabling process automation, such as the compilation and publication of slides through CI/CD pipelines, this study also proposes an optimized workflow for the collaborative creation of educational materials. Drawing on best practices in software development, the proposed workflow leverages GitHub features to ensure that collaborators can edit and contribute in an organized and efficient manner. In this model, all proposed modifications to the materials go through a structured discussion and review process, ensuring that only thoroughly evaluated contributions are integrated into the final document. This approach enhances the quality of the produced content and fosters a controlled and transparent collaboration environment.

In the context of the proposed collaborative workflow, GitHub plays a key role in the organization and shared editing of documents. The platform offers features like Issues and Pull Requests, which can manage the development of educational materials or academic projects. For example, when discussing the choice of a title for an educational material, the student can open a specific Issue, encouraging structured interaction with their advisor. This space allows for sharing ideas and arguments and clarifying doubts until a consensus is reached. Once a decision is made, a Pull Request can be created to formalize the change and linked to the corresponding Issue, allowing it to be closed in a documented and transparent manner.

Figure 6 illustrates this dynamic between student and advisor regarding the project title

selection. During the process, both parties can leave comments and suggestions, with automatic notifications for every update. This approach promotes collaborative interaction and creates a detailed and auditable history of decisions made, fostering an efficient and organized workflow.

When dealing with software development, whether in an individual project or within a team, managing a complex scope of tasks to be implemented is a common challenge. In this context, GitHub Issues is a handy feature that provides visibility and efficiency in communication between team members. Issues can be used to track bugs, enhancements, or other project demands [11].

The proposed method enables active participation from all involved in the discussion and review of relevant information, ensuring that each decision is well-founded. One feature that enhances this process is the visualization of Issues through a Kanban board, which makes it easier to track the progress of tasks related to academic work in a clear and organized manner.

The student and the advisor can access a structured view of task management through the Kanban board integrated into GitHub. This board allows them to monitor the status of tasks in real time, with cards being moved between columns to represent the progress of activities. Additionally, the history of changes is automatically recorded, providing complete traceability of the actions taken. This approach not only promotes transparency and control over the project's development but also offers a powerful visual tool for organizing and prioritizing tasks, helping efficiently manage the academic work.

The GitHub Kanban Board is a powerful tool that significantly contributes to the organization of projects, allowing for visual and efficient workflow monitoring. With the Kanban Board, columns can be created to represent different stages of the workflow process, and cards can be moved to indicate the progress of each task.Using this tool makes it easier to visualize which tasks are waiting to be started, which are in progress, and which have been completed. This clarity

Figure 6. Discussion via GitHub issue.

helps identify bottlenecks and increases team productivity, giving all participants an overview of the current project status [12].

GitHub also offers robust version control, another key element for the success of collaborative projects. In this process, the student forks the official version of the educational material, creating an independent repository where changes can be made freely. During the creation or review of files, modifications are systematically recorded in commits, documenting the progress of the changes made.

When the changes are ready for review, the student can submit it as a Pull Request (PR), automatically notifying the advisor or other collaborators with review permissions. GitHub's review interface is designed to facilitate the analysis of these changes, allowing for detailed comments on specific lines of code and the overall context of the Pull Request. This functionality fosters clear and objective communication and enables cross-references between Pull Requests, Issues, and Authors, enhancing interconnection and traceability within the project. Once all requested modifications have been made, the repository maintainers, who have elevated permissions on GitHub, approve the Pull Request and merge the changes into the official version of the material. This writing and review process can be entirely conducted through GitHub using a web browser. Adopting this strategy shows efficiency in the writing process by providing unrestricted but structured editing, intelligently limiting which authors or sections can be edited. Additionally, each commit is associated with a specific author, making it easier for collaborators to recognize individual contributions [13].

Managing Updates with Changelog and Releases

Building on the collaborative version control and review practices discussed earlier, it is crucial to adopt strategies that ensure the traceability and organization of the changes made throughout the project. Maintaining a changelog and using the Releases feature on GitHub is essential in this context. These tools document the changes made and structure communication among the contributors, ensuring clarity and accessibility regarding the progress of the material's development. The changelog is a detailed and systematic record of all significant changes made to the project, such as the development of new features, performance improvements, bug fixes, and other relevant modifications [14]. This documented history provides an overview of the project's progress and directly connects to previously discussed version control and collaboration features like Pull Requests and Kanban boards.

The integration of Marp with platforms and tools that enable CI/CD offers educational content creators a quick, flexible, standardized, simple, and maintainable way to create educational materials while providing access to different formats. The workflow presented in this article enables an automation process that transforms the creation and distribution of educational materials, offering greater efficiency and consistency in content publication. Using Marp in conjunction with CI/CD tools has significantly enhanced the process of creating slides for lessons.

Analysis and Conclusions

The integration with CI/CD allowed slides to be created, viewed, and automatically published on platforms like GitHub Pages. This ensures that any modification made to the materials is immediately reflected in the various versions made available to readers. This automated process eliminates the need for manual updates, reducing human error and saving time for the authors.

Moreover, using Markdown syntax significantly simplifies the creation of slides, allowing editors to focus on the pedagogical content. At the same time, the formatting and publishing stages are managed automatically through CI/CD pipelines. This approach removes the need for

advanced technical skills in creating professional presentations, making the process more accessible and efficient. Additionally, Marp's compatibility with formats like HTML, PDF, and PPTX offers essential flexibility for distributing materials across various platforms and devices, broadening the reach and promoting inclusivity for students with different access needs and preferences

Figure 7 presents a practical example of educational material on the Java coding of the Fibonacci sequence automatically published on a GitHub Pages HTML page. This example demonstrates the tool's potential and possibilities. This approach not only demonstrates the tool's flexibility but also its ability to integrate technical programming concepts into visual and didactic materials, offering a richer and more engaging learning experience. By making the content available quickly and organized, the tool promotes more effective interaction between teachers and students, strengthening the educational process.

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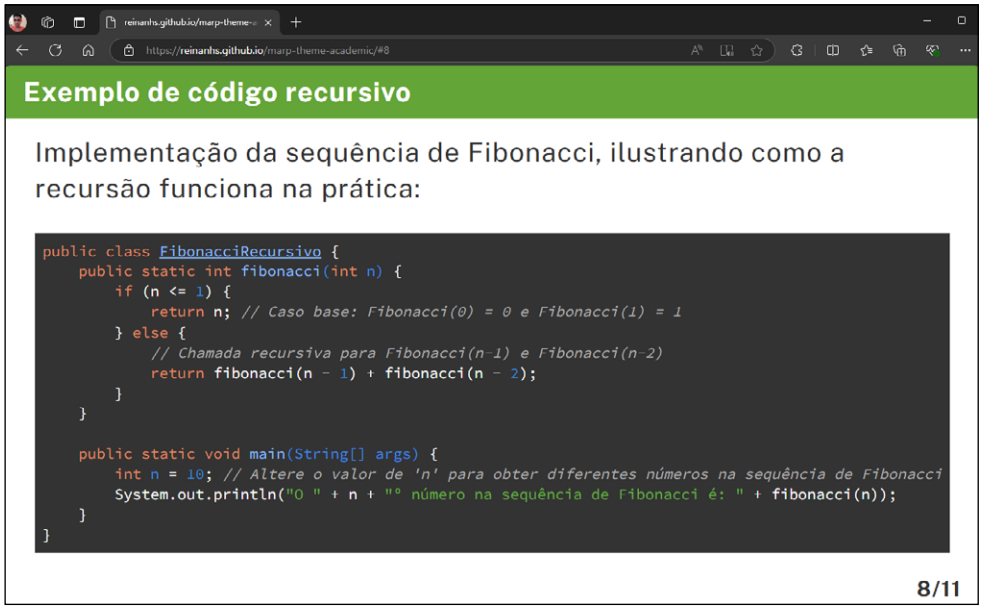
Figure 7. Educational material on GitHub Pages.



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