GitHub Classroom in Actuarial Education: A Modern Approach to Collaborative Learning

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Abstract: *In the digital era, cloud-based technology has profoundly transformed our daily business activities. Embracing this shift towards collaborative learning, this paper explores the innovative integration of GitHub Classroom into actuarial education, highlighting its transformative impact on collaborative learning, project management, and real-world application. Through the lens of the Society of Actuaries (SOA) Research Challenge, we discuss how this platform streamlines assignment processes while also enhancing transparency, accountability, and real-time collaboration. By adopting this modern approach, students' learning experiences have been transformed, emphasizing not only analytical proficiency but also teamwork skills and storytelling acumen. These qualities are all important in the evolving landscape of actuarial studies.*

Keywords: *Actuarial Education, Collaborative Learning, GitHub Classroom*

1. Introduction

The landscape of actuarial education is evolving, with a growing emphasis on integrating modern tools and methodologies to better prepare students for real-world challenges. Actuarial studies involve the study of mathematics, statistics, accounting, economics, finance, and their application to long-term financial management, particularly in insurance and superannuation, as well as in other financial services such as funds management and banking. Actuaries are experts at evaluating both risks and opportunities. They apply a combination of financial, economic, and data analytic approaches to solve a wide range of practical business problems. As the field evolves, a growing number of actuaries are branching into data science and risk management practices.

1.1. Actuarial Education

Given the interdisciplinary nature, actuarial education shares key characteristics with educational principles in mathematics, statistics, finance, economics, and business. This cross-field synergy leads to building a unique blend of both quantitative modeling skills and business acumen. As the demand for these skills is growing globally, there is an increasing need for innovative teaching methodologies. These methods should not only impart theoretical knowledge but also prepare students to tackle the real-world challenges inherent in the actuarial profession.

To better prepare students for real-world tasks, it is essential to cultivate teamwork skills. This involves the ability to interact and collaborate effectively with others to achieve a common business goal or complete a shared project. Teamwork benefits the business education process by enhancing students' sense of community, making teamwork more purposeful and valuable than individual projects, both within teams and across the entire class [1]. This paper explores the incorporation of GitHub Classroom into actuarial education as a modern collaboration and version control tool. It highlights the enhanced ability of students to showcase their team's websites globally, the peer support within the student community, and how cloud-based version control eases the scalability of managing groups within large classes.

1.2. GitHub Classroom

At its core, Git is a version control system, a primary tool designed to facilitate collaboration among individuals and teams on various projects. Building on this foundation, GitHub offers an online platform

to host these Git repositories, inherently promoting real-time collaboration [2]. The true potential of GitHub in an educational setting is realized through GitHub Classroom. This platform extension specifically tailors the strengths of GitHub to the academic environment. For example, GitHub Classroom is optimized to streamline the management of assignments, enhancing the efficiency of distribution, submission, and grading processes, as evident in the statistical education [3]. It also provides complimentary cloud repositories for teams, allowing students to work on shared projects without the burden of infrastructure costs. The platform's capability to host static pages also allows students to present their work in a polished and professional manner. Moreover, it offers students hands-on experience with a platform that is widely recognized and used in the professional domain.

2. Methods

Incorporating GitHub Classroom into actuarial education offers a significant intersection of modern technology and traditional pedagogy. There is an undeniable learning curve for both educators and students, especially for those who are familiar with conventional Course Management Systems (CMS). Nevertheless, as students and educators become proficient in navigating the version control environment and mastering essential commands, the implementation of GitHub Classroom becomes increasingly straightforward. This adaptation can be further enhanced through a self-iterative learning process.

One of the core conceptual frameworks in actuarial studies is the actuarial control cycle (Figure 1). This is a structured process that sequentially involves defining the problem, developing a solution, and reviewing and monitoring the experience. The iterative nature of the framework is further emphasized when the monitoring phase often leads to the identification of new challenges, which then feed back into the initial problem definition.
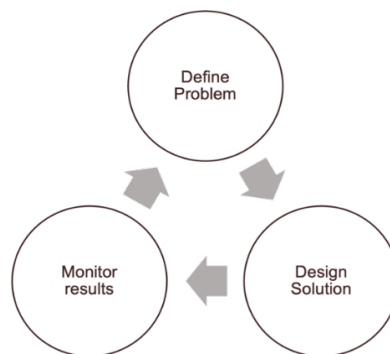

Figure 1: Actuarial Control Cycle.

The implementation of GitHub Classroom can be visualized in a cyclic fashion (Figure 2), which illustrates the feedback loop of GitHub Classroom. The process initiates by familiarizing students with GitHub functionalities, often utilizing the platform's provided starter code. After this, assessments are designed and distributed to emphasize actuarial practical applications. By incorporating both formative and summative evaluations, the instructor ensures a comprehensive assessment of skills and knowledge throughout the course. Continuous feedback, serving as the concluding step, not only pinpoints knowledge gaps from prior assignments but also fosters active learning. This approach resonates with the actuarial control cycle's focus on iterative problem identification and resolution.
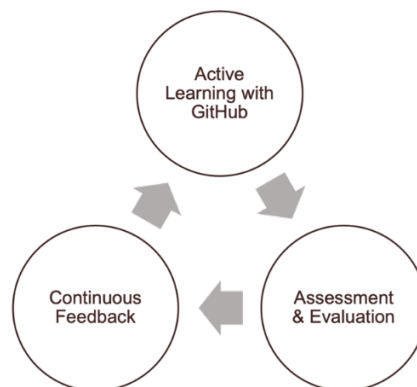

Figure 2: GitHub Classroom Feedback Loop.

In essence, the implementation of GitHub Classroom provides students with a dynamic platform to sharpen their problem-solving skills in a cloud-based environment. By framing challenges and solutions within real-world contexts, it provides educators and students with ongoing opportunities to improve their teaching and learning methods.

3. Case Study Findings

In the actuarial control cycle class, the Society of Actuaries (SOA) Research Challenge was selected as the course group project. This choice presented an opportunity to integrate GitHub Classroom into the actuarial educational framework. The SOA Research Challenge is a prestigious annual global actuarial competition hosted by the Society of Actuaries, the leading actuarial professional organization based in North America. It offers students a platform to apply their theoretical knowledge to practical real-world scenarios.

The integration of GitHub Classroom into the Actuarial Research Challenge brought forth numerous benefits. Firstly, it streamlined the research process by creating an organized, version-controlled environment for storing data and models. Before distributing assignments, the instructor provided participants with starter code and resources in the organization repository, which included an introduction to GitHub fundamentals. This arrangement enabled students to fork the main repositories and start their group assignments.

Furthermore, the use of team repositories enhanced transparency and accountability, ensuring that both individual and collective contributions could be easily traced through the commit history. Teams often face challenges with 'free-riders' who contribute minimally [4]. This approach addresses the longstanding challenge in teamwork: measuring collaborative performance. Historically, students have found it difficult to rate individual contributions, especially when participation is unequal. However, by examining the commit history, contributions become clear and provide quantifiable data for teachers to assess. Additionally, our analysis indicated that groups in which all members actively engaged in GitHub Classroom consistently outperformed those with only proportional participation by a margin of 10-15% in project report scores. This observation is consistent with the findings that graphical views and news feeds on such platforms not only enhance the process visualization but also serve as effective tools for monitoring student progress, activity, and engagement [5]. The platform facilitated real-time collaboration among students, simplifying the analysis and refinement of their solutions. It also provided a space for continuous dialogue within the class community, encouraging iterative improvements in their projects.

For the challenge content, teams of two to five students were given the "Relocation Social Insurance Case Study" based in the fictitious country of Storslysia [6]. With its diverse geography, this country is increasingly threatened by climate-related catastrophes. The primary goal of the challenge was to devise a social insurance program that addresses the financial consequences of large-scale displacements caused by these climatic events. The deliverables included a detailed report outlining the program's objectives, design, pricing structures, associated costs, and potential risk mitigation strategies. To aid in a thorough quantitative analysis, teams were provided with a comprehensive dataset that covered housing and demographic data, historical weather records, economic indicators, and projections related to future emission scenarios and expected climate impacts.

Upon completing the research case study, each student group was encouraged to develop a free GitHub Page site from their repositories. This initiative allowed students to decide which elements of their work to showcase, emphasizing the potential of these pages as platforms to share their analytical methods and modelling results with a wider audience. The students' enthusiasm for showcasing their accomplishments was evident, with 60% choosing to engage in optional peer feedback sessions throughout the course. This active involvement was further amplified by the interactive features of GitHub Classroom. These observations reinforce the concept presented [7] that cooperative learning enhances process gains, promotes more transferable learning, and results in heightened engagement compared to individualistic learning.

After the students' triumph in the SOA research challenge, their exemplary work caught the attention of universities globally. Many educators have expressed interest in these repositories, incorporating them as teaching examples and resources in their respective courses. GitHub Classroom is especially advantageous for business students, enabling them to showcase their analytical prowess and enhance their storytelling abilities — a key learning objective in business education. As Student A mentioned in the course evaluation, *"The experience provided valuable insights into the actuarial field, and I look forward to participating in similar challenges in the future if possible"*.

A significant 94% of students recognized the benefits of the course project. Integrating GitHub Classroom enhances business students' technology literacy. By utilizing real-world tools in an educational context, students can directly apply their theoretical knowledge. The ever-evolving nature of technological tools implies that students will need to continually update their skills. Introducing them to platforms like GitHub Classroom early on fosters a lifelong learning mindset, ensuring they remain adaptable and relevant in a swiftly changing industry. While GitHub has long been regarded as a toolbox for software engineers and coders, the increasing demand for data skills in the workplace suggests it can also benefit business students, equipping them with the evolved skills they need for the future.

4. Challenge and Discussion

While many students appreciated the platform's collaborative nature, some felt there was an initial learning curve. As Student B mentioned, *"At first GitHub Classroom was confusing. But after spending some time with it, I saw its benefits for our group work."* One of the key challenges that students face at the beginning of the project is setting up their repositories. Although they might be familiar with the concept of repositories, many are new to the Git version control system. To address this challenge and ensure that students can effectively collaborate and manage their work, we provide a table of essential Git commands (Table 1). These commands are specifically designed for the typical needs of the Actuarial GitHub Project, aiming to simplify the learning curve for students.

Table 1: Fundamental Git Commands for the Actuarial GitHub Project

Command	Description
git init	Initialize an existing directory as a Git repository
git clone [url]	Retrieve an entire repository from a hosted location via URL
git branch [branch-name]	Create a new branch at the current commit
git checkout [branch-name]	Switch to another branch
git add [file]	Add a file as it looks now to your next commit (stage)
git commit -m "[message]"	Commit your staged content as a new commit snapshot
git merge [branch]	Merge the specified branch into the current one
git push [alias] [branch]	Push local branch changes to the remote repository
git pull	Fetch and merge any commits from the tracking remote branch

5. Conclusion

This paper offers an innovative angle by emphasizing the role of collaborative learning for business students using GitHub Classroom in actuarial education. Historically, actuarial education has relied on individual assignments and conventional teaching tools. Such methods may not fully meet the ever-changing demands of the modern business world. By integrating GitHub Classroom into the curriculum, we create a bridge that transforms theoretical actuarial concepts into practical applications suitable for the contemporary business field.

The success stories from the SOA Research Challenge underscore the platform's effectiveness. By fostering collaboration, GitHub Classroom not only enriches personal learning experiences but also draws upon the collective wisdom, enhancing overall group achievements. The platform's transparency facilitates real-time feedback, making the learning process more interactive and adaptive. Moreover, its focus on collaboration equips students for the teamwork and project management challenges they will encounter in their future professions.

GitHub Classroom is more than just an educational tool; it reflects real-world business project management technologies. By introducing business students to this platform, educators effectively enhance the students' technological skills. In essence, by integrating such state-of-the-art tools into the educational framework, we are not merely improving the immediate learning experience. We are forging a future where graduates are prepared to be adaptable, technologically confident, and ready to navigate the intricacies of a rapidly evolving global landscape.

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