AGILE TEACHING STRATEGY FOR ONLINE CLASSROOMS

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This paper is focused on student management constraints in the online classroom and proposes modifications to teaching strategies to address them. It explores the organizational aspects of the education process and how to prioritize learning while mitigating distractions inherent to digital device use, such as multitasking, tab switching, and smartphone doom surfing. The paper is based on 9 years of High School Big Data and AI Challenge Program carried out by STEM Fellowship. It seeks to contribute to the discourse around students who are used to any time/anywhere/any device access to information by proposing a transition from traditional classroom management replicated online to a novel teaching strategy, inspired by principles from Agile methodologies in various industries. Such a shift has the potential to advance educational practices, enabling educators to create learning environments that are better equipped to meet the diverse needs of Generation Z and Alpha students in online classes.

KEY WORDS: learning management, artificial intelligence (AI), high school, interdisciplinary

1. INTRODUCTION

STEM Fellowship (https://stemfellowship.org/) is a Canadian charitable organization focused on advancing education through open data and artificial intelligence (AI)-based inquiry and knowledge acquisition. The organization runs an annual semester-long, interdisciplinary online learning program that helps high school students connect traditional science, technology, engineering, and mathematics (STEM) courseware with open data analytics and machine learning (ML) inquiry. This program draws in 400–500 students annually from across the country and even internationally.

The online delivery of this program encounters challenges in student and classroom management that are as significant, if not more so, than those faced by other electronic-

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learning (e-learning) high school programs. Due to the program's interdisciplinary and extracurricular nature, traditional motivators such as grades and credits are not available as tools to encourage learning. Additionally, local teachers may not always have the expertise to guide students in computational science and ML. These factors have driven us to explore alternative teaching strategies to ensure the program's success and the achievement of its learning objectives.

2. LITERATURE REVIEW

The learning environment and management of the learning process are critical aspects of effective teaching, influencing student learning outcomes, behavior, and overall knowledge and skills acquisition dynamics. This brief overview of some of the key literature studies aims to synthesize and analyze scholarly perspectives on key principles of current in-person and online classroom management and learning strategies. By examining various theories, strategies, and empirical studies, this review seeks to provide better understanding of the place of Agile principles in student management and an environment conducive to learning.

One of the first publications regarding the efficiencies of the transition to Agile management of e-learning projects in a collegial university environment was presented by Doherty (2010), in which the need to engage with institutional strategic and organizational concerns in order to increase institutional capacity for e-learning was discussed. This work was further developed by Batista et al. (2013) at the Open University of Brazil.

The aforementioned sources did not extend beyond applying Agile principles to institutional project management improvements. It was assumed that traditional teaching strategies—as defined by the Canter & Canter (1976) assertive discipline model—are fully compatible with online learning. This was done despite the fact that emphasizing clear expectations, consistent consequences, and positive reinforcement as fundamental elements in fostering a structured yet supportive classroom climate means something entirely different online compared to in person. Furthermore, the Dreikurs (1968) democratic classroom governance, where students actively participate in decision-making processes to promote a sense of responsibility and community, also takes on a drastically different hue online, where social networks and chats become an inevitable part of the learning experience.

The significance of effective communication and relationship building in classroom management cannot be overstated. Wong & Wong (2009) underscored the importance of building positive teacher–student relationships through rapport, respect, and empathy. Furthermore, the Glasser (1998) choice theory highlighted the role of connecting with students' intrinsic motivations, emphasizing the teacher–student relationship as a crucial factor in student behavior and engagement. In the context of online learning, it is essential to add to this relationship the powerful influence of online communities, which play a third-party role in teacher–student relationships through messages, rating sites, and social network status.

Preventative approaches play a pivotal role in managing classroom behavior. Marzano & Marzano (2003) introduced strategies such as establishing and teaching classroom rules, providing cues and prompts, and employing engaging instructional strategies as proactive measures to minimize disruptions. Additionally, the use of positive behavioral interventions and supports emphasizes proactive planning, teaching, and reinforcing positive behaviors (Sugai & Horner, 2009). Unfortunately, replicating classroom rules, engagement cues, and prompts designed for in-person settings has limited effectiveness in online classes, where students are fully exposed to tab switching and smartphone doomscrolling.

Classroom management and teaching strategies also encompass responsiveness to diverse student needs in order to ensure a conducive learning environment that maximizes student engagement, learning, and holistic development. Tomlinson & Allan (2000) advocated for differentiated instruction, emphasizing the importance of modifying content, process, and product (i.e., learning software) to accommodate varying student abilities and learning styles. This approach should reasonably include the information handling and knowledge acquisition habits of the data-native generation of students.

2.1 Problem Statement

The provided literature overview demonstrates that traditional learning strategies and the central role of a teacher are implicitly based on the assumption of a physical classroom environment. In the case of online learning, the physical environment of each individual student can vary widely, from a desk to a bed or any place in between. Additionally, an online classroom is merely a simulation of a common space and is effective only to the extent of students' engagement with the class at any particular moment.

While traditional classroom management methods still provide the foundation for educational practices, they exhibit limitations in accommodating the diverse and dynamic needs of any time/anywhere/any device (ATAWAD) learners in both physical classrooms and online environments. According to Hadar & Ben-David Kolikant (2023), these traditional methods struggle to address the unique challenges posed by the digital landscape. For instance, traditional strategies often rely on physical presence and non-verbal interaction, which are not possible in an online setting. The variability in students' physical environments can affect their focus, participation, and overall learning experience.

Furthermore, the online learning environment requires new strategies to keep students engaged and accountable, given the ease with which they can become distracted by other digital activities such as tab switching and smartphone use. The simulation of a common classroom space online lacks the physical cues and immediacy that help maintain student attention and discipline in a traditional classroom. Therefore, there is a need to develop and implement innovative management and instructional strategies that are specifically designed for the online learning context in order to better meet the needs of today's digitally native students.

The leading industry project management approach for online working environments nowadays is the methodology employed in the Agile software program (Agile Management, 2001). This led us to investigate Agile and its potential usage in online classroom environments. Agile methodology, known for its flexibility and iterative processes, was well-suited to adapt to the diverse learning styles of ATAWAD students and allowed us to develop new teaching strategies combining teacher- and student-centric learning approaches. By employing Agile principles, educators can create more responsive and dynamic learning experiences that accommodate the integration of AI tools for effective online learning (Cohen, 2024). This approach not only addresses the limitations of traditional classroom management in the digital age but also enhances student engagement and accountability in the virtual learning environment.

2.2 Agile Teaching Strategy

Recognizing the extracurricular and interdisciplinary nature of the High School Big Data and AI Challenge Program, the STEM Fellowship team has developed a teaching strategy that leverages the best practices of Agile methodology. Our choice of Agile (Agile Management, 2001) stems from its origins in addressing the inefficiencies of linear and rigid management practices, which failed to effectively respond to changing requirements, technological advancements, and evolving customer needs in software development.

In February 2001, 17 programmers gathered at a ski resort in Snowbird, Utah, to explore ways to incorporate flexibility, collaboration, and iterative progress in software development. This meeting resulted in the *Agile Manifesto*, a foundational document outlining the core values and principles of Agile management, which include the following:

- Emphasizing people and collaboration by prioritizing effective teamwork over rigid processes or tools;
- Delivering functional results by focusing on creating value through practical outcomes rather than extensive documentation;
- Close collaboration with stakeholders by ensuring that the end product aligns with user needs, rather than adhering strictly to predefined requirements; and
- Incorporating flexibility and adaptability by accommodating change and evolving project requirements with a dynamic approach rather than sticking rigidly to a plan.

The STEM Fellowship team recognizes a strong synergy between modern software development (which often occurs in a remote format) and online learning. This realization led us to apply Agile principles to the organization of online classrooms and formulate new teaching strategies based on the following (Fig. 1):

- Emphasizing the importance of individual students by empowering each student with the ability to collaborate effectively as part of an online team;

- Prioritizing experiential learning by focusing on hands-on, impactful learning experiences that resonate with students, rather than relying solely on extensive instructional materials;
- Fostering collaboration by encouraging close collaboration within student groups, participation in online professional communities, and access to open science in order to ensure that students acquire the knowledge and skills they need to meet their expectations rather than just fulfilling formal learning requirements; and
- Recognizing student achievements by celebrating accomplishments that go beyond traditional learning plans.

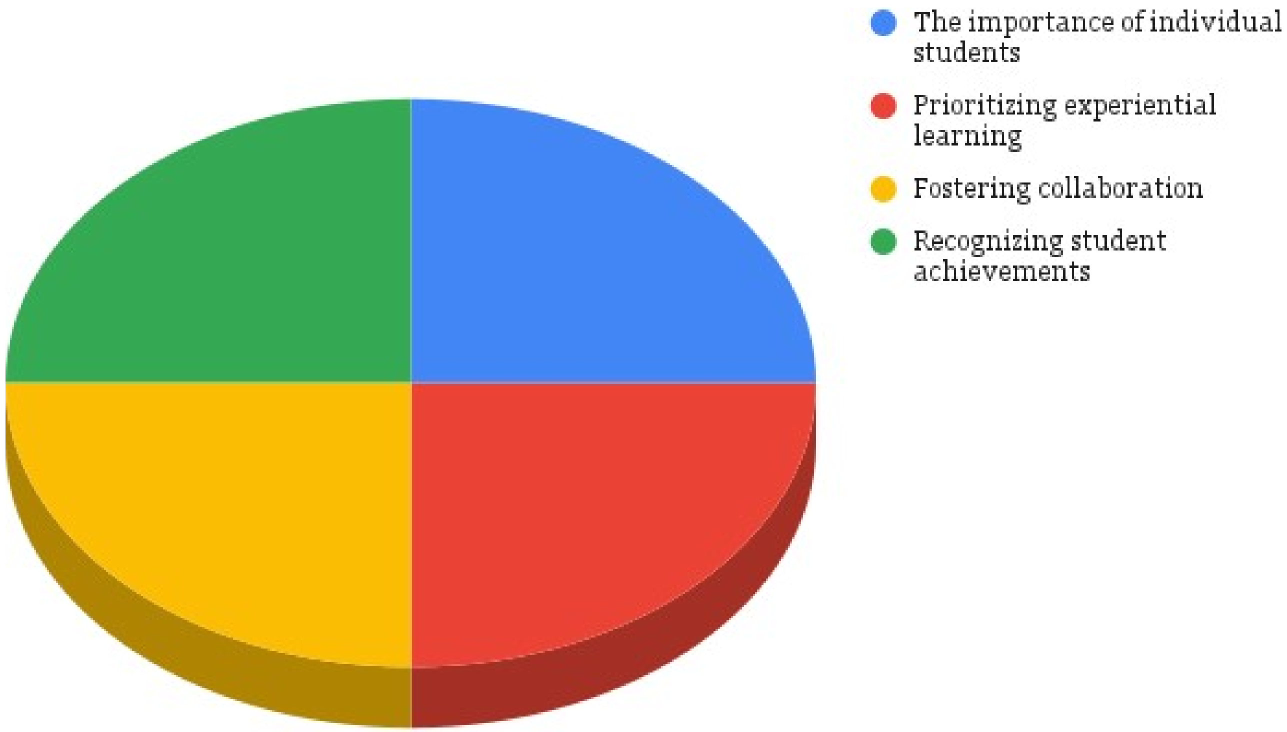

FIG. 1: Agile teaching strategies

Aligned with Agile teaching strategies, STEM Fellowship's annual High School Big Data and AI Challenge emphasizes iterative learning through small-group collaboration, teamwork, communication, and interdisciplinary knowledge exchange. Instead of following a rigid, one-path curriculum, students have the flexibility to choose the sequence and elements of theory and assignments, allowing them to work at their own pace and in their own ATAWAD manner.

The High School Big Data and AI Challenge online class, consisting of approximately 500 students, is organized into groups of 4–5 members who share similar online interests rather than geographical locations. The program offers a blend of synchronous and asynchronous learning, which includes the following:

- Synchronous learning through optional online workshops that cover the use of open data, analytical or ML methods, and scholarly writing;
- Asynchronous learning involving self-paced CISCO Networking Academy (https://www.cisco.com/c/m/en_sg/partners/cisco-networking-academy/index.html)

online data science courses that provide additional value through structured linear learning and industry certifications;

- Asynchronous learning, where students work in groups to define their research and future manuscript topics based on the analysis of a pool of open-access publications related to the program's theme research papers, which is offered to the entire class with recommendations to groups to find more on their own;
- Asynchronous learning, in which student groups search for relevant open data to support their ideas and experiment with various analytical and ML methods introduced in the program or discovered independently; and
- Asynchronous learning, where student groups work on their project reports starting with a literature review that is reviewed with feedback and critiqued.

The integration of synchronous and asynchronous learning is structured according to Agile teaching strategies, guiding student groups through multiple iterations to assess the relevance of their chosen data and deepen their understanding of the methods they employ (see the sample lesson plan given subsequently). Agile practices also help ensure that groups meet the program's deadlines and deliverables.

The 2023–2024 academic year program challenged participants to leverage generative AI and data cybersecurity to conserve and foster local biodiversity (STEM Fellowship, 2024a), allowing student teams to define their topics of inquiry and data sources. We utilized Google Classroom as our learning management system to organize the online classroom and implemented Agile teaching strategies within student teams, delivering data science and scholarly communication workshops, while facilitating inquiry-based learning.

A typical weekly team meeting followed this lesson plan (Fig. 2):

- Sprint planning (10 minutes):
    - Outline the plan for the meeting, focusing on discoveries related to local biodiversity made through AI and data analysis.
    - Provide brief updates on progress and any challenges encountered.
- Daily stand-up (5 minutes):
    - Brainstorm new AI prompts, identify potentially useful data, and consider possible analysis techniques.
    - Identify knowledge/skills to be learned and relevant online audio recordings of lectures.
    - Seek advice from a teacher.
- Mini-lecture (15 minutes):
    - Engage with program subject matter or data analytics workshops.
    - Find and watch research presentations on YouTube.

- Gallery walk/local biodiversity inquiry (20 minutes):
    - Experiment with AI prompts and plan data analytics experiments for the week.
    - Present findings, highlighting the significance of AI and data analysis results.
- Sprint retrospective (10 minutes):
    - Discuss how the findings contribute to or challenge the initial hypothesis.
    - Set up AI and data analysis inquiry plans for the coming week.

FIG. 2: Agile lesson plan

By leveraging AI and open data resources, the program facilitates hands-on, experiential learning. Students engage in real-world problem solving focused on sustainable development problems, utilizing data-driven insights and AI tools to analyze, interpret, and innovate. This integration mirrors the Agile principle of embracing change and harnessing technological advancements that enhance the learning experiences well presented in the abstracts of this year's projects (STEM Fellowship, 2024b). For instance, the research project, *Analyzing Urban Heat Islands and Their Impact on Monarch Butterfly Populations* (Khawar et al., 2024), conducted by a student team from Hillfield Strathallan College in Hamilton, Ontario, Canada, exemplifies an ideal high school interdisciplinary project. It exhibits enhanced critical thinking, problem-solving skills, and a deeper understanding of data science, AI concepts, and their ethical implications.

Agile teaching strategy places different requirements on a teacher, who now focuses on encouragement, teamwork, and accountability in reaching learning expectations. The teacher facilitates communication within the groups and brings in the latest research and innovation to align with the learning goals and student needs. By doing so, teachers create a dynamic and supportive learning environment that adapts to the unique requirements of each student, fostering a more engaging and effective educational experience.

Additionally, the program nurtures essential skills such as data analysis, collaboration, and adaptability, effectively preparing students for future workplaces that demand familiarity with Agile management. The success and outstanding learning outcomes achieved by all program participants suggest broader implications, advocating for a shift toward Agile teaching techniques in online learning and project-based studies. These techniques aim to improve both scholarly and applied learning outcomes while integrating emerging technologies into curriculum design for ATAWAD students.

3. CONCLUSIONS

The High School Big Data and AI Challenge Program presented both challenges and opportunities to develop new teaching strategies that address the limitations of traditional classroom management in online learning. By creatively rethinking Agile management from a pedagogical perspective, we leveraged technology and AI in learning, fostering adaptable learning experiences. The exceptional learning outcomes of the program highlight the potential for transformative change in teaching strategies for online education, signaling a shift toward more dynamic, technology-driven, and student-centered learning models.

One of the most interesting outcomes of this new teaching strategy is the different group work dynamics that develop strong peer support and connections. The combination of Agile methodology and student agency in the learning process resulted in all of the group members being equally motivated to work and acquire knowledge, assisting each other in achieving accelerated and advanced results.

By implementing Agile principles in online teaching strategies, educators can create a more engaging, adaptive, and effective learning environment for ATAWAD students, better preparing them for the challenges of the modern world.

The key approaches to improving online teaching include the following:

- Iterative learning, in which education can be structured into iterative phases that allow students to learn in small increments and take an active part in regularly reviewing and adapting their understanding;
- Collaborative learning that emphasizes teamwork, communication, and collaboration among students, in which group projects, discussions, and peer-to-peer learning are common strategies;
- Adaptive and flexible methods that recognize each student learns at a different pace and in different ways—Agile education encourages adaptability in teaching methods to cater to diverse learning styles and needs;
- Feedback-oriented approaches that provide continuous feedback loops between teachers and students and facilitate ongoing improvements in the learning process, in which the assessments are used not only for grading but also for providing insights for refinement;
- Problem-based learning that encourages students to tackle real-world problems, fostering critical thinking, creativity, and problem-solving skills;
- The Scrum methodology (Scrum, 2020), a specific Agile framework, can be used by educators to structure learning activities into sprints, setting short-term goals and reviewing progress regularly;
- Technology integration of Agile teaching strategies that often leverage technology to facilitate communication, collaboration, and access to learning resources;
- Student-centric approaches that focus on the needs and interests of students, allowing them to have more autonomy and ownership over their learning journey;
- Continuous improvement of practices to encourage both teachers and students to continuously reflect on their methods and outcomes, aiming for continuous improvement; and
- Embracing change by acknowledging that the learning environment is dynamic and adapting to changes in the curriculum, technology, and student needs using Agile teaching strategies.

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