Leveraging Generative AI Conversational Agents to Humanize Self-Regulated Learning

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Abstract

Behind the rising dropout rates in Higher Education lies a profound human crisis: first-year students often lose their "inner compass" during the vulnerable transition to higher education. While Self-Regulated Learning (SRL) is the engine of academic resilience, a "paradox of silence" exists: struggling students are the least likely to engage with long questionnaires designed to help them. This research moves from "academic assessment" to "empathetic conversation" using a Design-Science Research (DSR) framework. It is proposed that a Generative AI-based "virtual companion" could replace "dry" surveys with micro-interactions. By adopting distinct AI personalities (e.g., The Goal-Setter, The Time-Keeper), the system delivers low-friction, bias-free mentorship via a familiar digital platform. The hypothesis of the research is that this informal, human-centered dialogue will foster the honesty and consistent engagement that traditional tools lack. By automating the inferential measurement of SRL competencies, the tool provides immediate, personalized feedback. Ultimately, this work seeks to transform "intervention" into a supportive dialogue, building a scalable bridge to academic success and ensuring that no student has to navigate the "learning to learn" journey in isolation.

Keywords

Education, academic resilience, dropout, self-regulated learning, chatbot, generative artificial intelligence, conversational agents

1. Introduction: The Inner Life of the Learner

The concept of Self-Regulated Learning (SRL), which gained momentum in the 1980s, is essentially the study of how we steer our own lives [1]. As Parveen (2023) notes, self-regulation is that quiet, internal compass that keeps us moving toward our goals even when our environment shifts or challenges arise [2]. In an educational setting, this becomes the "human engine" of learning. It's the difference between a student who feels overwhelmed by a syllabus and one who knows how to break it down into manageable steps. While early researchers like Zimmerman [3] and Pintrich [4] mapped out the mechanics of this process, focusing on effort, environment, and time, we have come to realize that SRL is deeply tied to a student's sense of agency. It is about how a person manages their own energy, their doubts, and their limited hours in a day.

1.1. The Vulnerability of the First Year

According to the report by the UNESCO International Commission on the Futures of Education, developing self-management capacity is an indispensable requirement for fostering resilience and lifelong learning in students [5]. It is not just about logic; it is about emotional resilience. Teaching a student to plan and organize is, in many ways, teaching them how to manage the anxiety of failure and tap into their own intrinsic motivation. When these skills are missing, we do not just see lower grades: we see students lose their connection to their education entirely. We see this most painfully at the School of Telecommunication Engineering (EET) at the University of Vigo [6]. For many first-year students, the transition to university is a moment of profound vulnerability. We've observed a recurring pattern where motivation withers and performance drops, often leading to a quiet exit from the degree.

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This "dropout" is not just a statistical loss for the university's prestige; it represents a personal crisis for a young person who may feel they simply "weren't cut out" for the path they chose.

1.2. The Paradox of Asking for Help

In educational research, student silence represents a well-known challenge: the absence of observable participation does not necessarily imply the absence of cognitive engagement. This creates a "paradox of silence", where learning processes remain invisible to instructors and analytical systems [7, 8, 9, 10]. To help these students, we first must "see" them. But here we encounter a psychological paradox. Traditionally, we use tools like interviews, diaries, tests, MSLQ questionnaires to measure how students are doing [11]. However, a student who is already feeling unmotivated or anxious is unlikely to sit down and answer dozens of intrusive questions honestly. Their responses are often filtered through their current mood or a lack of sincere self-reflection. They tell us what they think we want to hear, or they do not answer at all. Furthermore, being forced to answer a series of uncomfortable questions can cause additional stress and mental fatigue, hindering the educational process.

2. The Proposal: A New Dialogue for Learning

2.1. Previous Work and Identified Gaps

The research of Liz at EET [12] tried to use "Learning Analytics" to solve this, looking for digital footprints of success. But the tragedy of the data was that the very students we needed to help, the ones struggling most, were the first to stop participating. By the end of the year, two-thirds of the story was missing.

In a search for a more "human" way to communicate, Amr Adel ElSayed [13] experimented with moving the conversation to social network Facebook. By breaking the questions into small, daily interactions in a familiar digital space, he tried to meet students where they felt safe and unhurried. This approach allowed for more honest reflection, but it created a massive burden for the researchers. Because the feedback was prepared manually, there was a delay. In the fast-paced life of a struggling student, feedback that arrives a week late is often a missed opportunity for change [14].

What we have learned is that an unintentional intervention often backfires. When there is no empathic connection with a learner the process of learning is perceived as a doctrine rather than a natural evolution. When a student feels observed or judged by a teacher or counselor, they often retreat [15, 16, 17]. We believe the future of student support lies in automation and anonymity.

By creating a system that can listen, analyze, and offer feedback instantly and without bias, we can turn a stressful "assessment" into a friendly, enriching conversation. We intend to move away from the "authority figure" and toward a supportive digital presence - one that encourages students to be honest with themselves so they can find their own way back to success.

An earlier conceptualization of this research was presented at the SIIE2024 Conference/Doctoral Consortium [6] and SIIE2025 [11]. While the initial work established the technical feasibility of using Generative AI for Self-Regulated Learning (SRL), this current study represents a significant evolution in both philosophy and methodology.

Specifically, we have moved beyond the broad categorization of educational chatbots to focus on the "Paradox of Silence" - the phenomenon where the most vulnerable students are the least likely to engage with traditional assessment. This version introduces a novel Learning Analytics (LA) part that interprets temporal patterns and interaction depth as "empathy triggers". By shifting the focus from mere automation to a human-centric dialogue, this work explores how "digital intuition" can bridge the emotional gap in first-year engineering education, a dimension not previously detailed in the original proposal.

Based on the identified challenges, the research presented in this paper proposes a shift in how we attend students. This research is part of the doctoral research of the author, Nina Yarovenko Kuzminykh,

and its goal is to move beyond static assessments and create a dynamic support system that helps first-year university students not only measure their SRL skills but actively mature through them.

2.2. From Questionnaires to Conversations

The heart of this proposal is the use of Generative AI conversational agents. We believe that the traditional "loss of enthusiasm" of students occurring while faced with long, dry surveys can be solved by changing the medium. Instead of a formal test, we envision a system that feels like a natural extension of the student's digital life.

Rather than asking a student to sit down and answer one hundred fifty direct questions at once, the system will deliver "micro-interactions" - small, thoughtful portions of a conversation spaced over time. To make this feel human and engaging, we will design the chatbot with distinct personalities, each representing a different facet of self-regulation, for example:

- `The Goal-Setter:` A person focused on planning and vision.
- `The Time-Keeper:` A friendly guide for managing time and avoiding burnout.
- `The Inner Critic/Coach:` An agent designed to help students navigate anxiety and self-reflection.

By giving these strategies names and faces, students can build relationships with the concepts themselves. We aren't just asking, "Do you plan your study sessions?" Instead, through lighthearted dialogue, the agent gauges the student's level of mastery based on their responses.

2.3. The Pulse of Engagement: Listening to the Unspoken

For a virtual companion to feel like a true ally, it has to do more than just follow a prompt; it also needs to "read the room." It is proposed to use just some of Learning Analytics (LA) not as a surveillance tool, but as a form of "digital intuition". It allows the system to observe those behavioral patterns that usually get lost in a digital interface, ensuring our support feels like a timely hand on the shoulder rather than a cold, mechanical notification. By quietly observing how a student moves through their day, analyzing login timestamps, session frequency and response delay, the companion acts as a protective servant for their well-being. Is focused on the "human rhythm" behind the data:

- `The Midnight Owl (Temporal Patterns):` There is a story behind when a student reaches out. For example, if we notice someone consistently logging in at 3:00 a.m., we aren't just seeing a timestamp, we're seeing a student who might be trading sleep for stress. By noting the duration and timing of these sessions, the AI can pivot its tone, offering a calming word to a night owl who might be spiraling into academic anxiety.
- `The Habit of Showing Up (Consistency Metrics):` We all know the feeling of slowly drifting away from a goal. By keeping a gentle eye on login frequency, the AI can spot the difference between a student who has found their groove and one who is starting to retreat. A sudden silence or lowering activity and participation is often a quiet call for help, a sign that the student might be losing their connection to learning.
- `The Breath of the Conversation (Interaction Depth):` Sometimes, what matters most is how much a student "breathes" during an answer. We look at response latency, the thoughtful pause before a reply, and the word count of their reflections. For instance, a two-word, hurried answer tells us they might be rushing or distracted. A long, detailed response, however, is a beautiful moment of genuine self-discovery and honest self-regulation.

This way, these analytics turn the chatbot into a more sensitive mentor. It learns when to push, when to praise, and when to simply be a steady, non-judgmental buddy for a student navigating the lonely stages of their first year.

2.4. The Role of the "Virtual Companion"

This thesis will evaluate whether modern Generative AI can truly create an experience that feels personal enough to improve participation rates. This "virtual companion" does more than just listen; it acts as an educational mentor. It identifies small signs of a student's struggle and immediately offers personalized tips to help them.

By using AI, the system can offer several benefits for people and institutions:

- `Empathy at scale:` Thousands of students are provided with a "listener" that never gets tired or impatient.
- `A safe space:` Removing the fear of judgment that often comes when speaking to a tutor or parent.
- `Freedom for educators:` This saves teachers and tutors time so they can focus on other important tasks, like providing high-level support, while the AI handles the daily "pulse-checks."
- `Flexibility:` A system that adapts to the student's unique rhythm, whether they study at midnight or at dawn.

2.5. Research Hypotheses and Questions

What we are exploring is a fundamental shift in student-institution communication. Our core belief is that informality can lead to honesty.

`The Measurement Hypothesis:` "An informal, objective AI chatbot will encourage more students to share their thoughts on learning habits than a traditional, direct questionnaire."

`The Intervention Hypothesis:` "Generative AI can translate complex learning strategies into agile, well-structured advice that speaks directly to a student's immediate needs, effectively reducing their academic struggles."

To validate this approach, this research will pursue three central questions:

1. `Impact:` How does this change in communication affect the student's emotional connection to their studies?
2. `Trust:` Will students view a digital agent as a reliable and secure space to share their academic vulnerabilities and worries?
3. `Utility:` Can the small details we learn in casual conversations be turned into useful feedback that helps improve performance?

In summary, the proposed "Learning to Learn" model has the potential to complement conventional surveys with the simplicity of conversation. The present study hypothesizes that the implementation of stress- and fatigue-reducing assessment process will assist students who are encountering difficulties in achieving success during their inaugural year of university studies.

3. Methodology

Our research is not just about building a tool; it's about understanding human struggle. To do this, we have chosen the Design Science Research (DSR) paradigm: a method that believes the best way to understand a problem is to build a solution for it [18]. By creating a "living" prototype, we can move beyond theory and see how real students interact with support in their moment of need.

Guided by the DSR cycle [19, 20], our process is an ongoing conversation between the researchers and the student experience:

- `Awareness of the Problem:` We begin by acknowledging the "silent dropout" - the student who feels invisible and overwhelmed. We recognize that our current tools aren't reaching them.

- `The Creative Spark (Hypothesis):` We suggest that a friendly, AI-driven dialogue can break the ice where formal surveys fail. This is our promise to find a more comfortable way for students to speak their truth.
- `Building the Companion (Artifact):` This is the heart of the work. We develop the "virtual companion," carefully crafting its personalities to ensure it feels like a mentor rather than a monitor.
- `Evaluation & Listening:` We do not just check if the code works; we check if the connection works. We look at whether students felt safe enough to be sincere and whether our feedback actually lightened their burden.
- `Growth & Conclusion:` Every cycle ends with reflection. We ask ourselves: "How can we make this even more human?". We then use those lessons to improve the next version of the journey.

The creation of this pilot system is a collaborative effort rooted at the University of Vigo. With access to the institution's technical resources, quiet research spaces, and a wealth of academic wisdom, the researchers is empowered to focus on the delicate balance of technology and empathy. This support allows us to ensure that every line of code is written with the student's success and well-being in mind.

4. Work plan

To ensure a well-structured research process for this thesis, a flexible, part-time, 5-year research plan was established. It will consist of the same work packages (WPs) for each year but will be designed to build upon itself, thereby continuously enriching the research process.

The first year will be dedicated to the self-regulation measurement component. Questionnaires and supplementary conversations will be defined for inclusion in the chatbot's database, along with an initial version of the programmatic implementation on a real platform.

In the second year, the intervention component—or, in other words, positive feedback—will be developed in parallel with the work carried out during the first year of research. Here, a response strategy will be designed, and a generative AI algorithm will be selected to provide automatic responses. Planning for the third, fourth, and final years will depend on the results from the previous years. It will be important to keep an open mind in order to adapt the research to any challenges that may arise along the way.

However, the main idea is that each year of research will consist of the same stages, which will be rigorously completed and will have a retrospective nature:

4.1. WP1. State of the Art

This work package will conduct an in-depth study of the current state of the art in the selected field. Although the primary focus of this work is on self-regulation, it is possible that, while compiling the literature review, the researchers will encounter extremely rapid growth in scientific knowledge regarding generative artificial intelligence (GAI). Even within a year, the researchers may have to constantly update their understanding of it. This field is the most debated globally in 2025. Therefore, this body of knowledge will be continuously updated throughout the entire period planned for the study.

4.2. WP2. Definition of the functionalities of the tool to be developed

This phase includes preliminary planning and the selection of IT tools before beginning or continuing the study, while maintaining the overall approach and the flexibility to refine it as the development and implementation of the new software progresses.

Each version will include structural and functional improvements, as well as necessary updates to the methodologies and software involved.

The software solutions chosen for the first year of this project:

- Python programming language;
- RASA Pro 3.10.8 framework with a free “developer” license, to develop the Short Language Model (SLM) that will handle the questionnaire flows and established conversations;
- Flask framework, to develop the platform’s backend, which will handle the "admin panel" and "chatbot" modules for users;
- Vue.js framework, to develop the visually appealing frontend for the chatbot;
- Remote connection to the server at atlanTTic research center with Meta’s Llama 4 LLM (Large Language Model);

4.3. WP3. Development and Implementation. Experiments

With the start of the second semester of the 2024/2025 academic year at the EET, a pilot version of a support chatbot was implemented for first-year students at the University of Vigo to conduct the first experiment with two groups in the course “Computer Science: Computer Architecture”. At the beginning of the 2025/2026 academic year the second experiment was launched with the same course, targeting newly enrolled students. All the experiments were approved by the Ethics Committee to ensure the lawful collection and processing of personal data used in each study.

In this phase, the results and conclusions of each experiment provides new options for optimizing and/or modifying the original proposal. The first concluded experiment will consequently give rise to the next stage of evaluating results and preparing for the next experiment, which will take place at the beginning of the next academic year.

All experiments are expected to be conducted on a small scale with volunteer participants.

4.4. WP4. Evaluation of Results. Opportunities for Improvement

To ensure a reliable interpretation of the data collected in the previous phase, evaluation surveys gathered at the beginning and end of the experiment will be used, along with the participants’ personal feedback.

Due to the poor participation observed in each experiment (of the total 112 volunteers who participated in both experiments only six completed all the questions), the researchers will focus primarily on the main issue observed throughout the study: improving the participation rate and the sincerity of students’ responses. For the next 2026/2027 academic year a better version of chatbot with indirect conversations included will be tested.

However, both the design and operation of the conversational agent may evolve and be adapted continuously to meet any additional and/or unforeseen needs.

4.5. WP5. Dissemination of Results

The results of this work must be disseminated within educational circles. To this end, it is proposed to carry out the following activities during the development of the tool and after each set of new results is obtained:

- Informational sessions for students at the beginning of the academic year.
- Project website with explanatory information and videos.
- Participation in research activity evaluation seminars (a mandatory training activity specific to EET).
- Publication in scientific journals: "Transactions on Learning Technologies" "Computers and Education".
- Participation in scientific conferences: "EDUCON", "FIE", "ECTEL", "LASI", "IEEE".

The writing, revision, and defense of this thesis aim to contribute to improving the quality of education for EET first-year students.

5. Conclusions: A Vision for Reclaiming Student Agency

This thesis was born from a simple but urgent observation: the way we currently try to help students is often the very thing that pushes them away. While this project is still a work in progress, it represents an intention to improve this dynamic. By moving away from traditional obtrusive surveys and toward the natural flow of Generative AI-driven conversation, the idea is to build a tool designed to reach the students who are currently navigating their first year in silence.

The goal is to explore a new kind of communication with students. By creating a virtual companion capable of assessing a student's anxieties or their lowering motivation, it would be possible to reduce the emotional barriers to their self-reflection that is quite necessary in the first year of university studies. The idea is not to replace the human mentor, but to try to provide a scalable, non-judgmental bridge that could help to detect first signs of dropout thoughts and patterns of a learner.

The research aims to show that when technology is built with empathy, it could do a little more than just collect data. It may contribute to the development of the resilience required for academic success. Ultimately, we hope to see that a simple, supportive dialogue can be the first step in transforming a student's vulnerability into a sustainable path forward.

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Declaration on Generative AI

During the preparation of this work, the authors used DeepL Translate and Grammarly in order to: Grammar and spelling check. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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