

A Digital Tool to Support Self-Regulated Learning in Academic Writing

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The capacity to plan, manage, monitor and reflect on one's learning—i.e. to engage in self-regulated learning (SRL)—is vital to academic success; seminal research identified fourteen SRL strategies and showed that learners' achievement was strongly predicted by their use of SRL strategies (Zimmerman and Martinez-Pons, 1986); this difference in achievement can be accounted for by strategy presence, frequency and consistency (Nandagopal and Ericsson, 2012). Empirical evaluations indicate that most SRL tools do not demonstrably improve actual SRL behaviour—most studies did not directly measure changes in students' SRL strategies (Edisherashvili et al., 2022), highlighting a gap in understanding of whether these tools are truly helping students internalise better self-regulatory practices or just providing short-term performance boosts. This paper describes STARS, a co-designed digital tool to help bridge this gap, in particular by helping learners to (i) identify specific learning goals (ii) select and use appropriate SRL strategies (iii) monitor their progress over time. Needfinding has been conducted using surveys, focus groups, and interviews with first-year bachelor students (N=63). We present the results to date. Firstly, the highest priority needs that emerged - goal setting, emotional overwhelm, and time management - are in line with wider evidence showing that most digital-SRL interventions still lack robust goal-setting scaffolds (e.g. van Jaarsveld et al., 2024), that writing-specific anxiety drives avoidance and procrastination in undergraduate writers (e.g. Fritzsche et al., 2003), and that time-management planning is a key behavioural mediator between SRL processes and achievement (e.g. Claessens et al., 2007). Secondly, the first version of STARS has been developed to address these priority needs, and this has been piloted with a small group of learners and tutors (N=10). We report on the promising pilot results, and finally, we describe how STARS will be deployed in September 2025 in 10+ modules in three EU countries (Ireland, Estonia, and Finland).

1. Introduction

Self-regulation refers to “self-generated thoughts, feelings, and behaviours that are oriented to attaining goals” (Zimmerman, 2002). Foundational studies have demonstrated that students who actively use SRL strategies tend to perform better, and their success is linked to the presence, frequency, and consistency of these strategies (Zimmerman & Martinez-Pons, 1986; Nandagopal & Ericsson, 2012). Yet, despite increasing interest in digital tools designed to support SRL, many of these interventions have shown limited impact on students' actual self-regulatory behaviour. Indeed, a recent systematic review found that most SRL tools fail to directly measure changes in learners' SRL strategy use, raising concerns that these tools may only yield short-term performance improvements without fostering genuine skill development (Edisherashvili et al., 2022).

This paper introduces STARS, a digital tool designed to address this gap. STARS aims to do this by combining measurement and support for specific SRL strategies, the so-called “third wave” of SRL support (Panadero, 2017). Using a participatory action research approach, co-designed with learners and tutors, STARS focuses on helping students (i) define clear learning goals, (ii) adopt and practice SRL strategies, and (iii) monitor their progress over time. Section 2 describes the aims of the research, the approach used (action research), followed by Section 3, which details the method and the results of the first needfinding phase with needfinding activities such as surveys, interviews, and focus groups involving first-year bachelor's students (N=63). The needs identified through these activities were used to inform the design of the digital prototypes given in Section 4. Section 5 concludes and outlines the next steps.

2. Research Approach

2.1 Aim

The effectiveness of SRL strategies on their learning achievement is well established, e.g., (Harris & Graham, 2016; Junaščíková, 2024; Lim et al., 2023). The work aims to enable learners to measure and reflect on their current use of SRL strategies and to facilitate the selection and deployment of new or enhanced SRL strategies to improve their learning achievement. The main research questions are: (i) How do learners' reported and

observed use of SRL strategies evolve over time? (ii) How well do specific tool features (e.g. scheduler, writing analytics, reflection journal) meet the identified learner needs in goal-setting, emotional regulation, and time management? (iii) What barriers and enablers do learners experience when attempting to deploy SRL strategies?

2.2 Approach

This study adopts an action research methodology, which is particularly suited to the development of educational interventions in real-world contexts. Action research involves a cyclical process of planning, acting, observing, and reflecting, which aims to improve practice and generate knowledge. It has different variations, but “what unites different conceptions of action research is the desire for improvement to practice, based on a rigorous evidential trail of data” (Cohen et al., 2017). In this case, the objective is to iteratively design, test, and refine a digital tool—STARS—that supports learners in deploying and reflecting on self-regulated learning (SRL) strategies in academic writing.

A core principle underpinning STARS is co-creation: learners and teachers are not treated as passive end-users, but as active partners in the design and refinement of the tool. By involving learners and teachers at multiple stages—through surveys, focus groups, usability testing, and ongoing feedback cycles—we ensure the tool is grounded in its intended users' lived experiences and authentic needs. This participatory approach surfaces the real barriers learners and teachers face and enables the development of usable and meaningful solutions in practice.

The action research process has been structured around successive design-test-reflect cycles. Each cycle contributes to the dual goals of improving the STARS tool and deepening our understanding of how digital interventions can support SRL in academic writing contexts. This methodological approach allows for the continuous alignment between learner needs, theoretical insights, and practical implementation.

The overall plan is for action research iterations to take place over three semesters. Needfinding informs prototype design, and as prototypes are used in authentic environments (embedded in modules) and evaluated with data captured by the tool, surveys, and focus groups, we can find barriers and enablers, determine how well the needs are met, and explore how learners' reported and observed use of SRL strategies evolves over time.

3. Needs Analysis

3.1 Method

A needfinding questionnaire was made available to three cohorts: nine MSc students, twenty-eight first-year Psychology undergraduates, and thirty-seven first-year Computing undergraduates. The questionnaire was designed to be relatively broad and flexible, and to realistically capture learners' everyday strategies (or their absence). The questionnaire was structured around Zimmerman's three phases of SRL (forethought, performance and reflection) and asked students to describe and evaluate their current practices with regard to: (i) goal setting and planning, (2) time management, (3) self evaluation, (4) managing emotions, (5) help seeking, (6) task strategies and (7) reflection. It combined both open and closed questions, and afforded students space to upload photographs of any specific tools (e.g. time management or planning tools) that they currently use when completing their assignments. The questionnaire was administered in class and was followed by focus-group discussions where learners were free to discuss the questions in more depth.

3.2 Results

Some key observations from the learner data were:

(i) Learners often don't set goals; 28% do not set any goals, and only 10% record their goals in a structured way. The majority rely on mental checklists or vague intentions. Nearly identical results were found from planning.

(ii) Learners often experience negative emotions, especially overwhelm; for example, students were asked to identify which emotion(s) they typically feel when doing an assignment (54% - overwhelmed, 32% - nervous, 19% - curious, 19% - excited).

(iii) Some learners have difficulty managing time; 16% reported poor time management or heavy reliance on procrastination and stress as motivators. The rest rely on fixed schedules or time blocks (42%) or break tasks into smaller components to manage workload (30%), but only 6% reported using external tools (e.g., diaries, calendars, or mind maps).

Across all three cohorts, students often described intentions to manage time effectively, but lacked consistency or formalisation in their methods. MSc students most frequently attempted to plan in advance using diaries or

timetables. However, some Psychology and Computing students adopt reactive or last-minute approaches, with time management described as "poor", "stress-inducing", or subject to procrastination cycles. Despite this, all groups strongly desired more structure, acknowledging that clear plans reduced anxiety and improved productivity. Barriers to effective goal setting and time management included emotional volatility (e.g., anxiety, overwhelm), lack of confidence in self-discipline, or difficulty translating abstract intentions into actionable steps.

3.3 Identified needs

Table 1 maps the principal learner needs to Zimmerman's SRL phases derived from participant data analysis. Another key need is minimising effort expectancy, which is "the degree of ease associated with the use of the system" (Venkatesh et al., 2003). This is significant regardless of whether usage is voluntary or mandatory but only in the initial phase of usage; it becomes insignificant after "extended and sustained usage" (Venkatesh et al., 2003). This is vital for those participants in our cohorts with low digital skills. It is vital that they feel they use STARS to help them deploy SRL, rather than STARS becoming yet another barrier to their learning.

Table 1: The top needs identified by analysing the participant data

SRL Phase (Zimmerman)	Participant data	Sample quote from focus group	Need
Forethought	Learners often don't set goals;	<i>"I don't, they pile up and then I complete them all last minute"</i>	Learners need a way to easily set goals and track their progress
Forethought/ Performance	The majority of learners feel overwhelmed/nervous about what they need to do;	<i>"Typically get stressed and overwhelmed and spend a lot of time panicking."</i>	Learners need a way to manage these emotions.
Forethought	Learners struggle with managing their time;	<i>"I don't manage my time much... I'm constantly procrastinating and... thinking that 'Stress is the ultimate motivator.'"</i>	Learners need flexible tools to plan their writing around real-life routines and energy levels.
Reflection	Learners do not use feedback to improve future work;	<i>"Aside from looking at feedback when it comes, I don't really engage in reflection, except maybe when I submit."</i>	Learners need a way to store, revisit, and act on their reflections.

4. Prototype Design

The previous section described the highest-priority needs that were identified. This section starts by showing why existing tools cannot meet these needs and then briefly describes current prototypes. It then provides a needs-features matrix indicating how features meet the needs using available evidence.

4.1 Shortcomings of existing tools to meet these needs

While participants were familiar with popular organisational tools (e.g., Google Calendar, Trello), they rarely used them for academic writing and almost never as part of a reflective process. While students use independent tools such as calendars, notes, or to-do lists, this fragmented approach to managing writing tasks limits their effectiveness. These tools are rarely integrated into the writing process itself, and as a result, they provide little structured support for planning, reflection, or progress monitoring. Our data indicate that students often rely on internalised strategies, such as mental checklists or spontaneous decisions, rather than leveraging tools that connect directly to their writing activity. Fragmentation across platforms or tools may contribute to a disconnect between planning and execution, where opportunities for metacognitive engagement, timely review, or feedback application are easily missed. This reflects broader concerns in the literature that such disconnected tool use can impair focus and time regulation without clear learning benefits (Berei & Pusztai, 2022).

Previous research found that introducing a standalone tool in a study skills and writing course led to high attrition rates within two weeks, as it provided little independent value. Additionally, even when endorsed by instructors

and tailored to specific modules, students may resist using such tools, despite recognising their potential benefits.

4.2 Overall design

The overall design of the STARS tool is that each star visually represents a different SRL strategy, and learners can deploy one or more of these strategies. For some of the stars, there is a digital component to help a learner deploy the strategy. This section describes a selection of prototypes of these components, which can be reached from a unified STARS home screen.

4.3 Components

4.3.1 Artefacts/Review Component

Teachers can set a brief (see Figure 1) and give feedback, and learners can set/update goals, submit work, self-review, and get AI review.

The screenshot shows the STARS SRL Project interface. At the top, there is a navigation bar with 'Home', 'All Briefs', 'Need Review', and 'My Work'. The 'All Briefs' tab is selected. Below the navigation bar, the 'Briefs' section is displayed. A specific brief titled 'ANC Brief 1' is shown. The brief description states: 'In class today, we discussed several principles of community development. Define the principle of participation and use appropriate citation(s). Link the theory of participation to your future work as a CD worker. Reflect on how learning about the principle of participation will influence your practice as a community development worker in the future.' Below the description, there is a 'Requirements' section. It includes a 'Current Goals' section with two goals: 'Is the principle of participation defined?' (Topic: Participation) and 'Does the answer go beyond just describing the class content or experience to analysing how it influenced your perspectives or thinking?' (Reflection). Below this, there is a 'Topic: Participation' section with three goals: 'Is the principle of participation defined?' (158), 'Are appropriate citation(s) provided?' (159), and 'Is the theory of participation linked to your future work as a CD worker?' (160). Below that, there is a 'Reflection' section with two goals: 'Does the answer go beyond just describing the class content or experience to analysing how it influenced your perspectives or thinking?' (161) and 'Does the answer provide specific examples of how this learning will impact on your future action?' (162). A 'Status Legend' at the bottom indicates that a checkbox represents 'Future work', a checked checkbox represents 'Current goal', and a green checkmark represents 'Completed'. A 'Save' button is located at the top right of the requirements section.

Figure 1: A learner setting a goal in the Artefacts/Review component.

4.3.2 Scheduler Component

The Scheduler allows learners to plan writing sessions by day and time, set measurable goals (see Figure 2), and use past data to inform weekly targets. It connects scheduling to actual writing behaviour and provides visual progress feedback.

The screenshot shows the 'Weekly Writing Goals' interface. It has a title 'Weekly Writing Goals' and a 'Learn More' button. Below the title, it says 'Set your time and word count targets – and track your progress each week'. There are two main sections: 'Weekly Time Goal: 4 hrs' and 'Weekly Word Goal: 1000 words'. Each section has a progress bar with a blue dot indicating the current status. Below the time goal, it says 'Scheduled: 4 hrs' and 'Remaining: 0 hrs'. Below the word goal, it says 'Target per session: 125 words'. There are also lightbulb icons next to each goal.

Figure 2. Used to set weekly goals: time spent on writing and a word count.

4.3.3 Writing Analytics Component

The Writing Analytics module tracks productivity across sessions, documents, and timeframes, providing visual feedback of effort. Users upload a document, specify time spent (see Figure 3), and view real-time analytics (see Figure 4).

Figure 3. Allows the user to select a Word or PDF document to upload at the end of their session, including the duration.

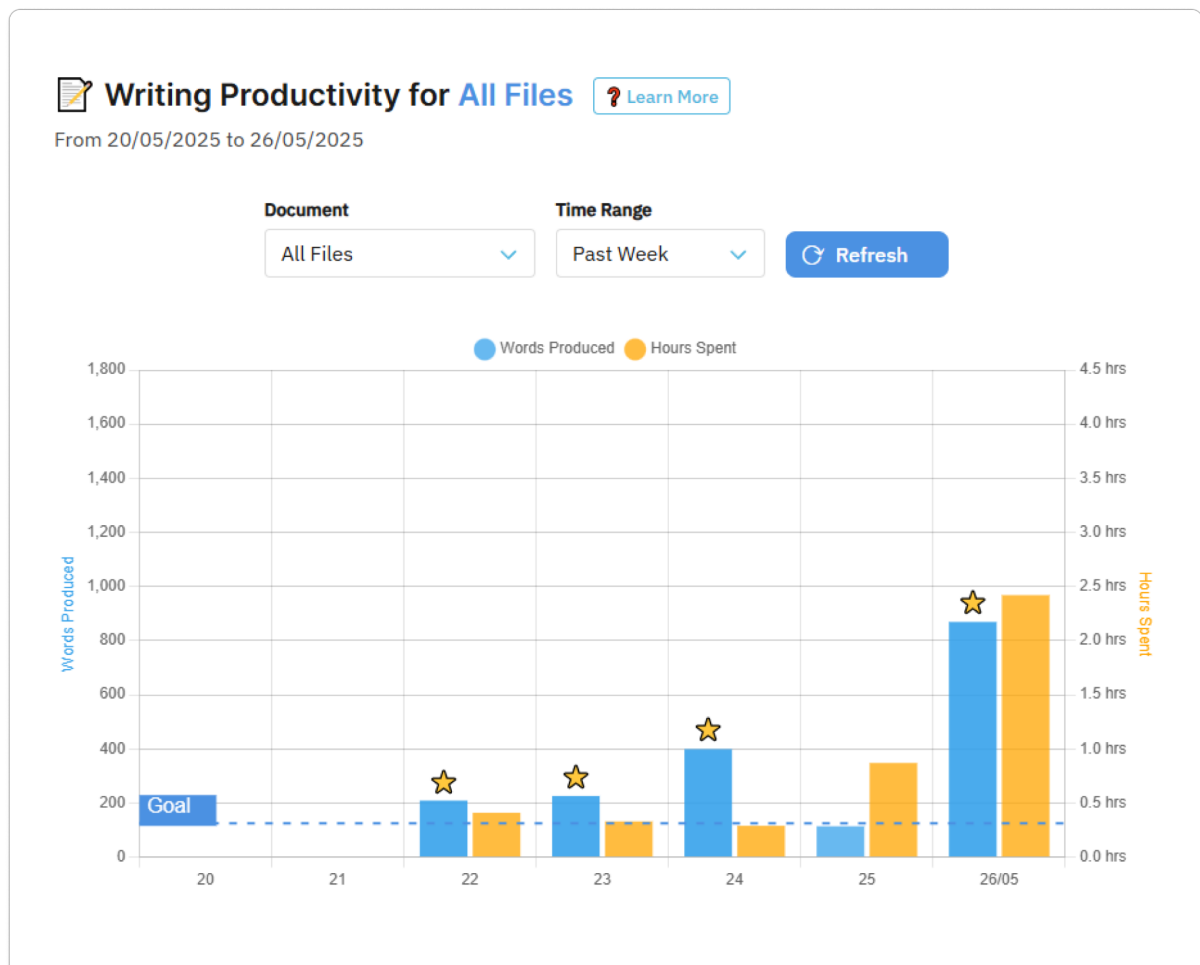


Figure 4. The number of words produced and time spent writing in the past seven days. The star indicates the user has achieved the minimum word count goal.

4.3.4 Needs-Features Matrix

Table 2 illustrates the degree to which each component satisfies a particular need.

Table 2: Needs-Features Matrix

✓ = expected to meet need; ⚠ = expected to meet need; ✗ = does not meet need (in the current version)

Needs	Artefacts/review	Skills	Scheduler	Writing analytics
Easily set goals and track their progress	✓ Can set goals and see progress	✓ Set which skills to work on, track mastery level	⚠ Set goals for word count and time, track progress visually in real time.	✓ Tracks writing output over time, aligning with sessions.
Manage overwhelm/anxiety	✓ Enables current goals to be reduced, reducing anxiety.	✓ By focusing on 1-2 skills at a time	✓ Sessions can be broken into flexible and manageable time blocks.	✓ Transforms effort into visual data, helping to recognise progress.
Low effort expectancy	⚠ Pilot tests showed some guidance was needed.	⚠ Minor usability issues identified	⚠ Integration with third-party calendars might require some effort.	✓ Updated automatically whenever the user submits their document and duration.
Help to reflect on SRL strategies	✗ Not yet; planned: comparison between self review and teacher review/AI review	⚠ Individual skill mastery only; Planned: time series, goal completion	⚠ Limited to writing sessions; will include customisable blocks like reading.	✓ Helps evaluate habits and outputs.

5. User Test (Pilot)

The pilot's objectives were (i) to test the prototypes for value, usability, and technology acceptance for tutors and learners, and (ii) to determine which SRL strategies the tutors could embed with their selected modules running in the next semester and how specifically they could be embedded. Table 3 provides an overview of the tasks given to the participants during the pilot, and Table 4 contains the results from the pilot study.

Table 3: Overview of the tasks given to the participants.

Artefacts/Review system:	Scheduler and Writing Analytics
As a learner, you are tasked with completing a cycle: - Set a goal - Submit your work (with an issue) - Self Review - Request an AI Review - Submit your work (with the issue fixed) - Update the goal	As a learner, you are asked to complete the following set of instructions: - Schedule a weekly time goal of 4.0 hours. - Schedule two sessions (e.g., Thur, 19:00 – 21:00 and Wed, 13:00 – 15:00) - Upload a Word document and set duration to 2.0 hours. - Review Writing Analytics

Table 4: Overview of results from the pilot user study.

Prototype	Main Result	Main issues
Artefacts/Review system	100% of participants completed the task with minor guidance	Users locating their place and navigating in the set goal/submit work/self review/AI review cycle.
Scheduler and Writing Analytics	100% of participants completed the task with minor guidance	Understanding how to schedule a session and understanding the writing session graph.

6. Conclusion and Future Work

This paper describes the steps in the action research process that have led to the first version of STARS, which will be deployed next semester (September 2025), embedded into 10+ modules in three EU countries (Ireland,

Estonia, and Finland). Three SRL strategies with digital counterparts will be available (goal setting, self evaluation, and time management). Each week, learners will use reflective journals to compare their current practice with their enhanced practice through these three SRL strategies. Data will also be gathered from the tool to enable learners' use of SRL strategies to be tracked over time, determine how well learner needs are met, and crucially, the barriers and enablers learners experience when attempting to deploy SRL strategies. This will help bridge the gap found in most existing SRL studies which do not directly measure changes in students' SRL strategies (Edisherashvili et al., 2022). The design of STARS will be iterated upon and deployed in more modules over the subsequent two semesters.

Ethical Declaration

This study has been approved by the SETU Ethics Research Committee (Ref: SETU/REC/24/25/055)

AI Declaration

ChatGPT was used for brainstorming, proofreading, and evaluation of drafts.

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