

Student Perceptions of Adaptive Goal Setting Recommendations: A Design Prototyping Study

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Abstract. Many AIED systems support self-regulated learning, yet, support for setting and achieving practice goals has received little attention. We examine how middle school students respond to system-recommended practice goals, building on the success of similar data-driven recommendations in other domains. We introduce an adaptive dashboard in an intelligent tutoring system. The dashboard tracks progress (time, mastery), suggests dynamic goal adjustments, and visualizes performance—aiming to increase learning opportunities. In a prototyping study with five middle schoolers (grades 6–7), we used scenario-based tasks to examine reactions to goal recommendations during under- or overachievement. Thematic analysis revealed: (1) students accepted system suggestions as guidance but wanted final control; (2) they valued adaptive recommendations tied to past performance to increase their chance of meeting their goal and pace themselves; and (3) they strongly preferred motivational features (e.g., streaks, celebrations) for engagement. Our study contributes design implications for practice goal-setting in tutoring systems, highlighting personalized, explainable learning analytics and motivational design to support goal-directed behavior.

Keywords: human-centered design, goal setting, self-regulated learning, prototyping study, intelligent tutoring systems, K-12

1 Introduction and Related Work

Goal setting is a crucial component of self-regulated learning (SRL) [23]. Effective goals feature clear timeframes and performance standards [20]. AIED systems often provide such features [17, 5]. However, in addition to setting and monitoring goals, learners must also set *intentions* to work toward goals. Gollwitzer’s model of action phases [13] suggests that goal pursuit involves a pre-actional phase of planning goal-directed behavior and a post-actional phase dedicated to reflecting on performance and goals. Without support at these stages, defining and acting on goals remains challenging for students using technology [22, 7].

How might AIED systems better support students in setting intentions and executing goal-directed behavior? Learners must be supported in *identifying and*

evaluating opportunities to work toward goals [14] and seek regular performance feedback [18]. However, past research has focused on supporting student goal setting *during* practice, after practice has already been initiated [5, 3].

We designed a goal-setting recommendation dashboard building open learner models (OLMs) displaying mastery progress, which can support performance reflection [8, 7], but, alone, are limited in providing goals and rewards, which are known to be effective [15, 4]. Conversely, non-digital goal contracts may not effectively integrate feedback and data capabilities (e.g., log data) [22].

We build on research showing that adaptive, performance-based goal-setting improves outcomes in health domains [1, 18], and extend our prior design work where students valued difficulty feedback in learning analytics for digital homework [22]. The dashboard supports goal intentions and planning *outside of practice* by (a) showing current goals, including those set externally (e.g., goal contracts [4]), and (b) enabling goal reflection and adjustment via data-driven recommendations. We explore student perceptions of these recommendations to inform future learning environment design. We ask:

- RQ: What are students’ perceptions of adaptive practice goal recommendations and constraints for tutoring system practice?

2 Goal-Setting Dashboard System

The Goal-Setting Dashboard is embedded in TutorShop and the Lynnette tutoring system [2]. The system tracks practice time and skill mastery (e.g., subtracting constants) through log data [19]. Students can work on multiple assignments, and progress is tracked and aggregated across all of them. The dashboard is compatible with any tutoring system and subject domain that uses an underlying skill model and complies with tutoring system log data standards [16]. Currently, the dashboard supports tutoring systems that are authored with CTAT [2].

2.1 Dashboard and Goal Recommendations

The homepage displays the current focus goal and its associated rewards based on deadlines. Goals and rewards—set collaboratively by students and parents or teachers through contracts [12]—are manually uploaded after paper-based goal setting [4]. The dashboard supports time-based (e.g., 30 minutes/week) and skill mastery goals (e.g., 2 skills/day), tracking progress toward both.

After practice, for each goal, the dashboard provides students with adaptive recommendations that foster growth. In the first eight days, if their goal achievement has been above or below 25% of their goal, the recommendation is $goal + (performance - goal) * 0.5$. Later, the algorithm recommends a goal according to the 60% percentile of students’ most recent, non-missing nine days of goal achievement [1]. Recommendations are accompanied by encouragement (Fig. 2). Students can accept, decline, or overwrite goal recommendations, but overwritten goals must be within 25% of the suggested value to prevent unrealistic or trivial targets. Since recommendations are based on past performance, they remain suitable across achievement levels.

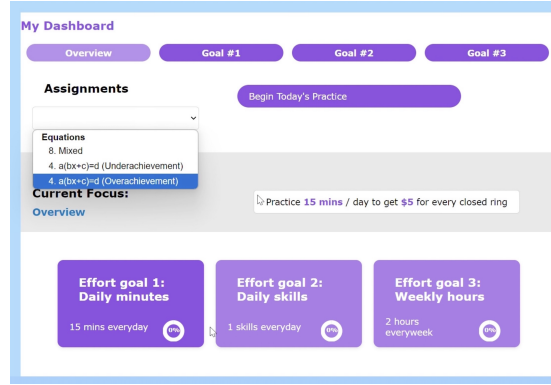


Fig. 1. Overview page where achievement conditions were simulated for the user study (default; underachievement; overachievement) with current goal focus.

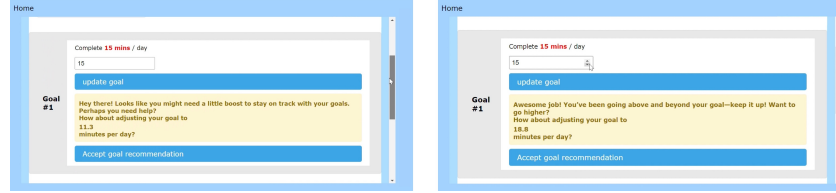


Fig. 2. (Left) underachievement and (right) overachievement scenario showing messages that encourage effort, celebrate progress, and suggest realistic goals.

2.2 Learning Analytics

The interface's goal tabs incorporate three visualization elements: a ring progress visualization showing time-based or skill-based goals with encouraging messages, a horizontal bar graph displaying skill mastery progress, and a line graph comparing daily practice minutes against weekly goal targets using a red dash-dotted line to represent the goal benchmark (Fig. 3). The red benchmark line represents the expected daily practice effort or achievement needed to meet the weekly goals to encourage spaced practice and repetition [11, 28].

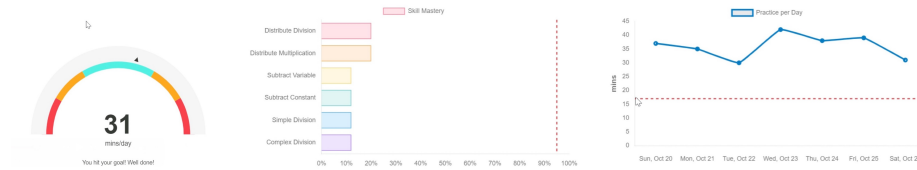


Fig. 3. Learning analytics: (1) a ring progress tracker, (2) a horizontal bar graph for skill mastery, and (3) a line graph comparing daily practice minutes against goals.

3 Methods

Five middle school students participated in the study. The participants, predominantly from urban areas in the Mid-Atlantic U.S. region, included two 6th and three 7th graders, aged 11 to 13. Students were 60% male, with three being Caucasian, one East Asian, and one mixed race. Recruitment was conducted through university outreach centers. Each participating student received \$50 in Amazon gift cards. The study was approved by the relevant institutional review board and included informed consent from participants and their guardians.

Participants interacted with the prototype on laptops, with all activities screen- and audio-recorded. All students, sitting in groups of 1-2 in a large room, were guided through UX tasks by a researcher each, prompting them to think aloud [21]. Tasks included navigating tabs and reviewing goal progress.

Afterward, participants engaged in scenario-based simulations. Using Carroll’s scenario-based design framework, all scenarios elicited participants’ interaction patterns and decision-making, providing contexts for reflecting on system features [9, 10]. They worked through three scenarios in a fixed order: (1) *average achievement*, where participants’ performance was just about enough to meet their goal; (2) *underachievement*, which prompted participants to adjust their goals; (3) *overachievement*, where participants were encouraged to set more ambitious goals. Students were prompted to adjust goals within system constraints.

Finally, a group feedback activity using sticky notes encouraged active participation and visual organization of thoughts [6]. Participants wrote reflections and categorized them under themes: *Ease of Use*, *Goal Motivation*, *Support & Feedback*, *Suggestions for Improvement*, and *Future Use*, placed them on the board, and voted on the reflections that resonated most with their experiences.

Transcripts, completed worksheets, and sticky notes were analyzed through an independent thematic analysis by two researchers [25]. Themes were cross-referenced and discussed. The analysis focused on understanding the dashboard system’s usability, functionality, and areas for improvement.

4 Results

Theme 1: All five students appreciated the autonomy to set goals with dashboard guidance and wanted to retain final control. When asked to adjust goals in the dashboard, recommendations supported students shifting from broad aspirations (e.g., [Green] *"to get it done"*) to more concrete targets (e.g., [Green] *"10 minutes a day, 1 skill a week"*; [Black] *"20 minutes per week, 3 skills per week"*). Students emphasized wanting to retain final control over their goal-setting: [Black] noted, *"The system doesn't know my situation,"* while [Green] stated, *"I prefer to set my goal myself."*

Theme 2: Students found system recommendations and guardrails helpful and broadly acceptable. *Subtheme 2.1: Students responded positively to achievement feedback and adjustment reminders.* [Pearl] found suggestions helpful, stating, *"It's helpful, it's like, if it's too little it can say*

like hey you can bring it up if you want, so that helps, I guess." [Red] appreciated the system recommendations, stating they *"would use the system recommendations of adjusting goals to make them harder under different conditions."* Students' underlying reasons for liking underachievement feedback aligned with our design assumption that such feedback would make future goal achievement more attainable, boosting motivation. When asked about responding to unmet goals, [Green] stated *"I would change my goals so I can meet them"*, and [Gold] noted *"I would want to try harder and make my goals a little bit easier so I can meet them."* **Subtheme 2.2: Students had varied responses to overachieving and appreciated flexibility.** Some students were motivated to increase their goals after exceeding expectations, as [Black] shared, *"Probably up it seems?"* Conversely, others were more cautious when overachieving, emphasizing the importance of not overworking. [Pearl] appreciated that the system set limits on goal increases, noting, *"It was said at first you cannot go up that high. I like that because then you don't like overwork yourself or anything like that,"* while [Green] similarly advised, *"Don't practice more than you should."* **Subtheme 2.3:** We observed that at least two students ([gold], [red]) had challenges comprehending goal recommendations expressed as percentages (e.g., 75% of your current goal) and decimals (e.g., 11.3 minutes).

Theme 3: Students strongly preferred motivational features and visual elements related to performance achievement to reward effort. **Subtheme 3.1: Students requested gamified elements like streaks or milestones.** [Pearl] shared, *"I think the goals would probably help you because you want to get your goals and finish what you set."* [Red] echoed: *"And like having this streak in any program is like having a reason to keep someone coming back."* [Black] further supports this claim by stating *"that's like a super big thing for other apps is just like setting a goal to make a streak for seven days and then it just moves on. For this, it's like it's right here so you can keep track of your goals and they're important."* **Subtheme 3.2: Students desired cohesive aesthetics and visualizations to recognize goal progress.** Several students suggested ways to make the interface more engaging. [Red] highlighted the need for celebratory elements, suggesting, *"the way the like completion is set up is cool, but nothing really happens when you complete your goals. Having even something simple like some confetti would be cool."* [Gold] suggested incorporating seasonal themes to make the interface more dynamic, stating, *"I feel like you have some very seasonal...like in fall you can make for like a farm...and then summer and winter, it's something that could be like getting snow, maybe Christmas tree."* These findings indicate students increasingly expect AIED dashboards to integrate gamification, recognizing its role in sustaining engagement and motivation.

5 Discussion

Students appreciated setting their own goals and viewed system recommendations as helpful refinements—consistent with prior research showing students often use recommendations as starting anchors [22]. Students still wanted con-

trol over final practice goals, echoing research on open learner models [7]. Results suggest this control can be balanced with recommendations: students found over- and underachievement feedback helpful for reflection and goal adjustment [14].

Students generally did not question goal-setting guardrails (e.g., preventing setting too easy goals). In contrast, they agreed that preventing overwork, one pitfall of goal setting [18], is important. Some students welcomed opportunities to increase their goals after overachieving, once again highlighting the need for flexibility and user control. Gentle prompts and visual cues in the dashboard could motivate students to reflect on their progress and preferences to adjust their goals. This result is encouraging as this active reflection on achievement may boost self-efficacy when intermediate, and progressively challenging goals are achieved [27, 24, 26]. Motivational streaks, celebratory visuals, and projections of potential future achievement [7] could further enhance these reflection processes and persistence in future design revisions.

5.1 Limitations and Future Work

First, our sample of five students limits generalizability to broader or more diverse populations. We plan to expand our sample upon revisions of our prototype. Second, we relied on scenario-based simulations rather than long-term, in situ usage. While these scenarios allowed us to observe students' immediate reactions to underachievement or overachievement, they may not capture the full complexity of how goals evolve over weeks of practice. Third, this study does not fully explore constraints imposed by deadlines, milestones, and in-class work time, which may vary by subject domain and content. Maintaining student autonomy may be challenging in these contexts, and we plan to interview teachers to study design alignment with classroom expectations.

6 Conclusion

Goal setting is a core component of SRL, but past AIED solutions are limited in helping students set realistic goals through data and spur reflection on goal progress. This study introduced an adaptive goal-setting dashboard for middle school learners and validated its design in a prototyping study. Three main findings emerged: (1) students appreciated system recommendations when they retained final control; (2) students were responsive to adaptive adjustments balancing under- and overachievement and goal guardrails, though at times preferred keeping current goal levels; and (3) students described motivational elements (e.g., streak counters, confetti) as key to sustained engagement. This work advances design knowledge for K–12 AIED dashboards, illustrating how adaptive feedback, explainable data, and gamified elements could support students in pre- and post-actional phases of goal setting, which past solutions paid relatively little attention to. We anticipate that shared student-system control while maintaining student autonomy and regular feedback will increase student learning opportunities to benefit from tutoring systems and increase the chance of goal achievement and its motivational benefits.

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