

# Students' Enjoyment of a Game-Based Tutoring System

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**Abstract.** iSTART-ME is a new game-based learning environment developed on top of an existing ITS (iSTART). The current study deviates from previous work focusing on individual ITS components, and utilizes a smaller number of students ( $n=9$ ) who engaged with the entire system over a period of several weeks. The participants indicated that they enjoyed the game-based aspects of the system significantly more than the non-game aspects. These results support the use of iSTART-ME as a system that promotes long-term enjoyment.

**Keywords:** Serious Games, Intelligent Tutoring Systems, game-based tutoring.

## 1 iSTART-ME

The Interactive Strategy Training for Active Reading and Thinking (iSTART) tutor is a web-based system for young adolescent to college-aged students designed to improve reading strategies [1]. iSTART training consists of three main modules: Introduction, Demonstration, and Practice. The Introduction module contains three animated agents that engage in a vicarious dialogue to introduce the concept of self-explanation and the iSTART reading strategies. The Demonstration module includes two agents who generate and discuss the quality of example self-explanations. The Practice module requires learners to generate their own self-explanations and an animated agent provides qualitative feedback on how to improve the self-explanation quality. An Extended Practice environment continues this generative practice over a longer time period and allows teachers to assign specific texts. This long-term practice is necessary for skill mastery [2], but it can often lead to disengagement. Thus, iSTART-ME (motivationally enhanced) has been developed on top of an existing ITS and incorporates many game-based elements [3].

Within iSTART-ME there are three methods of generative practice (Coached Practice, Showdown, and Map Conquest) as well as three isomorphic identification mini-games (Strategy Match, Bridge Builder, and Balloon Bust). Coached Practice is the updated version of the original iSTART practice, where learners generate their own self-explanations (SEs), are awarded points, receive feedback on SE quality, and an agent provides verbal feedback on how to improve the SE. In Showdown, a learner's generated SE is compared to a computerized opponent SE, and the player with the higher score wins the round (player with the most rounds wins the game). In Map Conquest the quality of a student's SE determines the number of dice that the student can use to conquer territories controlled by two virtual opponents. iSTART-ME also contains three isomorphic identification games that contain the same cognitive task

within different combinations of game features. Strategy Match, consists of a drag and drop interface where the students can earn points and move up levels. Bridge Builder uses a similar interface with points and levels, but also includes a virtual scene where the users construct a bridge. Balloon Bust adds in a perceptual element to the virtual scene, where users must follow and click on the correct balloons.

**1.1 Evaluation of iSTART-ME**

All participants (n=9) completed the full iSTART-ME training (Introduction, Demonstration, and Practice), spent five one-hour sessions freely using the Selection Menu, and filled out a posttest survey. Analyses of the posttest survey compared iSTART-ME modules as well as the various mini-games. Within-subjects ANOVAs found significant differences between modules for the items “I had fun using this module,” and “I would recommend this module to a friend,” but did not find differences for the item, “This module was easy to use,” (see Table 1).

**Table 1.** Means (SD) for module ratings (1-6, higher numbers = stronger agreement)

	Intro	Demo	Practice	Menu	F(1,8)
I had fun using this module	1.22 <sub>a</sub> (0.44)	3.00 <sub>b</sub> (1.58)	2.78 <sub>b</sub> (1.20)	4.33 <sub>c</sub> (1.73)	28.89
This module was easy to use	5.00 <sub>a</sub> (1.32)	4.78 <sub>a</sub> (1.39)	4.89 <sub>a</sub> (1.05)	4.78 <sub>a</sub> (1.39)	0.231
I would recommend this module to a friend	1.44 <sub>a</sub> (0.53)	2.78 <sub>b</sub> (1.64)	2.89 <sub>b</sub> (1.27)	4.11 <sub>c</sub> (1.90)	20.17

\*Subscripts indicate significantly different subgroups within a row,  $p < .05$ .

**Table 2.** Means (SD) for mini-game ratings (1-6, higher numbers = stronger agreement)

	Generation Games			Identification Games		
	Prac	Show	Map	Match	Bridge	Balloon
I liked the graphics in this game	3.44 <sub>a</sub> (1.24)	3.44 <sub>a</sub> (1.13)	3.89 <sub>a</sub> (1.45)	3.50 <sub>x</sub> (1.20)	3.50 <sub>x</sub> (1.69)	4.12 <sub>x</sub> (1.73)
I liked the sound effects in this game	2.33 <sub>a</sub> (1.23)	4.33 <sub>b</sub> (1.22)	4.22 <sub>b</sub> (1.56)	3.13 <sub>x</sub> (1.13)	3.62 <sub>x</sub> (1.60)	3.75 <sub>x</sub> (1.50)
I liked the music in this game	2.78 <sub>a</sub> (1.64)	4.22 <sub>b</sub> (1.09)	4.00 <sub>b</sub> (1.73)	3.50 <sub>x</sub> (1.51)	3.75 <sub>x</sub> (1.75)	3.75 <sub>x</sub> (1.49)
This game was fun to play	2.56 <sub>a</sub> (1.13)	3.33 <sub>a</sub> (1.41)	3.44 <sub>a</sub> (1.88)	3.38 <sub>x</sub> (0.92)	3.50 <sub>x</sub> (0.93)	4.62 <sub>x</sub> (1.30)
I would play this game again	2.56 <sub>a</sub> (1.42)	3.22 <sub>a</sub> (1.86)	3.22 <sub>a</sub> (1.79)	2.50 <sub>x</sub> (1.20)	3.62 <sub>y</sub> (0.74)	4.62 <sub>z</sub> (1.30)
This game was frustrating	2.44 <sub>a</sub> (1.33)	2.33 <sub>a</sub> (1.22)	4.00 <sub>b</sub> (2.06)	3.13 <sub>x</sub> (2.03)	2.50 <sub>x</sub> (1.31)	2.62 <sub>x</sub> (1.06)
I enjoyed playing this game	2.67 <sub>a</sub> (1.32)	3.44 <sub>ab</sub> (1.74)	3.67 <sub>b</sub> (1.73)	3.00 <sub>x</sub> (1.41)	3.62 <sub>x</sub> (1.06)	4.38 <sub>y</sub> (1.19)

\*Subscripts indicate significantly different subgroups within a row,  $p < .05$ .

Two separate comparisons were made to investigate the group of generation games and the set of isomorphic identification games. Within-subjects ANOVAs on the three generation games yielded significant differences for several posttest survey questions (see Table 2). Students rated Map Conquest as the most frustrating,  $F(1,8)=7.84$ ,  $p=.02$ , but also the most enjoyable generation game,  $F(1,8)=7.20$ ,  $p=.03$ . Within-subjects ANOVAs comparing the identification games found that Balloon Bust was significantly more enjoyable than the other games,  $F(1,8)=6.67$ ,  $p=.04$ , and was the most likely to be played again,  $F(1,8)=12.11$ ,  $p=.01$ .

## 2 Conclusions

The current results support the design of iSTART-ME and indicate that students enjoyed interactions with the new game-based aspects of the system over an extended period of time. Specifically the students provided higher ratings for those modules and mini-games that contained more game-like aspects.

One limitation of the current study is the small sample size, and how that limits generalization to a broader population of users. However, despite this limitation, the data indicate interesting trends that are supported by previous research [4],[5], and suggest that iSTART-ME can successfully sustain enjoyment over an extended period. This finding provides a foundation for future work focusing on the timelines of effects for specific game elements (e.g., competition, challenge, variety, etc.).

## References

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