Social Motivations and Goal Orientations with a Teachable Agent: Implications for Improving Test Performance

Sjödén, Björn

Published in:
Proceedings of the 19th International Conference on Computers in Education

2011

T. Hirashima et al. (Eds.) (2011). Proceedings of the 19th International Conference on Computers in Education. Chiang Mai, Thailand: Asia-Pacific Society for Computers in Education

Social Motivation and Goal Orientations with a Teachable Agent: Implications for Improving Test Performance

Björn SJÖDÉN[a]
[a] *Lund University Cognitive Science, Sweden*
bjorn.sjoden@lucs.lu.se

Abstract: A recent study of ours suggested that the very presence of a Teachable Agent (TA) from a mathematics learning game might affect students' test performance when the TA reappeared in the margin of a regular, digital math test. We hypothesized that this effect, which seemed to particularly target low-achievers, was due to the students' mindset changing from that of "taking a test" to that of "teaching a TA", besides offering low-performers with a unique opportunity to act as teachers. Here, we propose a framework for exploring these effects further, particularly with respect to the personal relationship students form with their TA and in relation to socially valued goal orientations. We outline three planned studies of TA-related social-motivational factors. The results would be useful for designing computerized tests that ease motivational constraints associated with traditional test situations at school, and construe more socially supportive test environments.

Keywords: Teachable Agents, testing, social motivation, goal orientations

1. Research Background

1.1 Affecting Social Motivation with Teachable Agents (TAs)

Teachable Agents, *TAs*, is a form of educational technology based on the idea that a good way to learn is to teach someone else. TAs provide teaching opportunities for students through interactions with a computer agent guided by AI techniques. Studies of TAs suggest that students develop a sense of social relationship to their TAs, which can have positive effects on learning through an impact on motivational factors [1]. In particular, students' feelings of responsibility and engagement from developing a social relation to their TAs has been proposed as an explanatory mechanism as to why students seem to make greater efforts and spend more time on learning material when using a TA, than when alone. Importantly, the core benefits of using TAs in education may be attributed less to the AI technique itself, and rather to the social arrangement of a Master/Apprentice scheme that positions the student in an instructive, leading role.

In a recent study [2], we examined whether social-motivational effects from working with a TA might transfer from the formative learning phase to a summative test situation. We let 49 students (9-10 years old) perform a digital pretest of math skills, followed by an eight-week period of playing a TA-based educational math game in school. The students were then divided into two groups, matched according to their pretest scores, and randomly assigned one of two posttest conditions: either with their TA present, or without their TA. The results showed that low-performers on the pretest increased their scores as much as 70% when tested with the TA, whereas high-performers showed no significant increase. We reasoned that low-performers might be particularly motivated by reframing the testing

situation from that of "taking a test" to that of "teaching a TA" and that low-performing students benefited more because for them, the TA provided a unique opportunity to teach someone else. Yet it is unclear what specific factors of the student-TA relationship form and influence such hypothesized effects, in relation to what students perceive as "learning" or "being tested".

1.2 Social Motivation and Goal Orientations toward Test Performance

One approach to explaining social-motivational influence on test performance is in terms of the different goal orientations that students have for performing well at school. Broadly, one may distinguish between social goals and task-related goals as to the efforts students make in an educational setting:

Social goals reflect such motivations as gaining approval from others, establishing personal relationships and cooperating with peers.

Task-related goals reflect such motivations as mastering subject matter, meeting a specific standard of achievement or challenge, and satisfying intellectual curiosity.

It is important to recognize that being a successful student entails both types of goals, and that prosocial behavior in the classroom in fact has been shown to correlate positively to academic grades and test scores (see [3] for a review and discussion of studies).

A central issue to research on social-motivational processes is how social and task-related goal orientations interact. Some schematic models have been proposed in terms of the types of relations between goals (Fig. 1). With respect to a TA, it raises questions as to what extent a virtual character may carry out the same kind of motivational influence for performance outcomes as is exercised in a human social environment. A TA makes a particular case as to both limitations (of being non-human) and potentials for social interaction. For example, unlike human peer students, the TA can be included in a (digital) test form and thus reproduce social goals also in the actual test situation. Whether or not social goal pursuits benefit test performance is hypothetically due to whether or not task goals are perceived independent of social goals (Fig. 1: A) or somehow dependent on social goals (Fig. 1: B, C).

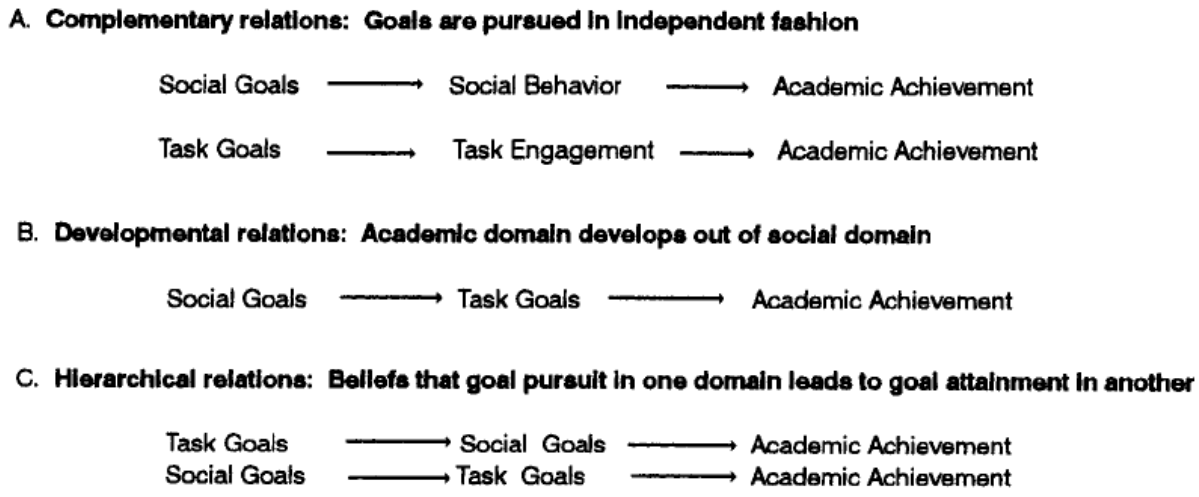

Fig. 1. Models for describing the relations between social and academic (school) pursuits and achievement, as presented by Wentzel [3].

2. Present Research Objectives

In our on-going work, we aim to conduct a series of empirical studies, drawing from our

observations of how particular social-motivational factors associated with a TA may work differently for groups of students with different motivations, in terms of goal orientations. A central question is what types of goal pursuits distinguish low-performers from high-performers with a TA. This knowledge may then be used for designing computerized tests and test situations that utilize students' natural motivations to perform well at school.

3. Three Studies of Social-Motivational Factors in relation to Goal Pursuits with a TA

3.1 History and Familiarity with the TA

Would the presence of a TA in a test affect test performance even without the extensive (eight-week) period of interacting with the TA in our previous study [2]? We hypothesize that social goal-oriented students benefit more from a familiar TA in a test, whereas task-oriented students may regard "teaching the TA" as simply another task to be solved and thus do not attribute much importance to the familiarity aspect. Performance effects of using both familiar and unfamiliar TAs in a test situation will be assessed, with respect to students' social and task-related goal pursuits (cf. Fig. 1: A).

3.2 Personal Attachment and "Ownership" of the TA

A second planned study addresses the importance of students being assigned a personal TA (e.g. carrying their name or distinct visual features) that follow them from a learning phase to a test situation, compared to having a general TA without distinct features. We hypothesize that strengthening the student-TA bond through personalization would benefit more social goal-oriented students within a developmental perspective (cf. Fig. 1: B).

3.3 Expressions of authority and compliance of the TA

In a third study we are interested in examining the importance of maintaining the certain power relation expressed in the Master/Apprentice scheme between the student and the TA. That the TA appears "teachable" and less knowledgeable than, and thus subordinate to, the student is an inherent feature of this relationship. Would the students' approach to the TA be affected by the TA's expressions of authority, as reflected in the pop-up dialogues when requesting the student to answer questions? One hypothesis is that authority statements (e.g. "Teach me this item!") may reactivate the conventional social goal in the classroom, that is, behaving like a student rather than a teacher. This might negatively affect the student's self-evaluation of mastering the tasks at hand and lead to decreased performance. A counter-hypothesis is that the student performs better, because he/she is used to complying with authoritative requests and dealing with authority figures in the classroom. Differential effects may depend on students' hierarchical ordering of task-related goals in relation to social (compliance) goals for performing well on the test (cf. Fig. 1: C).

References

[1] Chase, C., Chin, D., Oppezzo, M., Schwartz, D. (2009). Teachable Agents and the Protégé Effect: Increasing the Effort Towards Learning. *Journal of Science Education and. Technology*, *18*, 334-352.

[2] Sjödén, B., Tärning, B., Pareto, L., Gulz, A. (2011). Transferring Teaching to Testing – An Unexplored Aspect of Teachable Agents. In G. Biswas et al. (Eds.), *AIED 2011* (pp. 337-344). Berlin: Springer.

[3] Wentzel, K. R. (1999). Social-Motivational Processes and Interpersonal Relationships: Implications for Understanding Motivation at School. *Journal of Educational Psychology*, *91*(1), 76-97.