Pedagogical Agents for Intelligent Tutoring

Review of “The Effects of a Pedagogical Agent for Informal Science Education on Learner Behaviors and Self-efficacy”

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Introduction:

One to one learning with a teacher has always been one of the most effective paradigms of tutoring in the context of formal education. The efficiency of the learning process increases drastically when we incorporate guides in the process who is well equipped with the capabilities of driving the students through the learning experience, as it has never been so exciting to get knowledge all by ourselves. Like it’s effectiveness in the formal education domain, it has also been found very helpful for the domain of informal education. Informal Education is the term that we use to denote the learning experiences outside the institutions like schools and colleges. Typically, the learning that occurs in some public events, museums, quiz competitions etc. falls under this category. Due the effectiveness they showed in manual instruction systems, these techniques of learning have also been used widely in Intelligent Tutoring Systems(ITS), which are the computer aided artificially intelligent tutoring programs. In the paper mentioned above, the authors have inspected the effect of artificial pedagogical teaching agents in the environment of ITS platforms. It’s a verbose abstract view kind of literature which gives us the rough overview of the experiments they performed and some results associated with it. They also provided a brief analysis of the pros and cons of the results they found without going into much details about the actual ways of how the experimentation took place. I found the paper very introductory at times as it is shallow in nature for the most of the portion and is only effective to have a very rough idea about how this type of pedagogical characters can be incorporated in big tutoring systems. In addition to reading this paper, a further research into the other relevant literature is very much recommended for anyone who is wishing to dive into the world of artificial pedagogical agents to have some more clear view about it. At a glance, they introduced a new agent called Mike and performed experiments with and without his presence in the tutoring systems of a science museum. In another experiment, they introduced two different versions of Mike with different emotional characteristics and studied the efficacy of enthusiasm and self-regulatory feedback for knowledge acquisition. Despite the slight shallowness of the read, I believe that the work described in the paper is really a great reflection of how useful these agents can be, even without many-sophisticated abilities in those environments and the authors very clearly portrayed that in the literature. In a nutshell, it’s definitely a good start for anyone interested in pedagogical agents for ITS platforms. Here we provide the summary of different studies they conducted and our thoughts on the same so that we can see the bigger picture at a glance.
Pedagogical Agents in society:

The design of efficient pedagogical agents has always been an area of active research for educational technologists. Due to the social nature of the learning process, it can take advantage of the features of these agents like nonverbal behaviors, displays of empathy etc. Though there have always been signals showing that these agents help enhance the learning experience, we still not clear about whether the results show up due to the internal properties or the external properties. Apart from the cognitive outcomes, researchers are very much interested in the non-cognitives outcomes of these agents like promotion of skills such as perseverance, self-control, grit, motivation, and others have long-term societal benefits. We can see the need of these non-cognitive aspects of the learning process is more in case of informal education as compared to it’s counterpart. In case of institutional education, the students are somewhat bound to the learning environments and are often forced to learn a certain way that the system dictates. This, however is not the case with informal education. Imagine a situation where you are trying to explain something about your product to a customer. In this case, the most important thing is to keep the customer engaged in the explanation, after which you can start putting efforts to instill the knowledge components of the explanation. Pedagogical agents in the informal learning systems face the exact same challenges as the salesman in the above example does. This explains the need of non-cognitive tutoring abilities in these agents properly. In the context of the museum environment explained by the authors, they stated that “They must take seriously goals such as convincing a visitor to engage, promoting curiosity and interest, and ensuring that a visitor has a positive learning experience.” Then they give several examples of successful pedagogical agents deployed in some commercial systems and moves on to the actual description of the agent under research for this publication, “Mike”.

Incorporating Agent in Museum:

In the Cahner’s Computer Place of Museum of Science, Boston, they installed a robot programming interface with a character called Robot Park which had few programmable moves and actions which the visitors could try on through programming the robot. The basic idea was to show the general public how easy can robot programming be and that it is not a rocket science. But often they saw that most of the times the visitors didn’t voluntarily approach to learn the stuffs related to it or sometimes got stuck in between the programming task. In those scenarios, initially, the museum stuff used to help people out wherever they faced difficulties. In 2010, the authorities decided to incorporate a pedagogical agent in the system to help the visitors through the process which eventually can take up the responsibility of the stuff members explaining the moves to the visitors. The agent in the discussion, called “Mike” was primarily designed as a cartoon character to attract the middle school students. The character had a vision of teaching elementary programming concepts through the environment of Robot Park and it had a great collection of abilities from the point of view of both cognitive and non-cognitive aspects of the tutoring cycle. The paper provides snapshots of the character and explain some of it’s abilities with the help of some dialogs extracted from actual usage of the system. The best thing about Mike was it’s engaging feedback system which really helped in the retention of visitors in the programming task. The description helps the reader get a good idea about the usage and usefulness of incorporating the agent in the system.
The two experiments:

The authors explained the different tests done on the environment where Mike was installed. Basically, there were two sets of experiments. The first one included testing whether incorporating Mike into the Robot Park system was actually helpful. They found that the average holding time of the visitors increased by 51 seconds when Mike was active with Robot Park compared to the situation without Mike. Though they didn’t find any significant improvement in the overall programming behavior in terms of no. of programs written, they could see some improvement in some other aspects like retention time of visitors, probability to attempt and complete the task etc. Also, there was no improvement in visitor ratings while incorporating Mike. The second set of experiments were done to find out the effects of introducing personality and enthusiasm in the agent Mike. They developed two versions of Mike, one is enthusiastic Mike and the other being serious Mike. The former one had lots of appreciating and motivating characteristics in it like applauding the visitors on their successful programming on a task of Robot Park and some other emotional features. The latter one had more of a formal kind of feedback mechanism with very minimalistic reaction sequences. However, they didn’t see much improvement in challenge attempts, programs written or visitor retention. The authors described some other related experiments with the second set of experiments towards the end which explains a little bit of a detailed explanation of the self-efficacy beliefs. Though the second set of experiments doesn’t seem to yield many important results, they still write towards the end that they did detect a modest, but significant increase in visitors’ self-reported self-efficacy ratings when Coach Mike was configured to be enthusiastic and to deliver self-regulatory feedback. Overall, the results of these two sets of experiments showed some really interesting outcomes which indeed bolstered the belief that incorporating a pedagogical agent in an informal learning system is something that we must concentrate on.

Final Remarks:

Making people learn in informal settings has always been a great challenge to mankind. The main problem with these kind of teaching activities outside the class is that the teacher has to act both as a salesman and an instructor to the audience. In such cases, if intelligent tutoring systems can help us resolve this issue with pedagogical agents then the lives of the people who care about it will become much smoother. The architecture and the experiments explained in the paper indeed provides us with some really interesting empirical results based on which many subsequent research activities took place in this domain. The work is explained in a neat and simple manner which targets a vast range of audiences from the novice to the experts. Though it lacks technical details at places, still we believe the literature is certainly fulfilling whatever it was intended to. Along with the nice results obtained from the experiments, the authors also very humbly describes some of the main shortcomings of the research out of which two are really significant ones. First being the lack of experiments which could have checked the need of an animated character for Mike, as all the experiments happened only with the animated Mike and none with it’s non-animated counterpart. Secondly, the author says that he wishes if there were some more user emotion detection capabilities in Mike so that the feedbacks given to the audience were much more tailored to the need of the learning curve. However, considering all the aspects of the work, we would finally like to say that the paper is one of the notable ones in it’s domain and is highly recommended for everybody working in this field.