A Cross-Cultural Comparison of Effective Help-Seeking Behavior among Students Using an ITS for Math

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Abstract.. We use educational data mining to arrive at models of help-seeking behaviors associated with learning from datasets from three countries: Costa Rica, the Philippines, and the USA. The models were then tested on each country's data to find out how effective help-seeking behavior varies across countries. This study found that models of effective help-seeking are not necessarily transferrable across specific pairs of cultures.

Keywords: Help-seeking, Cross-Cultural, Cognitive Tutors, Scatterplot

Our objective was to find out whether effective help-seeking behavior is similar across cultures, as this would have implications on future efforts to develop meta-cognitive tutors, or tutors that try to incorporate tutoring effective help-seeking behavior. We do this by generating models of effective help-seeking for three countries and comparing them across cultures. This study made use of data collected from prior studies in Costa Rica [4], Philippines [5], and the USA. In these studies, data were extracted from logs produced by an ITS for generating and interpreting scatterplots [2]. From the scatterplot tutor logs, 17 help-seeking features were distilled. As in [1, 3], the features consisted of the frequency of semantic behaviors across all tutor use. We modeled effective help-seeking behavior by finding a set of related behaviors that led to the most learning for each country, and then created an additional 'universal' model from the combined data sets of the three countries. We quantified learning as student learning gains, as measured through a pre-test and post-test (e.g. post – pre). Our process for creating models of effective help-seeking for each culture involved several steps, very similar to that in [3]: feature engineering, feature selection, feature optimization, model creation, and model evaluation.In model

evaluation, we tested each country's models to the data sets of the other countries, and got the correlation of the actual learning and the predicted learning.

The Philippine and USA models performed well on each other's data sets (r=0.146, 0.228 respectively). Interestingly, other automated detectors have been shown to generalize between students in the US and Philippines, for example a detector of carelessness in [5]. However, the Philippine, USA, and the universal model did not perform well for data from Costa Rica (r=0.004, -0.085, -0.073 respectively). The collaborative behaviors seen in [4] for Costa Rican students may explain the difference in help-seeking behavior, as a more collaborative environment may make other students the main source of help while studying with ITSs, while only specific types of help that are not available from other students will be sought in the ITS.

In conclusion, we found that help-seeking behaviors do not necessarily transfer across specific pairs of countries. This exposes the possibility that the help-seeking model used by a meta-cognitive tutor may be effective in one culture but not in others. Hence, future work will be needed to determine how to develop models that can be used world-wide, perhaps involving data from a wide range of countries, or intelligent tutors adapting to help-seeking behaviors will need to have their models re-fit for the countries where they are used.

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