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Prediction-Based Learning: An Example of Weather Forecast Practicing

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Abstract: Prediction is a higher-order thinking skill. In this study, a technology supported prediction-based learning framework which covers buildingprior-knowledge, exploringenvironments, finding clues and inferring results is proposed. A learning camp, "Little Weather Scholars," was carried out based on the framework, which focused on the design and implementation of a learning course for elementary students to train their ability to make weather forecasts. Sixty-four4th to 6thgraderspupils coming fromthirty-one elementary schools in Taipei Cityparticipated in the camp. The results indicate that with the help of the scaffolding, the students could complete the process to make their own weather forecast.

Keywords: Weather forecast practicing; Taipei weather inquiry-based learning network

Introduction

Higher-order thinking skills which cover inquiry [3], prediction, problem solving and so on are more and more important for the students to face the 21st century challenges.Regarding the prediction skill, when the students engage inthe prediction-based learning activity, they need multiple skills, including questioning, hypothesizing, planning, carrying out investigations, making conclusions etc. Besides, the learners should construct knowledgeby themselves, making use of sophisticated information-gathering tools, and collaborative interactions with their peers. Prediction activities provide learners a valuable context to acquire, clarify, and apply toatangiblescience concepts. The activities also help the learners to develop cognitive abilities and science domain knowledge. Prediction learning activities emphasize on posing questions, gathering and analyzing data, and constructing evidence-based arguments. In this study, a technology supported prediction-based learning framework is proposed and designed. Based on the prediction-based learning framework, a weather forecast campnamed"Little Weather Scholars"was implemented. The camp practiced results reveal that by providing appropriate scaffoldings, the students could have better weather forecast ability and have much understanding about the weather domain knowledge in the meantime.

1. Technology Enhanced Prediction-Based Learning

By providing the students with the opportunity to pursue undefined answers to questions, prediction-based learning can enable students to discover new principles and refine their understanding of the concerned domain.However, implementing prediction-based learning in classroom has a lot of challenges for the teachers and the students. Technology offers new opportunities to support prediction-based learning. In this session, a technology supported predication-based learning framework is proposed. The framework includes four phases; they are building prior-knowledge, exploring environments, finding clues, and inferring results. Each phase is elaborated below:

- Building Prior-Knowledge: The goal of this session is to help the students to have a stronger background on the subject.
- ExploringEnvironment: At this phase, the learners need an environment where has a lot of raw data to study, analyze and explore.
- Finding Clues: Based on the explorationenvironment, the students can find some clues to make further decisions.
- Inferring Results: At the inferring results stage, the students need to make conclusion about their predictions.

2. An Example of Prediction-Based Learning: "Little Weather Scholars" Camp

The "Little Weather Scholars" camp was a scaffolding weather forecast learning and practicing activity for $4^{th}$to 6^{th}graders pupils. It took place on May 2and 8, 2010 for totally one and a half days. There were sixty-four students from thirty-one elementary schools in Taipei City attendingthe activity. The activity, according to the technology supported prediction-based learning framework guide, comprised four phases listed below:

- Building Prior-Knowledge: Weather Forecast Learning Course
  The weather forecast learning course comprises five parts. They are basic lectures of weather forecast, introduction of weather maps, drawing simple weather map, transformation of weather information, and weather forecast practicing. The course also includes a weather experiencing lesson and a lecture on the characteristics of EastAsian rainy season to enhance their understanding of the weather changesin season.
- Exploration Environment: Taipei Weather Inquiry-based learning Network (TWIN)
  Once the students learnt the knowledge of forecast, they need an environment to explore and to collect data. In Taipei City, there is a city-wide wireless weather sensor network (TWIN) which is a network with sixty weather sensor nodes. TWIN provides a huge Taipei area weather data for the students to explore. At this stage, the students can explore the weather data on the TWIN platform [1].
- Finding Clues: Scaffolding Weather Forecast Practicing
  After all of the lessons of the first day, next, the instructor guided students to read and analyze forecast weather mapsannounced from Central Weather Bureau (CWB). Students could refer to the forecast values of the highest temperature, lowest temperature and probability of precipitation (POP) in Taipei City thatwasannounced by CWB to make their own forecasts and write down the affecting elements and

factors. They also could refer to the measured data in Taipei weather station and adapt their forecast values based on the public information and forecasted weather changes made by CWB.

- Inferring Results: Producing the Weather Forecast Report
  All the students were requested to produce a weather forecast report according to their data. The report was a worksheet which includes the highest temperature, the lowest temperature, rain rate, and the reasons which are for supporting for their forecast.

3. Evaluating the Accuracy of Weather Forecasting

The effective samples were fifty-six copies from two classes of the camp. There were thirty copies from class A and twenty-six from class B. Among them, 27% were from 4thgraders; 44%, 5thgraders; and 29%, 6thgraders. Regarding the temperature forecast, the mean absolute error(MAE)was 1.7°C for class A and 1.8°C for class B. It showed that the learning results were almost no difference between the two classes. In addition, the MAE for 4th, 5th, and 6thgraders were 1.9°C, 1.7°C, and 1.6°C, respectively.It obviously refers to that the higher grade students could make better forecast.Analyzing students' weather forecast behaviors showed that 14 of them (25%) completely adopted CWB's May 1, 2010forecast. On the other hand, 42 students (75%) referred to CWB's forecast but made their own forecast. Among them, 44% of 4thgraders, 80% of 5thgraders, and 93% of 6thgraders proposed their own forecast. It also reveals that the higher grade students had much courage to put forward their views.

4. Conclusions

In this study, a technology supported prediction-based learning framework is proposed, and a prediction-based learning event, "Little Weather Scholars" camp is elaborated. Sixty-four 4th to 6th graderspupils from thirty-one elementary schools were recommended to attend this camp.They completed the process of weather forecast practicing on lowest temperature, highest temperature andPOP [2].The results showed that with the help of the scaffolding the students could complete the process to make their own weather forecast. 93% of 6thgraders could make self-judgment and modify CWB weather forecast. 80% of 5thgraders and 44% of 4thgraders could also do so. Among the self-judgment forecasters, 83% of them the MAEs were lower than CWB's MAE. The results also revealed that providing appropriate scaffolding lessons could effectively enhance elementary students' abilitiesto reasonably interpret and apply weather forecast information in their daily lives.This study demonstrates the benefits and potential of the prediction-based learning.

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