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數學建模教學方案設計比賽

《學教評方案設計》

參賽教學方案名稱：**Building a Power Consumption Equation Model for a Classroom**

設計特色

The teaching design is a structured data modelling activity to demonstrate the use of partial variation in a real-world context. The teacher makes use of the real data of the power consumption of a classroom and the weather to guide students to interpret, analyse, and evaluate data to build a mathematical model to describe and project power consumption patterns according to temperature. Students are provided with the opportunity to organise and represent raw data so as to observe patterns that can provide information for building a mathematical model, and hence link up the physical meanings in the real world with the data patterns which are an important component of interpreting a mathematical model.

Students should have some basic understanding of the factors that affect the energy consumption, but they may not have the opportunity to look into real data. The teacher makes use of the EMSD SEMS platform to visualize the energy consumption by date and time, so students have to apply a sensible way to extract and organise data in answering the questions under study, namely the relationship between temperature and power consumption in a specific classroom during the lesson time. The teacher states some of the assumptions, and guides students to look for information accordingly, as well as present the data in an organised manner.

With the aid of computational tools, there is no need for students to do a lot of repetitive calculations, but rather focus on observations of the data set. The teacher may discuss with students various ways to describe the distribution of data which are clustered in two groups. However, more importantly, the physical meaning that causes the clustering should be discussed so that the data patterns can be related to real-world scenarios. The clustering pattern also provides a foundational reason to derive a mathematical model as a piecewise function.

Besides, the teaching design also places a focus on the concept of data cleaning, namely identifying the outlying data, as well as normalizing data which could be identified with factors which are not discussed in the mathematical model. Students should be well reminded to observe the data in detail, and at the same time be aware of the limitations of the assumptions made for the mathematical model so as to locate the data that need to be neglected or normalized.

In finding the parameters of the mathematical model, students may use computational tools to find the line of regression, and pay attention to the meanings of these parameters and their connections with the real-world scenario. With a good understanding of how the mathematical model could represent the real-world scenario, students may therefore make use of the model to make predictions, or manipulate the boundary of the piecewise functions to propose energy-saving solutions.

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