A Study on the Construction of Science Education Website Evaluation Indicators from the Perspective of Learning Strategy

Summary

Introduction

In an age in which Internet resources continue to proliferate at an astonishing rate, it is necessary to develop appropriate evaluation indicators to help promote the use of excellent science education websites. This study aims to construct Science Education Website Evaluation Indicators (SEWEI) from the perspective of learning strategy. This study also provides suggestions to teachers and students for selecting appropriate learning resources on the Internet, and to website designers for implementing good websites in the future. The research questions are listed as follows: (1) What are the constructs in SEWEI? What is the weight value for each construct? Which construct has the highest weight value? (2) What are the indicators in SEWEI? What is the weight value for each indicator? (3) Among all indicators, which indicator has the highest weight value? Among all constructs, which construct has the highest index weight value?

Method

Procedure

This study applied an expert questionnaire, the Fuzzy Delphi Method (FDM) and Fuzzy Analytic Hierarchy Process (FAHP) as the main methods. After systematic literature reviews of studies related to learning strategy and

website evaluation, the first frame of indicators was established. The expert questionnaire was used to modify the first frame of indicators and form the FDM questionnaire, which was then applied to assess the quality and the suitable degree of the indicators. Finally, the FAHP questionnaire was used to estimate the weights of the indicators.

Participant

The expert questionnaire

Nine experts were invited to complete the expert questionnaire in this study. Five of the experts were professors in the fields of science education, learning theory or information education. The rest four were elementary school teachers.

The FDM questionnaire and FAHP questionnaire

Twenty experts were invited to evaluate the FDM questionnaire and FAHP questionnaire in this study. Eleven of the experts were professors in the fields of science education, learning theory or information education. Nine of the experts were elementary school teachers in the fields of science, mathematics or computers.

Data Collection and Analysis

The procedure for FDM

(1) Collecting opinions of the decision group; (2) setting triangular fuzzy numbers; (3) screening evaluation indexes.

The procedure for FAHP

(1) Establishing the hierarchy architecture; (2) establishing a fuzzy positive reciprocal matrix; (3) consistency testing; (4) calculating the fuzzy weight value; (5) defuzzification; (6) sequencing.

Results

Expert Questionnaire Analysis Results

The hierarchical structure and indicators of the expert questionnaire were determined based on the literature review. We identified 3 first-level indicators, 11 second-level indicators and 43 third-level indicators in the expert questionnaire. After nine experts clarified the meaning or simplified the descriptions of the above indicators, one of the third-level indicators was deleted and the others were retained.

FDM Questionnaire Analysis Results

The FDM questionnaire for the second round was developed based on the analysis results of the first round. According to the opinions of twenty experts, five third-level indicators did not reach the threshold, so they were deleted. At this point, the hierarchical structure of SEWEI included 3 first-level indicators, 11 second-level indicators and 37 third-level indicators.

The three first-level indicators included cognitive strategy, metacognition strategy and resource management strategy. There were four second-level indicators and thirteen third-level indicators in the cognition strategy construct; the four second-level indicators were rehearsal & selection strategy, elaboration strategy, organizational strategy and practice strategy. There were three second-level indicators and nine third-level indicators in the metacognition strategy construct; the three second-level indicators were planning strategy, monitoring strategy and regulating strategy. There were four second-level indicators and fifteen third-level indicators in the resource management strategy construct; the four second-level indicators were time management, effort management, environmental management and feedback & support.

FAHP Questionnaire Analysis Results

The FAHP questionnaire for the third round was developed based on the analysis results of the second round. Microsoft Office Excel was

employed in the present study to calculate each indicator's weight value and consistency. Consistency existed when the Consistence Index (CI) and Consistence Ratio (CR) were smaller than 0.1. CI & CR among constructs and the CI & CR among items in a construct were less than 0.1, implying that consistency existed among constructs and among items in each construct.

The sequence for the first-level indicators was cognitive strategy (43.64%), resource management strategy (34.70%) and metacognition strategy (21.66%), based on the weight values. The sequence for the second-level indicators was feedback & support (14.27%), practice strategy (13.36%), rehearsal & selection strategy (12.07%), organizational strategy (9.12%), elaboration strategy (9.09%), planning strategy (8.40%), regulating strategy (8.07%), time management (7.89%), effort management (6.69%), environmental management (5.85%) and monitoring strategy (5.19%), based on the weight values.

Conclusion

The major conclusions of this study are listed as below: (1) There are 3 first-level indicators, 11 second-level indicators and 37 third-level indicators in SEWEI, with overall consistency and measurable value exhibited among the indicators. (2) The first-level indicators include cognitive strategy, metacognition strategy and resource management strategy. The weight of cognitive strategy is the highest among all first-level indicators. (3) The second-level indicators include rehearsal & selection strategy, elaboration strategy, organizational strategy, practice strategy, planning strategy, monitoring strategy, regulating strategy, time management, effort management, environmental management and feedback & support. The weights of feedback & support, practice strategy, and rehearsal & selection strategy are the highest among the second-level indicators. These findings may be important references for practice and future studies.