THE IDENTIFICATION OF TEMPORALLY RELATED STRUCTURAL ELEMENTS OF THE EXPERIENTIAL COMPONENT OF ELECTRONIC SPREADSHEET TASKS

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ABSTRACT

The structural elements of the experiential component involved in learning electronic spreadsheet applications, from the learner's point of view and relative to exposure length, have not been systematically studied and identified. Furthermore, any relationship between such structural elements that may exist relative to performance is also lacking in definition. Therefore, this study concerns itself with the assessment of the structural elements of experiential spreadsheet tasks based on 'earner perception. This study takes the first empirical step toward a more complete understanding of the temporal relationships between the perceived structural elements of experiential spreadsheet task learning and performance. It also looks forward to the expansion of useful information for developing teaching materials and approaches to enhance educational processes involving experiential learning.

DEFINITIONS AND OBJECTIVES

Short-term is defined as four fifty-minute meetings including supporting laboratory time. Learners in this group were identified as Group 1. Long-term is defined as approximately forty fifty-minute meetings including supporting laboratory time. Learners in this group were identified as Group 2. Both groups used Lotus 1-2-3 software run on microcomputers and received equivalent lecture and demonstration instruction.

The short-term goals of this study were to identify and interpret the structural elements of the experiential component involved in learning electronic spreadsheet applications, from the learner's point of view, relative to exposure length. The overall, longer-term, goal of this research is to utilize the results of this initial empirical step in the expansion of useful information for developing teaching materials and approaches to enhance educational processes involving experiential learning.

ANALYTICAL APPROACH

The data were analyzed using factor analysis and comparisons were made of the results. A multivariate analysis approach was considered reasonable because the study involved an analysis of the relationships among variables, particularly the interdependence of variables. Since the focus of this study was an attempt to confirm the presence or absence of latent constructs of student perception relative to specific spreadsheet tasks, factor analysis was deemed appropriate.

A questionnaire designed to provide assessment of proficiency was administered to learners in both the short-term and long-term groups. The questionnaire used a Likert-type scale with proficiency levels ranging from one to ten, with one representing the lowest level of proficiency. Proficiency was measured for ten common spreadsheet tasks: loading the software, saving files, replacing files, changing cell label alignment, writing simple formulas, writing formulas using built-in statistical functions, using relative and absolute cell addressing in formulas, copying a range of cells, moving a range of cells and editing the contents of a cell. The questionnaire was completed by a random sample of 41 students in the short-term group. All 41 students from the long-term group completed the questionnaire. The frequency distributions and mean responses for each group suggested that learners in both groups felt that overall they had a relatively high proficiency in all tasks.

FACTOR ANALYSIS RESULTS

The factor analysis procedure began with a study of the correlation matrix to assess the covariance relationships or linear association among the variables. The correlation matrix was used in this study because although the units of measure change by one on a scale of one to ten the differences in proficiency levels from one

number to the next are not commensurate. Therefore, the variables were standardized by using the correlation matrix. Factors were then rotated to allow a more precise interpretation of the factor pattern.

The Group 1 correlation matrix revealed strong relationships between a number of short-term group variables. Twelve correlations of .5 or higher were reflected for Group 1, with the strongest correlation (.909) between the variable "formula" and the variable "function." Two variables had moderate correlation with three other variables: The variable "replace" had correlations of .528, .55 1, and .640 with the variables "cellref." "copy," and "label," respectively; the variable "label" correlated at slightly higher levels of .603 with "cellref.", .659 with "formula." and .722 with "function."

The Group 2 correlation matrix indicated that nearly all variables for the long-term group were highly correlated. All but five of the correlations were .5 or higher. The strongest correlation (.848) was between "move" and "copy." The three variables. "save," "copy," and "edit." correlated with all other variables at .5 or higher.

FACTOR EXTRACTION AND INTERPRETATION

The purpose of factor extraction is to determine the factors that identify structure. The inclusion of all factors accounts for all the variance of each variable so that a unique factor serves no purpose. However, since a primary goal of the research was to summarize the data, factor extraction was performed.

Green (1978) suggests that the rotation of factor loadings leads to a "more interpretable orientation and recomputation of factors scores in the new orientation." Variables that load heavily on a given factor are correlated in a multivariate sense. This study utilized a combination of the factor extraction approaches along with factor rotation to extract factors for each group.

COMPARISON OF THE TWO GROUPS

A comparison of the 3-factor rotated factor matrices for Group I and Group 2 show that for

both groups the variables "function,' "formula," and "cellref' load heavily on Factor I. This suggests assigning the variable "label" to this group also because in the Group I rotated factor matrix "label" loaded heavily on Factor 1. In the unrotated factor matrix for Group 2 "label" also loaded heavily on Factor I. The loadings suggest a common factor of the type data management tasks.

The variables "move," "copy," and "edit" load on the same factor in each group, but the factor number is different between the groups, i.e., for Group 1, the three variables load on Factor 2; and for Group 2, the three variables load on Factor 3. This does indicate that a common factor exists for the three variables. The common factor type for these variables is of the type range management tasks.

The variables "save," "load." and "replace" exhibit loadings on the same factor in each group, but like the variables discussed in the previous paragraph, the factors numbers are different by group. Therefore a common factor of the type file management tasks is suggested.

CONCLUSIONS

The short-term goals of this study were to identify and interpret the structural elements of the experiential component involved in learning electronic spreadsheet applications, from the learner's point of view, relative to exposure length. Structural elements, based on underlying latent constructs, were identified. These factors were termed: 1) file management tasks, 2) data management tasks, and 3) range management tasks. These experiential components were interpreted as common to both short-term and long-term learning groups. Although the measurement of spreadsheet tasks performance required for the further analysis of latent constructs identified herein was necessarily delayed, this study, provides a theoretical foundation for measuring the relationship between proficiency in completing selected tasks over both the short term and the long term

REFERENCES

Available on request.