Work in Progress - Effects of Instructional Delivery Messages and Media in a Digital Signal Processing Course

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Abstract - In a Digital Signal Processing (DSP) course for senior Electrical Engineering majors, students received two different types of instructional delivery messages (online text only and text along with a simulation tool: MATLAB) via two different types of instructional delivery media (Desktop PC and Personal Digital Assistant (PDA)). An experimental study was designed to investigate the potential main effects and the interaction of these two independent variables: instructional delivery message and instructional delivery media on three dependent variables: students’ learning achievement, their intention, and satisfaction to use those instructional strategies. This study was a 2 x 2 randomized post-test design. A Multivariate Analysis of Variance (MANOVA) was used to analyze the collected data. Significant results were found in independent variables. However, there was no significant interaction found between the two studied independent variables for all the three dependent measures.

H0(1): There will be no statistically significant differences in student test achievement, intention, and satisfaction when students learn using different types of learning devices (PDA vs. PC).

H0(2): There will be no statistically significant differences in student test achievement, intention, and satisfaction when students are presented with different types of instructional messages (text only vs. text with simulation tool).

H0(3): There will be no statistically significant interaction in student test achievement, intention, and satisfaction between the two studied independent variables: learning device and instructional message.

Methods

- Subjects: 28 students were recruited to participate in the study from the Electronic Engineering Department of National Kaohsiung University of Applied Sciences (KUAS) in Taiwan. Out of the participants, 25 students (89%) finished the entire experimental study; 3 (11%) dropped out. For those who completed the experiment, 22 (88%) were male, 3 (12%) were female. Their age levels ranged from 21 to 23.

- Instructional materials: One instructional unit in the course: Introduction to Digital Filter was used to conduct the experiment. It covered Finite Impulse Response Filter (FIR) and Infinite Impulse Response Filter (IIR).

- Variables: Two independent variables were studied: (1) instructional device (PDA and Desktop PC) and (2) instructional message (text only and text with a simulation tool: MATLAB). Three dependent variables were measured in this study: (1) knowledge test, (2) intention to use devices, and (3) satisfaction about learning environments. The knowledge test was given after students learned from the assigned experimental treatments. A questionnaire was designed to measure two student affective constructs: (1) intention to use learning devices and (2) satisfaction levels toward the assigned instructional treatments. The knowledge test was given after students learned from the assigned experimental treatments. A questionnaire was designed to measure two student affective constructs: (1) intention to use learning devices and (2) satisfaction levels toward the assigned instructional treatments. They were measured by a seven-point Likert scale. In order to guarantee the validity of the two dependent measures, the test items and the questionnaire were reviewed by subject matter experts.

- Research design: The research was a 2 x 2 randomized post-test design. The two independent variables were instructional device and instructional message. The dependent variables were one criterion knowledge test, and two affective measures collected from two

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questionnaires. A Multivariate Analysis of Variance (MANOVA) was performed to analyze the collected data. The main effects and the potential interaction of the two independent variables were examined.

**FINDINGS**

I. Finding 1: Main Effect of Instructional Device

Analysis of the dependent variables showed significant main effect of the instructional device only on the intention measure. For the knowledge test and the satisfaction measure, there were no significant differences found among students. Specifically, students who used a simulation tool performed significant better scores on their knowledge test than those who did not use it. In addition, the students who used the simulation tool expressed a significantly higher intention to learn in a Desktop PC environment, not in the PDA. Thus, it might be concluded that the null hypothesis 1 on instructional device should be rejected. In other words, the significant difference was found in the variable of instructional device.

II. Finding 2: Main Effect of Instructional Message

Regarding the main effect of instructional message, it was detected in the knowledge test and intention measure, there were significant differences found among students. Specifically, students who used a simulation tool performed significant better scores on their knowledge test than those who did not use it. Therefore, it might be concluded that the null hypothesis 2 on the students’ prior knowledge should be rejected. That is, the significant difference was found in the variable of instructional message.

III. Finding 3: Interaction

The statistical results showed that there was no significant interaction found between the two studied independent variables: instructional device and instructional message for all the three dependent measures. The absence of this interaction implies that the difference in students’ test achievement and dependent measures of intention and satisfaction between students who use the simulation tool and who did not is non-significant for both types of instructional devices. Therefore, it may be concluded that this null hypothesis should be retained.

**CONCLUSIONS**

This study explores the effects of varied types of instructional devices and instructional messages on undergraduate students majoring in Electronic Engineering. Results show that the interaction between two studied independent variables (instructional device and instructional message) is not significant. Therefore, a further investigation for main effects of the independent variables should follow [2].

**REFERENCES**


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For the effect of instructional device, it is found that significant difference exists between two studied groups: the Desktop PC group expressed significantly stronger “intention to use” measure than the PDA group, while the two groups are not significantly different in the measures of “knowledge test” and “satisfaction.”

Even though mobile instructional devices such as PDAs could provide learners with more flexibilities to learn anywhere at any time than the Desktop PCs, the learning achievement of the knowledge test does not exhibit significant differences between the two groups. It suggests that students’ learning performance seems not to be influenced by varied types of hardware equipments. This finding is consistent with Dillon and Gabbard’s results [3] from a meta-analysis research, stating that many media comparison studies have shown no differences in learning achievement.

Another interesting finding is that students prefer to learn in a Desktop PC environment than the PDAs. A reasonable inference is that Desktop PC provides a bigger display screen than PDAs, which might be easier for students to read the course content.

For the effect of instructional message, the two studied groups exhibit significant differences in the “knowledge test” and the measure of “intention to use”. Specifically, students who used a MATLAB simulation tool performed significantly better in knowledge test and expressed a significantly higher intention to learn than those who did not use such a tool (text-only material group).

This finding is consistent with Davis’ finding [4], concluding that interactive multimedia contents enhance student learning. The topic of digital filter involves student understanding in complicated mathematical equations. The use of such a MATLAB simulation tool indeed helps boost student learning performance. In addition, it is found in this study that the design of multimedia content is more attractive to learners, thus enhances their intention to learn, which is similar to Venkatesh and Davis’ finding [5].