The Effect of Training Methods on Perceptions and Intended Use of Bioinformatics Tools/ Aviv Shachak

Abstract

For centuries, biological research has been influencing midicine, agriculture and the food industry. A recent development in biological research is the emergence of bioinformatics – a relatively new field which combines a variety of tools and techniques from mathematics, computer science and biology to aquire, store, organize, archive, analyze or visualize biological data. Many bioinformatics products and analysis tools are currently available and vast amounts of biological data have already been accumulated and stored in large central databases. Experimental biologists, however, have not yet fully adopted the use of bioinformatics, or have even resisted it. While the importance of training for the advancement of bioinformatics had been widely recognized by scientists as well as by government institutions, little attention has been paid to the effect of training on bioinformatics adoption by experimental biologists.

In this study, a theoretical framework from the field of diffusion of innovations, which is widely used in the study of information technology acceptance, was used. This theoretical framework suggests that an individual's perceptions of an information system play an important role in explaining his or her intention to use it. Intention, in turn, is a predictor of actual usage. Thus, a field experiment to study the effect of training on perceptions and intended use of bioinformatics tools was conducted.

In the first stage, two hands-on training methods for two bioinfromatics tools were developed. The two training methods employed in this study were built upon distinct instructional-design theories, namely: Robert Gagne's "Conditions of Learning" and John Carroll's "Minimalism". These theories reflect distinct views about the way people learn. While Gagne builds primarily on behaviorism and a model of information processing, Carroll anchors his theory in constructivism and in findings from the study of human-computer interaction.

The tools for which these training methods were developed were GeneSpringTM and Oligo6. These tools represent different stages in biological

research, different task characteristics and exhibit different degree of complexity. While GeneSpringTM is used for data analysis, cutting-edge task and is highly complex, Oligo6 is used for experimental design, routine task and is a simpler application.

Ninety people participated in a field experiment conducted at seven bioinformatics workshops. After initial exposure to one of the tools, participants were given a pretest questionnaire which measured their perceptions and intended use of that tool. Trainees then engaged in a hands-on session in which they practiced using the tool by one of the training methods, "Conditions of Learning" or "Minimalism". After this session they were given a posttest questionnaire. In addition, twelve in-depth interviews with participants were conducted several months after the workshops.

After hands-on experience, intention to use the tools significantly decreased. Significant effect of the interaction beween tool and hands-on experience was found. Specifically, this interaction effect was significant on ease of use and job relevance perceptions: both perceptions of Oligo6 increased, but perceptions of GeneSpringTM decreased after hands-on experience. No significant differences in perceptions and intended use were found between Conditions of learning- and Minimalism-based training. Strong and significant correlations were found between three perceptions: usefulness, compatibility and job relevance. Each of these perceptions also strongly and significantly correlated with intended use. Perceived ease of use also significantly, but less strongly correlated with intended use. Significant correlation was also found between previous computer experience and perceived ease of use.

Interview data suggested two additional factors which are important for bioinformatics adoption: cost and knowledge barriers. Particularly, these factors inhibited the adoption of GeneSpringTM. Instead of using GeneSpringTM or equivalent software, people preferred to use research collaborations or services to analyze their data.

These results suggest a view of training as an intervention which helps people form more realistic perceptions of information systems in general and bioinformatics tools in particular. A possible mechanism to explain the effect of the interaction between tool and hands-on is proposed on the basis of Cognitive Dissonance Theory.

The lack of difference between the two training methods could be explained

by the composition of the study population. All subjects of this study had a B.Sc.

degree or higher and conduct or had conducted independent research. Therefore

they are used to structured, step by step instructional methods, which are

commonly used in the academic environment, as well as to learning by

exploration.

The relationships between perceptions and intended use of bioinformatics

tools are consistent with findings from numerous studies on the diffusion of other

information systems. They suggest that perceived usefulness, job relevance and

compatibility are most important for successful diffusion of bioinformatics.

Several new factors, hypothesized to be important for bioinformatics adoption, are

also proposed including task and tool complexity, self-efficacy, perceived

resources and knowledge barriers. The role of these factors has yet to be explored.

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