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# Databases' interface interactivity and user self-efficacy: Two mediators for flow experience and scientific behavior improvement

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ABSTRACT

Testing the influence of user interface interactivity (UII) in databases on scientific behaviors (SB) and investigating the flow experience (FE) as mediator between UII and SB, as well as the role of self-efficacy (SE) as an interferer were the aims of this research. 366 Faculty members and Ph.D. students participated as scholars to complete a questionnaire. We made a SB questionnaire through a comparative review of the related literature on FE, UII and SE. Structural equation modeling was used for data analysis. We found that the more self-efficient participants, the more they experience UII and SB changes/adaptations. Also, we found those participants who experienced more flow, had more chance to experience SB changes and adaptations in UII environments.



## 1. Introduction and problem statement

Attitudes and behaviors which result in scientific productivity are characteristics of a small portion of the society whom are known as scholars. A collection of cognitive and behavioral characteristics which, by use of knowledge structures, results problem solving and adds human knowledge and can be observed as actions/processes is called scientific behaviors (SB). This definition was implied by Shrager and Langley (1990), when they tried to categorize SB in two dimensions (Knowledge Structures and Actions/Processes).

SB is gained through reading, interaction and experience (if we postulate that the person is talent enough). In other words, self, environment, scientific communications, and feedbacks to attitudes can influence SB. According to Glanz, Rimer, and Viswanath (2008), p. 468) scholars' ability to evolve their cognitive and behaviors depends to the scientific communication and interaction extend in environment. So environment is an important factor influencing SB.

Because of overcoming with time, space, social and psychological obstacle, most of researchers do their scientific interactions in electronic environment. Data bases are the most scientific sources in electronic environment and scholars use them as scientific communication tools. Databases' Interface is an important element in successful communication and user satisfaction.

In literature we can find efficacy and efficiency studies of information systems' user interface and found information systems success model (Petter, DeLone, & McLean, 2008; Shackel, 2009). Accessibility, accuracy, integrity, relevance, understandability, simplicity (to use and learning), flexibility, format, appearance, customization/personalization and usability are the most studied concepts in user interface evaluation (Sedera, Gable, & Chan, 2004).

These mentioned features result in user satisfaction. User satisfaction is one of the most important constructs of information systems successful measurement (Zviran & Erlich, 2003). Some studies found that interaction features are important elements in user satisfaction (Chang & Chen, 2008; Liu & Shrum, 2002; Zhang & Von Dran, 2000). And some researchers emphasize on the influence of human – machine interaction on attitude and behavioral evolution (Glanz et al., 2008; Kolko, 2007: 183; Lockton, Harrison, & Stanton, 2010).

In spite of long usage of databases' user interface by faculty members and Ph. D. students, it seems that the influence of this environment has not studied on their SB. This study was conducted to investigate the influence of databases' user interface interactivity (UII) on users' SB.

## 2. Theoretical framework and hypotheses

Among psychological theories such as use and gratification (Hausman & Siekpe, 2009), playfulness (Kuts & Playful user

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interfaces: Literature review & model for analysis, 2009) flow experience (FE) (Finneran & Zhang, 2005) which are used for User eXperience (UX) studies, we found the concept of flow as the more comprehensive and used framework in literature. Also, some studies have found that flow acts as a mediator between interactivity and learning in user interface environments (Ghani, 1995; Ho & Kuo, 2010). The Flow theory was coined by Csikszentmihalyi (1975), Csikszentmihalyi (1990) in positive psychology and gained human–computer interaction researchers' attention in 1990s (Ghani, 1995; Hoffman & Novak, 1996).

Through a comprehensive literature review in sociology of science, research ethics, research methodology, scientific productivity, scientist psychology (especially scientists' traits/characteristics), we found 120 evidence concepts. We categorized these concepts as Five Scientific Behavior Dimensions (FSBD) as follow: Personality, Attitude, Norm (ethics), Action/Process, and Knowledge Structure (see methodology section for more details about FSBD). However, we postulated that scientists/researchers have potential to manage their FSBD, in real and virtual environments. This postulation is according to Bandura (1986), Bandura (1997) Self Regulation Theory.

According to Fishbein and Ajzen (1975) and Ajzen (1991), behavior is the outcomes of behavior intention which is affected by attitude, subjective norm and perception of control. These three factors are affected by behavioral beliefs and evaluation of its results, norm beliefs and following motivation, control beliefs and power perception, respectively. The beliefs, evaluations, motivations and perceptions are influenced by other environmental/contextual factors such as personality traits, individual difference, attitude about aims and demographic factors (Glanz et al., 2008).

All in all, according to both Self Regulation Theory (Bandura, 1986; Bandura, 1997) and theory of planned behavior (Ajzen, 1991), the environment elements along with human interaction can refine attitude. So, user interface as an electronic environment may affect user attitude in a sensible interactivity search session.

According to Moore (in Liao, 2006) there are three kinds of interactions in distance education: educator–learner, learner–learner, and learner-content. Learner-content interaction is defined as a process in which human mind has interaction with content and learner's understanding, attitude and cognitive structure evolve as its result (Liao, 2006). Learner-content interactivity occurs when the learner thinks about information that gets via media (print or electronic). This interaction occurs in many stages (from scrutinizing search results in user interface to deep study of the retrieved document). As a whole, elements and features of user interface can help user have interaction with the retrieved results.

Dholakia, Zhao, Dholakia, and Fortin (2000) categorized user interface interactivity construct elements and conceptualized them for its measurements, as a result of literature review: (1) user control, (2) responsiveness, (3) on-time interaction, (4) connectedness, (5) personalization/customization, and (6) playfulness. As a result we have developed the first hypothesis as follow:

**H1.** User interface interactivity (UII) influences the user's scientific behaviors (SB).

The Flow theory (Csikszentmihalyi, 1975; Csikszentmihalyi, 1990) attracted human–computer interaction researchers in 1990s. This theory has been studied in systems' user interface (Hoffman & Novak, 1996). Previous findings show its consequences as increased communication (Trevino & Webester, 1992), increased learning (Ghani, 1995; Liao, 2006), increased exploratory behavior (Ghani, 1995; Ghani & Desphande, 1994; Webester, Trevino, & Ryan, 1993), and more use of computers (Ghani & Desphande, 1994; Trevino & Webester, 1992; Webester et al., 1993).

According to flow theory, there are some auto telic activities which in human motivations are intrinsic. Csikszentmihaly (1997) believes that this optimal experience is gained with machine interaction, satisfaction and acts as self-reinforcing in computer environment. The Flow state occurs as a cognitive state while user navigates computer environment (Hoffman & Novak, 1996). Some researchers believe that flow is the core in human–computer interaction studies (Ghani & Desphande, 1994; Koufaris, 2002). Csikszentmihalyi (1997) introduced nine conditions (Clear goals, Immediate feedback, Challenges and skill balance, lose of self-consciousness, time distortion, user control, enjoyment, action with awareness) to experience flow state and later researchers confirmed his findings (Chen, Wigand, & Nilan, 1999; Pace, 2004; Woszczynski, Roth, & Segars, 2002) and conceptualized its components as *flow antecedents*: skill, challenge, interaction, presence; *flow or optimal experience*: flow state; and *flow consequences*: increased learning, attitude and behavior change (Ghani, 1995; Hoffman & Novak, 1996; Skadberg & Kimmel, 2004). Following these three stages of flow components, we draw a conceptual framework as Fig. 1 to declare hypotheses 2 and 3.

Previous studies found that the interaction in website user interface results in flow state, we formed H2 and H3 as:

**H2.** Databases' user interface interactivity results in scholars flow state.

**H3.** User Flow state in databases' interface influence user' scientific behaviors.

The fundamental postulate that SB improvement, as human–computer interaction, is based on, is scholar's ability to regulate his attitude and behavior according to scientists' standards. According to Bandura (1986), Bandura (1997) self-regulate persons are capable to evaluate their behavior, attitude and manage themselves in learning process. Self-regulators and self-managers, according to his theory, are believed on their ability to improve their behavior. Bandoura coined the term self-efficacy for this ability. Recently, researchers (such as Dinther, Dochy, & Seger, 2011; Hsu, Ju, Yen, & Chang, 2007; Shea & Bidjerano, 2010) confirmed that self-efficacy is an important indicator for measuring self regulation in education and learning field. So, we formulated 4th hypothesis as follow:

**H4.** Participants' self-efficacy in electronic environments and sources influence UII ($H_{4a}$), flow experience ($H_{4b}$), and SB ($H_{4c}$) modification while using databases.

## 3. Literature review

There is little or no empirical research about SB, albeit Shrager and Langley (1990) articulate two dimensions (knowledge struc-

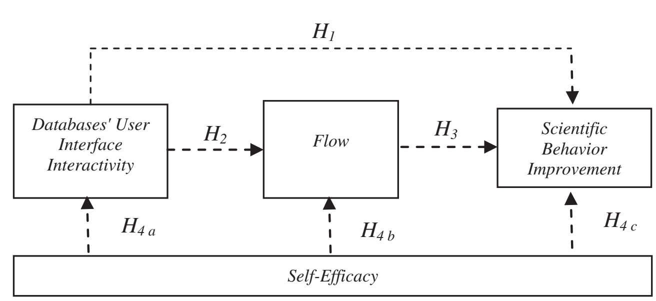


**Fig. 1.** Conceptual framework assumption to declare hypotheses.