

“One cannot seek knowledge about an innovation until he or she knows it exists.”
Everett Rogers, 1963

Review of Literature

Diffusion of Innovations

Rob Darrow

Dr. Sharon Brown-Welty

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Theoretical Framework

The framework entitled “Diffusion of Innovations” (DOI) was developed by Rogers (2003) as the result of a study that took place by Ryan and Gross. Ryan and Gross studied the diffusion of a new innovation at the time - hybrid seed corn - by farmers in Iowa. They had secured a grant from the research arm of Iowa State University for this purpose. It naturally followed that they would study the diffusion of the hybrid seed corn since the hybrid seed corn had been developed at the university. The university was interested in how the use of hybrid seed corn would diffuse throughout the state, so that, as other farm innovations were developed by the university, they would know the process of adoption (Singhal and Obregon, 2004). Rogers characterizes this study as the seminal work that defined diffusion theory. Additionally, Surry and Brennan (1998) asserted that the writings of Rogers and others have shown us that adoption, far from being a spontaneous, hit and miss, mystical act, is, at least in theory the result of a fairly well defined orderly process.

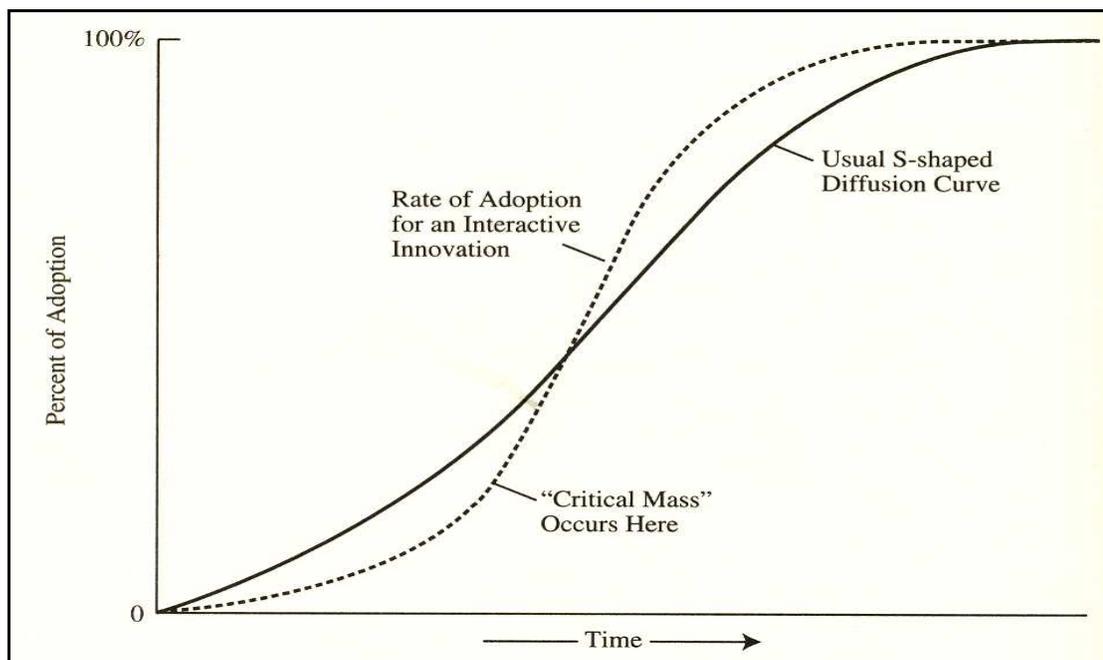
This review of literature is organized into the following sections:

- Diffusion of Innovations Theory and Components
- Adopter Category Studies
- Innovation-Decision Making Process Studies
- Communication Channels and Role of Change Agent Studies
- Attributes of the Innovation Studies
- Discussion
- Summary and Concluding Thoughts

Diffusion of Innovations and Components

Diffusion is the process by which an innovation is communicated through certain channels over time by members of a social system. An innovation is defined as any new idea, object or practice (Rogers, 2003). Rogers reviewed existing studies of innovations in agriculture, education, medicine, marketing and other disciplines and discovered common characteristics in each of these innovations. He studied how innovations diffuse and become adopted including: hybrid seed corn, water purification in Egypt, adoption of family planning in Korea, and various educational innovations such as new math, kindergarten and educational technology (Rogers, 2003). Rogers refined the DOI theory through ongoing research and identified various concepts and measurements that are utilized across a multitude of disciplines. Rogers discovered, and other researchers validated, that all innovations result in a S-shaped curve of adoption over time. See Figure 1.

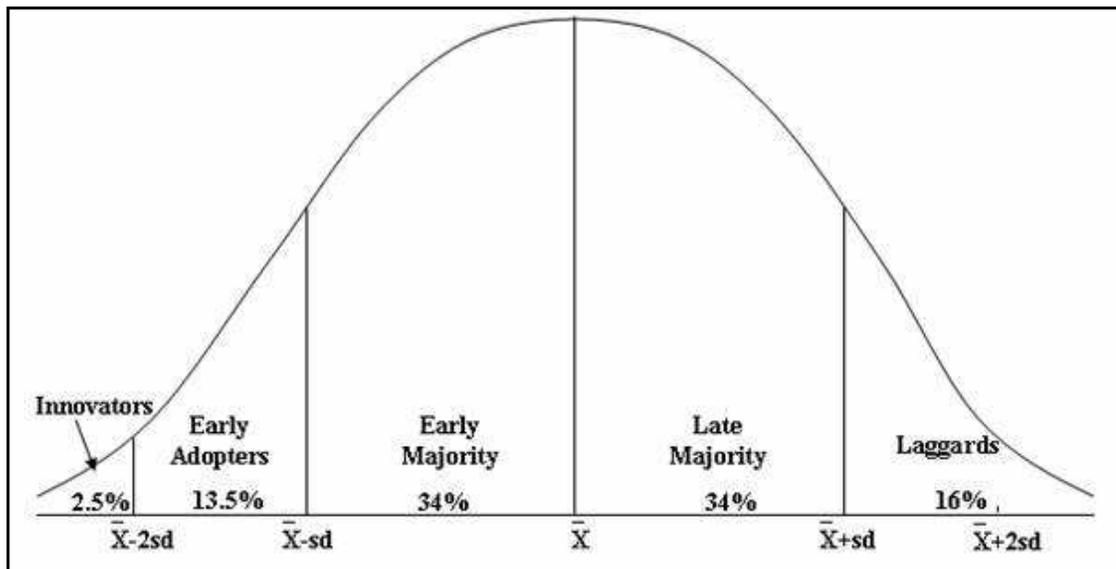
Figure 1. S shaped curve indicates adoption of an innovation over time



Various educational studies that utilized Roger's framework were examined for this review of literature. To understand the studies, it is important to first comprehend the various components of Rogers' theory. The specific components included are: A) adopter categories; B) innovation-decision process; C) communication channels; D) role of a change agent; and E) attributes of an innovation.

Adopter categories include innovators, early adopters, early majority, late majority, late majority and laggards as Figure 2 indicates. The five categories are exhaustive (except for nonadopters). Note that the figure is not symmetrical because there are three categories to the left of the mean and two to the right of the mean (Rogers, 2003).

Figure 2. Adopter Categories



Similarly, as individuals or groups adopt an innovation, all go through similar stages called the *innovation-decision making process*. These stages include knowledge, persuasion, decision, implementation and confirmation. It is at the decision stage that individuals or groups

choose to adopt or reject an innovation (Rogers, 2003). The decision to implement an innovation or change a behavior is a personal decision (Blankenship, 1998).

Communication channels are divided into mass media and interpersonal. Mass media are characterized by media such as television, newspapers or websites. Interpersonal communication is defined as a two-way exchange of information between two or more people, usually in a face-to-face setting. Rogers (2003) showed that the type of communication influences adoption at different stages of the innovation-decision making process. Also, the adopter category of individuals or groups (innovator to laggard) is influenced by different communication channels. Those individuals in the later stages of adoption are most influenced by their peers to adopt an innovation.

The role of the *change agent* is another important aspect of Roger's framework. The change agent's role is to provide support to the participants, guide them to the direction of adoption, and provide reassurance once the decision to adopt has been made. (Hoerup, 2001). Rogers identifies seven roles of a change agent including: develop a need for change, establish an information exchange relationship, diagnose problems, create an intent to change with the individuals, translate an intent into action, stabilize adoption and prevent discontinuance, and achieve a terminal relationship. Specifically, the change agent seeks to shift the clients from a position of reliance on the change agent to one of self-reliance (Rogers, 2003).

Finally, the *attributes of the innovation* itself plays a role in its adoption. Rogers found that there are five attributes that facilitate the adoption of innovation. These five attributes are: relative advantage, compatibility, complexity, trialability, and observability. If these attributes are present, then the innovation is more likely to be adopted (Rogers, 2003). Innovations that are generally perceived by receivers as having greater degrees of positive attributes are predicted to have more rapid rates of adoption than other innovations (Surendra, 2001).

Researchers have applied the framework of the DOI in a variety of educational innovations including curriculum, professional development and educational technology. This review of literature focused on the use of Roger’s DOI framework as it has been applied in K-12 and higher education settings with the adoption of technology innovations.

Technology is defined as information put into use in order to carry out some task while *technology transfer* is the application of information into use (Rogers, 2003). Figure 3 indicates which part of Roger’s framework was utilized for each study reviewed.

Figure 3. Categories of studies and Rogers’ framework chart for review of literature

<u>Category</u>	Adopter Categories	Innovation- Decision Making Process	Communication Channels	Role of Change Agent	Attributes of the Innovation
Higher Ed Technology Innovation	Signer, Hall & Upton (2000)	Sahin and Thompson (2006)	Surendra (2001) Signer, Hall & Upton (2000)		Surendra (2001) Johnson (2001)
K-12 Technology Innovation	Hoerup (2001)	Blankenship (1998)	Blankenship (1998) Frank, Zhao & Borman (2004) Hoerup (2001)	Frank, Zhao & Borman (2004) Hoerup (2001)	

Adopter Category Studies

Signer, Hall & Upton (2000) studied the degree of use of web-based course tools by college faculty at St. John’s University in New York. Utilizing a questionnaire tool, 204 faculty members responded to two different questionnaires in two different years. With this data, they found that in certain adopter categories, organizational incentives facilitated adoption. Furthermore, they concluded that it was critical for the individuals in the “early adopter”

category to receive a variety of support such as training, user groups and summer grants to develop online courses (Signer, Hall & Upton, 2000).

Hoerup (2001) conducted ongoing interviews with seven fifth grade teachers and one computer resource teacher in one school district who were beginning to integrate computer technology in the classroom. She found that there was a correlation between those in one stage of the adopter category and the rate of adoption of others on the grade level team. When those in the *late majority* category were partnered with those in the *early adopter* category for collaborating, the individuals in the *late majority* category integrated technology sooner than if the collaboration had not occurred (Hoerup, 2001). Overall, both research studies indicated that at certain adopter categories, individuals and groups needed different types of support to facilitate the adoption of the technology.

Innovative-Decision Making Process Studies

Sahin and Thompson (2006) and Blankenship (1998) applied the use of the innovative-decision making component. Sahin and Thompson surveyed 117 faculty members of the college of education at Anatolian University in Turkey regarding their use of technology for instruction. They found a positive correlation regarding computer expertise, computer access, barriers to computer access, attitude toward computer use, support for computer use, and adopter categories based on innovativeness. Two major findings included the need to take advantage of faculty members' positive computer attitudes (those further along the innovative-decision making process) and collegial communication to help move to the higher levels of use and expertise in instructional technologies (Sahin and Thompson, 2006).

Blankenship (1998) similarly applied Rogers' innovation-decision making process to technology integration with teachers in grades Pre-Kindergarten through eighth grade. The

survey instrument was administered to 233 teachers throughout this school district regarding their use of technology for instruction. The researcher used a multiple regression analysis, frequency response matrices and study group meeting interviews to analyze the data. Findings indicated that for teachers at all grade levels, interpersonal communication channels and training positively affected the movement of the teachers along the innovative-decision making continuum towards the implementation and confirmation stages.

Communication Channels and Role of the Change Agent Studies

The importance of communication channels and the role of the change agent for an innovation to be adopted were indicated in a variety of studies (Surendra, 2001; Signer, Hall & Upton, 2000; Blankenship, 1998; Frank, Zhao and Borman, 2004; Hoerup, 2001). Surendra surveyed 109 professors at a community college in Ontario, Canada about their use of web based technology. He found that the diffusion factors that were crucial to adoption were community pressure and support. The more positive the innovation was communicated to others, the more likelihood there was of adoption. Signer, Hall and Upton (2000), Frank, Zhao & Borman (2004), and Hoerup (2001), whether in higher education or K-12 education, concluded that the informal interpersonal communication channels were important at many stages of adoption. Frank, Zhao and Borman (2004) interviewed five teachers and one principal in six different schools in three states and then surveyed 143 teachers in the same schools. They found that an influential person or change agent in the same social circle or group positively affected the adoption of an innovation over time.

Attributes of the Innovation Studies

Surendra (2001) and Johnson (2001) found that the innovation itself needs to have positive attributes if it is to be adopted. Surendra (2001), who surveyed community college faculty, found that the “trialability” of the web based technology was crucial to the technology being adopted. Johnson conducted surveys and interviews with 19 college faculty members regarding their use of web media objects. Her results were consistent with Surendra. She found that the innovation attributes were among the predictors that lead a web media object to be adopted for use (Johnson, 2001).

Discussion

These studies suggest that Roger’s framework regarding diffusion of an innovation can be applied to educational settings and to the adoption of various technologies in both higher educational and K-12 educational settings. The adopter category of individuals or groups in a school or college affect how quickly an innovation is adopted (Signer, Hall & Upton, 2000; Hoerup, 2001). Signer, Hall & Upton indicated that in the study of higher education faculty use and adoption of web based instruction, that collegial support for early adopters is critical. These early adopters need to have positive experiences so they can share positive experiences with other faculty members leading to adoption or the innovation may fail. Hoerup (2001) came to the same conclusion with fifth grade teachers, that those in the early adopter category most influenced other group members towards adoption of technology use.

Interpersonal communication channels play a significant role in how and when an innovation is adopted (Surendra, 2001; Blankenship, 1998; Frank, Zhao and Borman, 2004). Influential individuals or change agents, who work with or teach with others in a grade level or

department, most influence members of that group to adopt an innovation (Frank, Zhao & Borman, 2004; Hoerup, 2001). Surendra reported that access to information from peers and training was found to be the best facilitator of successful adoption of educational Web technology.

Finally, if the attributes of the technology innovation itself is not easy to understand or use, adoption is not likely to occur (Surendra, 2001; Johnson, 2001). Johnson found that Roger's (2003) innovation attributes: relative advantage, compatibility, trialability, and observability were among the predictors of the innovation adoption. Surendra (2001) concurred when he found that the diffusion factors explain the variation in acceptance or adoption.

Summary and Concluding Thoughts

The researchers who conducted the studies contained in this review of literature have illustrated how Roger's theory of diffusion of innovations can be applied in various educational settings. This review of literature specifically focused on the adoption of educational technology based on Roger's theory in both K-12 and collegiate settings. However, the components of the diffusion of innovations theory are also applied in other studies of education including school change, professional development and implementation of new curriculum. Further study is needed to explore other theories in addition to the diffusion of innovations theory that may also address the implementation and sustainability of educational technology innovations. Theories such as Ely's eight stages of implementation and Fullan's school change theory should be considered for further research and study (Ely, 1999) for studies regarding the integration of educational technology.

The authors of the studies in this literature study suggested areas for further research. Frank, Zhao and Borman (2004) recommended that further study is needed about how the interaction between collegial subgroups influence the adoption process. Blankenship (1998) noted that studying how training programs are designed could help innovations to better diffuse throughout a school or school district. Signer et al (2000) indicate that studying any innovation takes many years and that they will repeat their developed survey on a yearly basis and assess how web based courses are being adopted at St. John's University in New York.

Additionally, Surry and Brennan (1998) suggest five areas of suggested study related to the diffusion of innovations theory: (1) interaction of adopter groups, (2) adoption versus retention, (3) product versus process, (4) technical and societal accommodations, (5) perspectives of innovation. Further research will determine if one of these recommendations may be adopted for further doctoral study.

References

- Blankenship, Strader K. (1998). Factors Related to Teacher Use of Computers in the Classroom. (Doctoral Dissertation, Virginia Polytechnic Institute and State University). *Networked Digital Library of Theses and Dissertations*. (VT 1998-04-27).
- Ely, Donald P. (1999). New perspectives on the implementation of educational technology innovations. (ERIC Document Reproduction Service ED 422 892.)
- Frank, K., Zhao, Y., & Borman, K. (2004). Social capital and the diffusion of innovations within organizations: The case of computer technology in schools. *Sociology of Education* 2004, Vol. 77 (April): 148–171.
- Frank, K., Zhao, Y., & Lei, J. (2006). The social life of technology: An ecological analysis of technology diffusion in schools. *Pedagogies: An international journal*, 1(2), 135–149.
- Hoerup, Sharon L. (2001). Diffusion of an Innovation: Computer Technology Integration and the Role of Collaboration. (Doctoral dissertation, Virginia Polytechnic Institute and State University, 2001). *Networked Digital Library of Theses and Dissertations*. (VT 2001-12-06).
- Johnson, K.T. (2001). Factors influencing the faculty adoption of web media objects: identification and recommendations. (Masters Thesis, Virginia Polytechnic Institute and State University, 2001). *Virginia Polytechnic Institute and State University Digital Library and Archives*. (ETD-02282002-172446). Available at <http://scholar.lib.vt.edu/theses/available/etd-02282002-172446/>.
- Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
- Sahin, I. & Thompson, A. (2006). Using Rogers' theory to interpret instructional computer use by COE faculty. *Journal of Research on Technology in Education*. 39, 81-104.

- Sahin, I. (2006). Detailed review of Rogers diffusion of innovations theory and educational technology-related studies based on Roger's theory. *The Turkish Online Journal of Educational Technology*. 5 (2). Available at <http://www.tojet.net/articles/523.htm>.
- Signer, B., Hall, C., & Upton, J. (2000). *A study of faculty concerns and developmental use of web based course tools*. Paper presented at the annual meeting of the American Educational Research Association (New Orleans, LA, April 2000).
- Singhal, Arvind and Obregón, Rafael. (2004). A Conversation with Everett Rogers. *Communication Forum for Social Change Consortium*. Retrieved October 1, 2007 <http://www.communicationforsocialchange.org/dialogues.php?id=240>.
- Surendra, S. (2001). Acceptance of web technology based education by professors and administrators of a college of applied arts and technology. (Doctoral dissertation, University of Toronto, 2001). *National Library of Canada*. Available at <http://www.collectionscanada.ca/obj/s4/f2/dsk3/ftp04/NQ58603.pdf>.
- Zhao, Y., Frank, K. & Borman, K. (2004). Social capital and the diffusion of innovations within organizations: The case of computer technology in schools. *Sociology of Education*, 77, 148–171.