

Innovation Constructs: An Exploratory Study

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ABSTRACT

Many organizations strive to improve performance by creating and marketing new products and/or services. Understanding why some new products and services succeed while others fail is critical to managers and marketing researchers. Diffusion of innovation theory addresses the reasons for, and rate of, the adoption of new ideas, products, and services. This theory and its related constructs have been successfully applied to new products while there has been less on emphasis on new services such as educational innovations. Further, research of educational innovations, has focused on adoption by teachers and administrators rather than students. This research study addresses this gap by empirically investigating whether diffusion of innovation theory and constructs apply to student adoption of new academic programs. The study involves surveying undergraduate students from a northeastern college on their perceptions of newly launched and traditional majors. Survey items are adaptations of previous scales as well as new items that relate to the new major decision. The proposed scale utilizes innovation constructs of relative advantage, compatibility, complexity, trialability, and observability. Study results suggest that the diffusion of innovation constructs apply to the new major decision, but contrary to prior research some of the scales are multi-dimensional rather unidimensional as reported in prior studies. This research study provides useful scales that can be used by marketing professionals and designers of new services, especially in the area of education. Also, study results raises issue for the research community regarding stability of innovation constructs in different settings.

BACKGROUND

*M*any organizations create and market new products and /or services to meet the needs of current and future customers. In a similar manner colleges and universities launch new academic programs to meet the changing needs of its students. The creation of a new major at a university often requires commitment by at least one faculty member who is willing to champion the cause for adoption. Often a faculty member will have a sense of what is changing in the marketplace as faculty are often at the cutting edge of research in their field or have access to journals and modes of communication that provide that information. They are the content developers who plan the course content that is to be delivered to students enrolled in a major area of study. Some examples of new majors are International Business, BioInformatics, Digital Media Arts and Accounting Information Systems.

In addition to the development of content, which is similar to development of the actual physical product in industry, the development of delivery systems similar to supply chain systems in industry can also constitute a new product in academia. The growth of online education is one example of this type of new product. The focus of our paper is, however, on the development of new major content irregardless of delivery method and examining the adoption of new majors from the perspective of diffusion of innovation theory.

“An innovation is defined as an idea, practice, or object that is perceived as new by an individual” (Rogers, 2003 p. 12). Adoption of innovations is a vast research area that has focused on topics such as the characteristics of the innovation, the rate of adoption, the influence of the social network, and the characteristics of the innovator (Rogers, 2003). Consistent with other innovations, these research areas are relevant to educational innovations. For

instance, new programs and majors should be designed with regard to student perceptions of the major's benefits and attributes. Further, understanding rates of adoption of educational innovations would enable administrators to better evaluate the status of new programs and project future success of these innovations. Comprehending the innovator's social network and the influence of others on the decision to adopt innovations is also useful for educators. Finally, being able to identify and develop marketing strategies that attract innovative students will increase the success rate of new educational programs and methods.

There is a rich tradition of research in the acceptance and diffusion of educational innovations that dates back to the 1920's (Rogers, 2003). Many of the studies have focused on the rate at which different educational innovations have been adopted by educators. Some examples of educational innovation studies are diffusion of modern math (Ready, 1992), worldwide diffusion of kindergarten (Wollons, 2000), educational use of technology (Frank et al., 2004), and online marketing of educational programs (Gomes & Murphy, 2003). Educational innovation adoption studies may involve adoption by administrators, instructors and students. Scales addressing perceptions of innovations have been developed and applied to numerous innovations (Rogers, 2003). Applying perception scales to educational innovations offers an opportunity to evaluate the applicability of these scales to new educational services. This empirical study focuses on applying existing scales and developing new scales, where necessary, to evaluate their appropriateness in the domain of educational services.

ADOPTION PROCESS

The diffusion process defines the rate at which adoption occurs through time and space. The potential market for the product defines the limit of diffusion (Bass 1969). A model of the diffusion process should consider a variety of factors including the characteristics of the innovation, be it a product or service, the adopter, be it a person or an institution, and the environmental and social system affecting the adopter and personal influence (Rogers 2003). The diffusion rate depends upon the relationships between these factors that affect adoption of the product. The form of a model of the adoption and diffusion processes depends upon the nature of the product or service being adopted.

To stimulate research, Gatignon and Robertson (1985) develop an extensive model of the diffusion process integrating a variety of research work on the consumer diffusion process. They note that their model is not exhaustive, but provides a general framework in which components may be expanded to enrich the depiction of the theoretical process. We shall use this model as a basis for examining the innovation process, thereby leading to hypotheses of relationships we will expect to find in the higher education market.

The adoption process mediates market/social and organizational systems components effects on the diffusion process. Rogers identifies four components of the innovation process as including the innovative product itself, the communication process, the social environment and the time frame for adoption. Gatignon and Robertson (1985) identify four major components of the market or social system: innovative characteristics of the individual; influences of significant others; characteristics of the innovation itself; and, marketing and communication efforts of the organization promoting the innovation. It is important to identify these components of the market/social/organizational system to be able to model the academic new major innovation process. We begin by examining the characteristics of the innovation.

CHARACTERISTICS OF THE INNOVATION

Innovation attributes have been shown to affect innovativeness (Ostlund 1964). Roehrich (2004) identifies three levels at which characteristics of the innovation may vary: the general level; the product level; and, the domain-specific level. In reviewing innovativeness scales and their psychometric properties, Roehrich notes that most scales only identify 10% of the variance in innovative behavior, except for the scales operationalized at the domain-specific level. A scale to measure domain-specific innovativeness has been developed by Goldsmith and Hofacker (1991). Domain-specific measures of innovativeness relate better to adoption behavior than more general measures of innovativeness (Foxall 1995).

It is important to distinguish between innovativeness as a characteristic of a person versus a characteristic of a product or service. Sethi, Smith and Park (2001) define innovativeness of a product as the “meaningful uniqueness” (p. 74) of the new product. Uniqueness implies both novelty and appropriateness.

Rogers (2003) identifies five characteristics of products that affect adoption; relative advantage; compatibility; trialability; observability; and, complexity. Relative advantage “is the degree to which an innovation is better than the idea it supersedes” (Rogers, 2003, p. 15). Compatibility “is the degree to which an innovation is perceived as being consistent with the existing values, past experiences and needs of potential adopters” (Rogers, 2003 p. 15). Complexity “is the degree to which an innovation is difficult to understand and use” (Rogers, 2003, p. 16). Trialability “is the degree to which an item may be experimented with on a limited basis” (Rogers, 2003, p. 16). Observability “is the degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 16).

Courses that colleges and universities offer are intangible and therefore defined as services, not products. How then might service firms differ from firms that produce products and how might that affect adoption? How also do new majors offered by colleges and universities differ from services offered by other organizations?

While there has been some research on innovations in the service industries, the bulk of the research has tended to focus on financial products (e.g., Martin and Horne 1993, Naslund 1986, Reidenbach and Moak 1986, Scarborough and Lannon 1989). The shift to a service economy, however, has resulted in increased attention being paid to service firms and the unique ways in which they serve markets. Many service firms today operate in knowledge-intensive industries (Miles, Kastrinos, Flannigan, Bilderbeek, der Hertog, Hunting and Bowman 1994). Colleges and Universities are one type of knowledge-intensive firm with unique characteristics. As Starbuck (1992) notes, a firm that is knowledge-intensive will make knowledge, as opposed to labor or other factor, the most important input into production of the good or service.

In developing a physical product, a firm makes a commitment to a specific design and produces a number of these identical products. Recently developed terms such as mass customization and flexible manufacturing reveal how products manufactured today can be tailored to more closely match the individual needs of each customer than in the past. Yet this flexibility does not come close to matching that available in service industries where the producer and deliverer of the product can make changes as the service is being consumed. In teaching a college course, for example, an instructor has the ability to change the content of the course material as the course is being delivered, even during active class sessions. The courses that are offered to majors in a field of study may change in minor or major ways from semester to semester due to faculty development, faculty attrition, etc. Major areas of study combine these always evolving courses into a series of courses that promise to deliver a certain specific package of knowledge to a consuming student. Because of this flexible characteristic of services, particularly this type of service, the name of the new major becomes important in selling it to prospective students.

SIMILARITIES AND DIFFERENCES OF CHARACTERISTICS OF NEW MAJORS

There are also significant differences between students and consumers of products and services that make modeling the choice of enrolling in a new major different from that of a physical product or another service. The difficulties in applying past research results to the market for new majors are that many measures that are applied to consumers do not apply to students. For example, demographic characteristics typically associated with innovators such as greater social mobility, higher income, younger, higher education, and greater likelihood of using mass media information (Gatignon and Robertson 1985) do not readily apply to incoming college students. The innovation itself has different characteristics. The new major is not a physical product that can be taken home, used and examined for quality and performance easily. Neither is it a service that is consumed at one time and/or for which a substitute can easily be found. It indirectly incorporates a lifetime decision in that it will open some opportunities after college and close others. How can a new major be evaluated? The scant information about new majors that is often available is difficult to analyze. Advice from peers and other important relatives and friends plus a track record of secure employment after graduation of past students often are the only indicators that are meaningful to students. An early encounter with one or two bad professors teaching courses in or related to the major may discourage students from continuing pursuit of the new major, eventually resulting in a switch to another major. Colleges do not promote new

majors in exactly the same way companies promote new products. Ultimately promotion and dissemination of information may depend upon one or two faculty members with limited resources. Table 1 summarizes the difference between new majors as an innovation and typical new products and services as innovations.

Table 1
Differences Between New Majors And Other Types Of New Products And Services

Characteristics of the Innovation – Domain Specific	New Major	New Product	New Service
Relative Advantage	Varies by major	Varies by product	Varies by service
Compatibility	Difficult to determine	Easy to determine	Easy to determine
Trialability	Impossible to test	Varies by product	Varies by service
Complexity	Extremely	Varies by product	Varies by service
Observability	Impossible	Varies by product	Varies by service
Uniqueness	Variable by course	Varies by product	Varies by service
Characteristics of the Innovator			
Demographics	Homogeneous	Heterogeneous	Heterogeneous
Psychographics	Unlikely related	Easily measured & related	Easily measured & related
Influence of Others			
Parents	High for some students	Usually Low	Usually Low
Relatives	High for some students	Usually Low	Usually Low
Friends	Varies by year in school	Varies by product	Varies by service
Peers	Varies by peer characteristics	Varies by product	Varies by service
Organizational Information and Marketing Efforts			
Level of Information	Low	High	High
Promotion Efforts	Low	High	High
Advertising	Low to none	High	High

It is obvious from Table 1 that there are difference between new majors as a new service and other new products and services. Understanding the innovation characteristics and the impact of them on the adoption process requires an analysis of this unique market. We next discuss our methodology for analyzing innovation scales in the education domain.

METHODOLOGY

We administered our survey to 259 undergraduate students enrolled in business courses at a northeastern U.S. college. Men constituted 52.3% of our sample and women 47.7%. The average age of the respondent was 20 years old. The survey instrument was developed based on prior diffusion of innovation scales. Scales developed by Moore and Benbasat (1991) were applicable to adoptions of innovations in information technology but can adapted to adoptions of other innovations (Rogers, 2003). Accordingly, where possible, existing scales were adapted to the adoption of a new major. See Table 2 for the concepts, measures and sources addressed in the survey. The scale for the resulting survey is a five-point Likert scale ranging from strongly agree to strongly disagree. See Appendix 1 for a listing of survey items.

Data analysis consisted of an exploratory factor analysis. Each of the scales were factor analyzed using a common factor procedure -- Principle Axis -- with an oblique rotation -- Promax. The mineigen criterion that a factor’s eigenvalue must exceed 1.0 for the factor to be retained was imposed. To identify the factors, all variables with a factor loading of absolute value |0.4| or higher were used.

Table 2
Concepts And Measures

Concepts	Measure	Source
Relative Advantage	Relative Advantage*	Moore and Benbasat (1991)
Compatibility	Compatibility*	Moore and Benbasat (1991)
Trialibility	Trialability	Moore and Benbasat (1991)
Observability	Visibility*	Moore and Benbasat (1991)
Complexity	Complexity*	New Measure
New Major Features	Major Features	New Measure

*Measures adapted to new major as the innovation

RESULTS

Relative Advantage

This set of items that begins the survey includes items that assess the five characteristics of products/services that speed adoption. The first of these is relative advantage. Results of the EFA indicate three dimensions of relative advantage with respect to major areas of study, see Table 3A and 3B. The first factor is career oriented – the ability to land a good and interesting job as a result of choosing a specific major. The second factor is hedonic – the pleasure brought about by enrolling in a major. The third factor is ease and speed, the ability to progress through the major on time or ahead of time (time being a four-year tenure at most for the student). This speed of completion may be especially important to students who plan to return to the family business and simply want to get through school as quickly as possible. There are other reasons too such as cost, family, etc. Results of the factor analysis are shown in Table 3A and B.

Table 3A
Relative Advantage – Factor Loading Pattern Matrix

	Factor		
	1	2	3
This major will lead to higher paying job	.925		
This major will improve my ability to get job	.838		
This major will lead to an interesting job	.487		
Courses in this major will be more fun		.844	
Courses in this major will be more interesting		.834	
I perform better in this major courses		.330	.320
Courses in this major will be easier			.603
With this major - complete studies faster			.571

Table 3B
Factor Correlation Matrix

Factor	1	2	3
1	1.000	.315	-.116
2	.315	1.000	.337
3	-.116	.337	1.000

Compatibility

Results of the factor analysis reveal that the six-item compatibility scale is one-dimensional which is consistent with a previous study (Moore and Benbasat, 1991). Still this is somewhat surprising because given the diverse content – skills, lifestyles, goals – with which the new major must be compatible; one might expect at least two dimensions to emerge.

Trialability

Results of the factor analysis revealed two trialability factors, see Table 4A and 4B. The first factor captured the ease or convenience with which trial of the major or courses in the major could take place. The second factor was a hurdle factor that indicated that to begin to “use” this major the student had to take other courses as a form of prerequisite.

Table 4A
Trialability -- Factor Analysis -- Pattern Matrix

	Factor	
	1	2
Able to take courses in major before enrolling	.654	
First course filled requirement for another major	.621	
First course in major - nor prerequisites		-.318
First course after required college courses		.567

Table 4B
Trialability -- Factor Correlation Matrix

Factor	1	2
1	1.000	.169
2	.169	1.000

Complexity

Factor analysis revealed two factors, see Table 5a and 5B. Factor one had only one variable load on it. It indicated that extra courses would be required for the major. Factor two indicated complexity with respect to understanding, rigidity and fit.

Table 5A
Complexity -- Factor Analysis -- Pattern Matrix

	Factor	
	1	2
Topics in major difficult to understand	.563	
Difficult to fit this major courses in schedule	.477	
Selection of courses in this major is rigid	.402	.313
Easy to dual major in combination with new major (Reverse Coded)	.401	
Need extra courses for this major		.788

Table 5B
Complexity -- Factor Correlation Matrix

Factor	1	2
1	1.000	.179
2	.179	1.000

Observability

Results of the factor analysis reveal two factors, see Table 6A and 6B. The first factor is job or career related information heard about the major. The second factor is performance in major (ease of use of the product). The correlation matrix reveals very low correlation between the factors. The factors are measuring two separate dimensions.

New Major Scale

This scale was unique to our study. It was not derived from any scale used in past research. A factor analysis revealed three factors as shown in the table below, see Table 7A and 7B. Factor 1 is opportunity, both in terms of job and course content. Factor 2 is the high demand, work and time, required to “consume” the new major. Factor 3 is the risk relative to the job market inherent in enrolling in the new major.

Table 6A
Observability -- Pattern Matrix

	Factor	
	1	2
Hear grads in this major more likely to get job	.880	
Hear skills in major valued by employees	.782	
Hear grads in this major do well in career	.734	
Hear more likely to get paid internship in this major	.680	
Hear students get better grades in this major		.688
Hear students enjoy this major		.372

Table 6B
Observability -- Factor Correlation Matrix

Factor	1	2
1	1.000	.046
2	.046	1.000

Table 7A
New Major Scale -- Factor Analysis – Loading Pattern Matrix

	Factor		
	1	2	3
New Majors offer Better Job Opportunity	.631		
New Major in touch with New Economy	.630		
New Majors offer more Interesting Courses	.614		
New Majors require more Difficult Courses	.441		
New Major Better if no Part-time Job		.698	
New Majors only for Best Students		.678	
Like to Design My Own Major		.350	
New Majors too Risky			.758

Table 7B
Factor Correlation Matrix

Factor	1	2	3
1	1.000	.383	.093
2	.383	1.000	.479
3	.093	.479	1.000

DISCUSSION

Study results suggest that scales for relative advantage, trialability, complexity, observability, and new major are multi-dimensional while the scale for compatibility is one-dimensional. Interestingly, relative advantage, trialability and observability were found to be of singular dimension when considering an information technology

innovation (Moore and Benbasat 1991). These results shed light on the potential differences between perceived dimensions of information systems innovations and dimensions of educational innovations. Perhaps the new major innovation is perceived as being more multi-dimensional while information technology innovations are not. Another plausible answer is that information technology innovations have perceived dominant dimensions in areas such as relative advantage that shape the perceptions of the innovation. A final possibility is that the relevant constructs and measures may vary based on the innovation as is suggested by Rogers (2003). These possibilities have very significant ramifications for designers and marketers of new innovations.

The results of the study suggest that the innovation scales are not stable in studying different innovations. Accordingly, marketing and management professionals should not assume that the scales can be applied uniformly to new innovations. Instead exploratory fact finding should be performed to identify whether pre-established innovation scales are one-dimensional or multi-dimensional. Furthermore, pilot studies through techniques such as consumer (student) interviews should be performed to identify relevant perceptions of a particular innovation and to begin scale development of additional scales.

While the study provides evidence regarding permanence of the innovation scales, it also provides information regarding dimensions uniquely related to education innovations. Relative advantage had three dimensions relating to future benefits (i.e., job opportunities) and two benefits relating to taking the major, namely, fun and interesting; and, easy and courses completed quickly. These dimensions highlight the importance of future versus current rewards and the trade-off between student effort and intrinsic enjoyment. In regards to complexity, the scale has two dimensions relating to the difficulty in comprehending the contents of the major and the extensiveness of the requirements to complete the major. The complexity in comprehending the program may be addressed through marketing communications, while the major requirements are considered as part of the design of the major. Academic program designers must consider the trade-off between the benefits of extensive unique courses in a major with the other course requirements a student must satisfy to complete a degree. Two trialability dimensions were identified as being able to try out new major course prior to declaring the major and the first course in the major fulfilling other college requirements. Both dimensions reflect the ability to try out the new major before having to fully commit to the major. Observability dimensions relate to the visibility of the benefits of a future career and the ease of use of currently taking the courses in the major. The new major scale has three dimensions representing opportunity, demands on the student, and the risk of a less known major. These dimensions highlight trade-offs of risk, reward, and available resources (e.g., time and student ability) to successfully complete a new major. Compatibility represented a one-dimensional scale consistent with information systems innovations.

Limitations

The generalizability of the results of our reported study is limited by the fact that the college at which the study was conducted is of a particular type (private, liberal arts college), is located in a specific geographic region of the United States and includes only respondents who are students from a single common discipline, business majors. In order for the results to be more representative of the general university population, the study needs to be extended to other colleges and universities and the sample size increased. Replication should include other universities of varying types (state vs. private, technical vs. liberal arts, etc.) in various regions of the United States. Although the study was limited to one school, it still offers valuable evidence to educators. Future research should address scale refinements based on results of studies of both business and non-business majors at other schools.

This study only identifies the measurement dimensions of the individual scales. To test the nomological validity of the scales, an extension of the study to include determining whether or not a student will enroll in a new major based on these perceptions. This would provide valuable information to educators and marketers in determining what aspects of new majors should be concentrated on in the design and promotion of the new major.

CONCLUSION

This study provides exploratory evidence that some scales are not stable when considering different innovations. It also provides evidence that innovation scales are able to be adapted to be used by educators and

marketing professionals to evaluate new educational innovations such as new academic majors. Study findings suggest that creators and marketers of innovative products and services should consider characteristics of the innovation and related dimensionality in developing scales to measure perceptions of the innovation.

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APPENDIX: INNOVATION PERCEPTION ITEMS IN SURVEY

Student Perceptions Of A New Major

Instructions: In answering the following questions use the new business major (i.e., Accounting Information Systems, Digital Media Arts, International Business, Bioinformatics, Athletic Trainer Education, Criminal Justice, Early Childhood Education, Entrepreneurship, Environmental Science, or Special Education) that you are most familiar with.

The new major that I am using to answer these questions is _____.

Scale: Strongly Agree to Strongly Disagree

Relative Advantage

1. Selecting the new major will improve my ability to get a job after graduation.
2. Selecting the new major will allow me to have a higher paying job after graduation.
3. Selecting the new major will allow me to have an interesting job after graduation.
4. The courses in the new major are (or will be) more interesting than my other courses.
5. The courses in the new major will be more fun.
6. The courses in the new major are or (will be) easier than my other courses.
7. I perform (or expect to perform) better in the new major courses.

Compatibility

1. The new major is compatible with what I want to do when I graduate from college.
2. The new major is compatible with my information technology skills.
3. The new major is compatible with what I have studied in the past.
4. The new major is compatible with my lifestyle.
5. The new major is compatible with my educational goals.
6. The new major is compatible with academic skills.

Complexity

1. I took (will have to take) extra courses to complete the new major.
2. The selection of courses in the new major is rigid and inflexible.
3. It is difficult to understand what topics are covered in the new major.
4. It is easy to dual major in combination with new major.
5. It is difficult to fit the new major courses into my course schedule.

Trialability

1. I was able (or will be able) to take a course in the new major before choosing the new major.
2. The first course in the new major fulfilled a requirement for the School of Business or another major.
3. Prior to deciding on major, I was (will be) exposed to new major topics in another course that is not part of the new major.
4. I was able (will be able) to take the first course in the new major without any prerequisites courses.
5. I was able (will be able) to take the first course in the new major after taking the required Business School courses.

Observability

1. I have seen (and/ or heard of) students enjoying the new major.
2. I have seen (and /or heard of) graduates in the new major doing well in their careers.
3. I have seen (and/or heard of) that skills taught in the new major being valued by employers.
4. I have seen (and or heard) that graduates in the new major being more likely to get a job when graduating from College.
5. I have seen (and or heard of) other students use skills learned in their new major.
6. I have seen (and or heard) that students in the new major being more likely to get interesting paid internships.
7. I have seen (and or heard) that students get better grades in new major courses than their other courses.

New Major

1. New majors offered at the school are more in touch with the new economy than old majors.
2. New majors are too risky given the current job market.
3. New majors require taking more difficult courses than old majors.
4. New majors offer more interesting courses than old majors.
5. New majors are designed for only the best students.
6. New majors in business offer better job opportunities.
7. New majors are for students who don't have part-time jobs.
8. I would like to design my own major.

NOTES