Using SEM and TCM to Improve Services to Libraries: A Comparative Study on Chinese Academic Libraries

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ABSTRACT

By comparing the usage of structural equation model (SEM) and tetra-class model (TCM) in the model structure, data analysis method, and result presentation when evaluating Chinese academic libraries, this study aims to illustrate the strategies in evaluating satisfaction of academic library services. The study sample consists of 353 academic library users who are asked to evaluate 27 Chinese typical academic library service elements. The findings show that SEM could reveal the influence relations among constructs by path coefficients, while TCM focuses on the visual classification and comparison of specific service elements based on their contributions to user satisfaction. These two models are complementary to each other. They can be used for comprehensively showing the influence factors and current situation of service satisfaction, which are valuable and instructive for improving the service quality of a digital library. The results also indicate that a digital library needs to ensure the quality of retrieval service elements and to improve the service capability of information-organizing service elements. Meanwhile, the developments of characteristic resources and library community are critical to the promotion of user satisfaction of academic library service.

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INTRODUCTION

Under the network environment, the service ability of an academic library is promoted gradually with the increase of electronic resources and the adoption of information technology. Since user and service are two indispensable aspects in the discussion about the academic library (Moreira et al., 2009), the measurement of user perception on service quality based on user experience is essential for the development of the academic library.

Satisfaction evaluation of academic library service is a way to show the quality of academic library service. It can reveal the differences between user experience and user expectation while providing the basis for the continuous improvement of libraries. Factor analysis is one of the most common approaches to satisfaction evaluation. It discovers the critical factors which have significant effects on user satisfaction. It normally utilizes covariance matrix to complete structural equation modeling (SEM) and realize the relational analysis among the influence factors (Anderson & Gerbing, 1988; Lane et al., 2012). As a result of this analysis, a path diagram with coefficients which indicates

the effect degree among factors can be obtained (Fornell & Larcker, 1981). According to the variety of satisfaction evaluation models on an academic library, factors related to content, technology, interface, user and evaluation of context have frequently been proved to have influences on user satisfaction (Li, Shen, & Guo, 2010). Since the factors which have effects on user satisfaction are already proposed and testified, SEM aims to concentrate on the recognition of influence relations, and to provide macro strategy-making directions for library service improvement. However, it cannot show the performance of specific academic library services and their problems.

In addition, the service quality of an academic library is closely related to the content of service resources and the process of providing the library service as well (Li & Han, 2009). Since the contributions of individual service to satisfaction and dissatisfaction are dissymmetric (Ray & Gotteland, 2005), tetra-class model (TCM) is proposed to visually categorize services according to their contributions to the satisfaction and dissatisfaction. The measure element of TCM is the specific service which is different from the abstract impact factor of SEM. Through correspondence analysis, service elements are manifested in a tetra-class graph which directly shows their impacts on both satisfaction and dissatisfaction (Bartikowski & Llosa, 2004). TCM thus makes the user's perception on each service element more recognizable and comparable (Hu, Yan, & Hu, 2014). It can also give some specific references for libraries, like how well certain service elements perform and which service deserves to be given priority when it comes to carrying out improvements. However, TCM cannot reveal the relationships among service elements.

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TCM is also weak in helping stakeholders grasp the development directions of academic libraries.

Since these two satisfaction evaluation methods have different emphases, this paper aims to analyze the Chinese academic library service satisfaction with a comparison of SEM and TCM from the perspective of service elements. The research result can be a reference for the model selection of academic library satisfaction evaluation, and can help improve services for academic libraries. The structure of this paper is as follow: literature reviews about SEM and TCM are respectively provided in the next section. In the third section, the methodology of this paper is described. It includes the selection of evaluation service elements and the procedure description of the empirical study. Then the findings from the comparison of using SEM and TCM respectively on the survey data are illustrated, and they are further discussed to explain the ways of improvement of academic library service quality. Meanwhile, the limitations of this study are listed in the subsequent section. Lastly, the whole paper is concluded and the directions for further studies are pointed out.

LITERATURE REVIEW

FACTOR ANALYSIS WITH SEM

Factor analysis is one of the most commonly used procedures in the development and evaluation of psychological measures (Floyd & Widaman, 1995). It focuses on studying the interplay of various factors, and usually uses SEM as the analysis technique for specifying and estimating models of linear relationships among them (MacCallum & Austin, 2000). Generally, each factor (also named latent variable in SEM) is a hypothetical construct that cannot be directly measured. Meanwhile, each such construct is typically represented by multiple measured variables that serve as indicators of the construct. A SEM, then, is a hypothesized pattern of linear relationships among a set of indicators (measured variables/observed variables) and factors (latent variables/constructs) (Schreiber et al., 2006). More specifically, the directional relationships in SEM imply some sort of directional influence of one factor on another (MacCallum & Austin, 2000).

Factor analysis is widely used in the evaluation of services. User perception is one of the criteria for the judgment of products, services, and experience with regard to their needs and expectations (Oliver, 1980). It is a better measure than other performance measures (Akan, 1995). Considering service as an experience rather than a physical item, SERVQUAL is proposed based on the idea that quality is a subjective user evaluation (Parasuraman, Zeithaml, & Berry, 1985, 1988). It reveals that tangibles, reliability, responsiveness, assurance, and empathy are the factors that affect service quality. With the development of information technology and the Internet, studies have further revised and supplemented SERVQUAL to become E-S-QUAL which has some additional dimensions such as flexibility, ease of navigation and site esthetics (Zeithaml, Parasuraman, & Malhotra, 2002).

With the application of SERVQUAL and its revised models, various studies focusing on factor analysis have evaluated academic library user satisfaction and have further discussed its service quality. For example, LibQUAL+®, provided by the Association of Research Libraries (ARL), is one of the most widely used models for measuring library service quality. It was originally developed using the SERVQUAL methodology. After several structural revisions, LibQUAL+® purports to measure three dimensions of service quality: service affect, library as a place, and information control (Cook & Thompson, 2001; Thompson, Cook, & Kyrillidou, 2006). Lane et al. (2012) further examined this three-factor structure using SEM, and proposed that technology items (information control) contributed mostly to service quality. In addition, technology acceptance model (TAM) is widely used to understand user acceptance of an academic library from the technical perspective with the help of SEM. The results proved that system interface characteristics, organizational context and individual differences all have remarkable effects on user behavior in the academic library (Jeong, 2011; Thong, Hong, & Tam, 2002). Based on the interaction of system, content and user of the library, interaction triptych framework (ITF) which also utilized SEM was used for integrating knowledge and experience from the fields of information behavior and human–computer interaction (Tsakonas & Papatheodorou, 2008). Some other empirical studies utilized SEM to certify the satisfaction-influencing factors of the academic library, such as usability (Park, 2000; Xie, 2008), efficiency (Ferreira & Pithan, 2005; Meyyappan, Foo, & Chowdhury, 2004), interaction (Chowdhury, Landoni, & Gibb, 2006), sustainability (Lynch, 2003), learnability (Quijano-Solis & Novelo-Pena, 2005; Tsakonas & Papatheodorou, 2008), relevance (Jeong, 2011; Ramayah, 2006), accessibility (Gonçalves et al., 2004; Lankes, Gross, & McClure, 2003) and user interface (Hariri and Norouzi, 2011; Saracevic, 2000; Thong et al., 2002).

Since the factors are abstract and can be applicable in various environments, factor analysis is conveniently used in evaluating academic library service. Meanwhile, the research results for one academic library can usually be applied to other libraries as well, even to other industry services. Hence, factor analysis is preferred in the majority of studies about academic libraries. Most of these factor analysis studies successfully utilized SEM to construct influence relation models and to measure the degrees of impact of the factors, especially on user satisfaction. However, factor analysis ignores the fact that indicators have different degrees of impacts on user satisfaction even if they are used for measuring the same factor. Furthermore, the proposed factors are generally applicable to Web services. In other words, they do not reflect the exclusive characteristics of academic library services.

SERVICE CATEGORIZATION WITH TCM

Different from the frequently-used SEM which emphasizes on the relations between factors and user satisfaction, TCM is a method focusing on the categorization of specific service elements according to their contributions to user satisfaction. The categorization of the service elements would help a user recognize the characteristics of service elements in groups. Since positive and negative responses have been found to make independent contributions to satisfaction and dissatisfaction (Horley & Little, 1985; Oliver, 1993), the tetra-class model considers that service evaluations have two modalities: positive and negative. The performance of each modality determines the weight of the services. As a result, each service element would be categorized into one of the four categories: basic, secondary, plus and key (Llosa, 1996). The categorization is based on users' own experiences of services, which means it objectively reflects the performance of services according to users' evaluation (Hu et al., 2014). Bartikowski and Llosa (2004) further compared several methods for identifying the service elements' contributions to customer satisfaction, and proved that TCM is the most accurate one, since it respects the nature and particularities of the satisfaction by asking consumers about services they have experienced, and by comparing the performance of service elements with each other. TCM has been successfully applied in the evaluation of services in various sectors. For example, Clerfeuille et al. (2008) used TCM to evaluate pharmacy services and identified several variations in service categorization among different locations of a pharmacy and different characteristics of clients. This approach permits the manager to instantly see from contribution charts what needs to be improved in order to raise the quality of pharmacy services. Bodet (2009) selected the sport-service industry to conduct TCM because of the industry's characteristic drastic mutations in consumer demand. It confirmed the importance of the contribution of service elements to satisfaction and explained that the nature and intensity of consumption values appear to be the key variables in the satisfaction analysis in service industries. Similar researches have been conducted in catering, veterinary, microblog, etc. (Hu et al., 2014; Llosa, 1997; Poubanne, Clerfeuille, & Chandon, 2006). All these studies demonstrate the widespread