

THE EFFECTS OF COURSE DESIGN CHARACTERISTICS, SELF-REGULATED LEARNING AND KNOWLEDGE SHARING IN FACILITATING THE DEVELOPMENT OF INNOVATIVE BEHAVIOUR AMONG TECHNOLOGY STUDENTS AT UNIVERSITIES

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ABSTRACT—Literature identifies individual and contextual level factors that promote innovative behaviour among employees. The effect, however, of knowledge sharing, self-regulated learning, and course design characteristics in facilitating the development of innovative behaviour among technology students at universities is not well understood. The research question and objectives aim to address this literature gap by examining how self-regulated learning and course design characteristics act as significant individual and contextual antecedents of innovative behaviour, via the action of knowledge sharing behaviour. The research method employed a quantitative cross-sectional survey. The subjects were 268 undergraduate technology students enrolled in technology programmes, from seven public universities in Kenya. Data collection was with the aid of a questionnaire. A 2,000-bootstrap sample was generated to test the standardized total, direct and indirect effects. The findings are summated in a knowledge sharing-innovative behaviour structural equation model, with the results largely supporting all hypotheses. The results of the research reveal that both course design characteristics and self-regulated learning act as significant drivers of knowledge sharing and innovative behaviour among undergraduate technology students. Key recommendations are provided for managers involved in university education, on how to leverage attributes of the antecedents of innovative behaviour.

Keywords: Course Design Characteristics, Self-Regulated Learning, Knowledge Sharing, Innovative Behaviour, Technology Students.

1. INTRODUCTION

This study was inspired by the existing problem regarding the paucity of multi-disciplinary studies, simultaneously investigating antecedents of Individual Innovative Behaviour (IIB), and the possible mediating role of Knowledge Sharing Behaviour (KSB), in the context of undergraduate technology students. Most of the existing studies, which correlate KSB with IIB, have focused on organizations and employees, and not students in a university setting (Afsar, 2016; Seo, Kim, Chang, & Kim, 2016).

1.1 Aim, Objectives and Research Questions

The aim of this study was to develop and test a structural model, which hypothesizes that Course Design Characteristics (CDC) and Self-Regulated Learning (SRL) are positively related to KSB among technology students. In turn, KSB, CDC and SRL are positively related to students' innovative behaviour, with KSB acting as a mediator variable. Based on the main research question, the study will seek to respond to seven objectives, which were used to investigate links between the various exogenous and endogenous variables, including establishing the relationships between:

1. Course design characteristics and innovative behaviour
2. Self-regulated learning and innovative behaviour
3. Knowledge sharing behaviour and innovative behaviour
4. Course design characteristics and knowledge sharing behaviour
5. Self-regulated learning and knowledge sharing behaviour,

as well as the possible mediating role that knowledge sharing behaviour could have between:

5. Course design characteristics and innovative behaviour
6. Self-regulated learning and innovative behaviour.

The reader should note that seven hypotheses, corresponding to each of the objectives, were made regarding this study. For the sake of brevity, only one example will be provided:

1.2 Course design characteristics are positively related to technology students' innovative behaviour.

Based on an extensive literature search, it is evident that this study was necessary, because of the paucity of studies on the mediating role of KSB in terms of linking the individual and contextual antecedents of IIB. This paucity is especially in the context of university education students in Africa, and specifically a developing country like Kenya. Consequently, the study offers theoretical and practical applications, by providing a multi-disciplinary lens, to explore the individual and organizational antecedents of IIB and the possible mediating role of KSB in that relationship.

Specifically, this study should contribute theoretically by seeking to validate the CDC construct as a significant antecedent and driver of IIB, by investigating relationships surrounding CDC. Further, the study seeks to bridge the knowledge gap on research that model the mediating influence of KSB on IIB, with SRL and CDC as possible antecedents of knowledge sharing in the setting of university education, in the context of undergraduate technology students.

2. THEORETICAL AND CONCEPTUAL FRAMEWORKS

This section presents the key theoretical underpinnings that support and inform the study, with a view of providing justification for the seven (7) study hypotheses. The section attempts to explore the sub-components of the selected individual and contextual factors of SRL and CDC. Further, the dependent endogenous variable of IIB is discussed, and how it is influenced by SRL, CDC and KSB. The theoretical and conceptual frameworks, which guide the study, are thus presented.

2.1. Individual Innovative Behaviour (IIB)

According to Messmann and Mulder (2011), the challenge of providing solutions to the emerging problems and challenges require students to develop innovative tendencies. This has, however, not been the case, as many countries in Africa have failed to attain the critical threshold of producing knowledge workers, who can trigger the process of innovation, and hence leverage technological innovations to provide solutions for societal challenges (World Bank, 2011). This makes the need even more explicit for the stimulation of innovation in Africa, as a panacea for societal development. All is not lost for Africa, however, as it is beginning to command the attention of business executives, as well as scholars, as a viable investment destination. In South Africa, Shuttleworth is credited for developing the Ubuntu Operating System, which has found wide application (Hill, Helmke, & Burger, 2009). The telecommunications industry in Africa has clearly leapfrogged the Western world in the field of mobile technologies (Nyaundi, 2011).

The study employs the four (4) dimensions of innovative behaviour detailed by de Jong and den Hartog (2010, p. 24), i.e. "opportunity exploration, idea generation, idea championing and idea implementation". Seminal work by Scott and Bruce (1994), on the determinants of IIB, found empirical evidence that problem solving style, leadership and work climate have significant influence on IIB.

2.2. Knowledge Sharing Behaviour (KSB)

KSB, according to Yi (2009, p. 68), refers to a set of individual behaviours "involving sharing one's work-related knowledge and expertise with other members within one's organization". In addition, Ryu, Ho, and Han (2003, p. 113) defined KSB "as the behaviour of disseminating one's acquired knowledge with other members within one's organization".

Literature suggests that KSB has four (4) major dimensions by which individuals share their knowledge within an organization, as suggested by Bartol and Srivastava (2002, p. 65), which include, firstly, the “contribution of knowledge to organizational databases; second sharing knowledge in formal interactions within or across teams or work units, third, sharing knowledge in informal interactions among individuals, and fourth sharing knowledge within communities of practice, which are voluntary forums of employees around a topic”. In the present study, an attempt was made to adapt the four (4) components of the KSB scale by Yi (2009, p. 69), or the dimensions of KSB assessed by the scale identified by Ramayah, Yeap and Ignatius (2014), which both also contained communities of practice (CP), as well as “written contributions (WC), organizational communications (OC)” and personal interactions (PI).

2.3. Self-Regulated Learning (SRL)

Effeney, Carroll and Bahr (2013, p. 58) viewed self-regulated learners as having the capacity to “actively set goals, decide on appropriate strategies, plan their time, organize and prioritize materials and information, shift approaches flexibly, monitor their learning by seeking feedback on their performance and make appropriate adjustments for future learning activities”. Some recent studies specifically promote the uptake of SRL in various contexts at the university level of education. Seraphin, Philippoff, Kaupp and Vallin (2012) found evidence that metacognitive reflection is a significant driver of change in the scientific thought patterns of students, resulting in better critical thinking and scientific skills.

2.4. Course Design Characteristics (CDC)

This study expands the work of Morgeson and Humprey (2006), by focusing on two motivational constructs of their work design questionnaire, to develop a new construct termed Course Design Characteristics. CDC, in the context of the study, refer to students’ perceptions of the range of knowledge and task requirements in a technology course. The idea to develop this new construct was informed by a suggestion by the conceptualized students study by Cotton, Dollard and de Jonge (2002), with the university as a form of a job. Consequently, an examination of the students work context may provide an answer and linkage to the development of innovative tendencies among undergraduate technology students.

3. RESEARCH METHODOLOGY

The research setting was undergraduate technology classes from public chartered universities in Kenya. The students selected were undertaking technology programmes. The participants were either in their third or fourth years of study, and had participated in project work as prescribed in their study programmes. The study was conducted in various counties of Kenya, with a rider that universities included be publicly chartered.

3.1. Research Design

A cross-sectional research design was employed to explore the relationships between the constructs, as such a design is suitable for data obtained in a short period in time (Creswell, 2013). The research method utilised was a quantitative, non-experimental, cross-sectional, explanatory (correlational) survey.

3.2. Data Collection Instrument

The measurement of the latent exogenous and endogenous variables made use of a set of quantitative self-report measures. This entailed use of Likert scales, in conjunction with other demographic measures. The Course Design Characteristics scale was composed of 20 items, which measure

knowledge characteristics, and 24 items that gauge task characteristics. The measurement of Self-Regulated Learning was with the aid of a revised version of the 31 items from the Motivated Strategies for Learning Questionnaire by Pintrich (2000). The measure of Knowledge Sharing

Behaviour involved a variation of the KSB scale from Yi (2009). Finally, the measure of IIB was based on the scale by De Jong and Den Hartog (2010), which has twelve items that measure the four (4) sub-constructs of opportunity exploration, idea generation, championing, and implementation. The actual wording used, however, was changed, where necessary, to fit the context of undergraduate technology students.

3.3. Population, Sampling, and Sample Technique

The context as already described, of technology students, was employed in delineating the sample population of technology students. The study was conducted in the Kenyan university education sector, with a focus on public universities, which offer applicable technology courses. As of September 2015, Kenya had 33 public universities and 37 private universities. Out of these public universities, seven (7) universities (21%) were selected at random as the target population, based on logistical and time considerations. Therefore, a representative selection of these universities was made, using stratified random sampling techniques. Within these, the target populations were three

7. clusters of Bachelor of Science courses. The generalizability of the study relied on the representativeness of the respondents. Fifty (50) students was selected from each public university, using simple random sampling, to yield a sample of 350 undergraduate technology students. A response rate of 81.1% (n=284) was achieved. Sixteen responses were discarded as they contained incomplete data; hence, 268 students satisfied the minimum criteria for inclusion and were retained for further use.

3.4. Validity and Reliability

The estimation of the internal consistency reliability in terms of composite or construct reliability was based on the computation of coefficient alpha (Cronbach, 1951), using the critical value of 0.70 (Hair, Anderson, Babin & Black, 1998). The results suggest that the scales had suitable reliability, as they were all above the critical value of 0.7. Further, each of the five (5) composite scales had at least three (3) items, which were adequate to realize content adequacy. To ensure construct validity, the measurement items were sourced and adapted from previous validated multi-disciplinary measures with proven and acceptable reliability, as recommended by Boudreau, Gefen and Straub (2001). Confirming construct validity involved an exploration of the convergent validity and discriminant validity, as during the pilot study, the nomological and face validity were already examined. The content validity was achieved by using measures available from literature, which had acceptable psychometric properties (Hair et al., 2010). The results of the study indicated that there was evidence of convergent validity, since all the Average Variance Extracted values were above 0.5 (Hair et al., 2010), as well as above the correlation coefficients for the other variables, thus providing support for discriminant validity.

Table 1. Reliability coefficient of scales and subscales

Scale	Cronbach's Alpha	Number of Items
Self-Regulated Learning Strategies	.945	31
Knowledge Characteristics	.720	13
Task Characteristics	.777	17
Knowledge Sharing	.884	16
Innovative Behaviour	.789	11

3.5. Data Analysis

Following Gaskin (2016), data analysis started with the preliminary stages of data entry, exploration, and screening by examination of the “outliers, independence of errors, absence of multicollinearity, normality, linearity, and homoscedasticity of residuals”, as recommended by Su, Cuskelly, Gilmore, and Sullivan (2017, p. 1178). Besides the exploration of missing values, outlier patterns were examined by following the three (3) steps suggested by Field (2005).

The next step was an exploratory factor analysis, through an examination of the appropriateness of data, communalities, dimensionality, and factor structure to obtain an orderly simplification. Following this, confirmatory factor analysis techniques were used to assess the model fit, validity and reliability, common method bias, invariance and second-order factors. The existence of common method bias was tested using Harman’s single-factor test in the Statistical Package for Social Sciences (SPSS) and the common latent factor method in the Analysis of Moment Structures (AMOS) (Byrne, 2016; Fuller, Simmering, Atinc, Atinc & Babin, 2016). This data analysis made use of SPSS version 18. SPSS was also used to generate descriptive and inferential statistics.

Other data analysis techniques used included computation of correlation, multiple linear regression, and Structural Equation Modelling (SEM). For the statistical treatment of data, the study utilized the two-stage model-building procedure (Schumacker & Lomax, 2010) that required developing a measurement model and later a structural model. AMOS 18 software was employed to conduct the SEM analysis, generating data for hypothesis testing. This study innovates by applying the advanced analytical techniques of SEM, which is well-suited to analyse correlations between the hypothesized constructs. Using SEM analysis, the computation of the direct, indirect, and total effects involved an examination of the effect of the exogenous variable on the endogenous variable to compute the direct effect, as well as an examination of the indirect effect of the exogenous variables of Course Design Characteristics and Self-Regulated Learning, through the mediating variable of Knowledge Sharing Behaviour. Finally, the sum of the direct and indirect effects provided a measure of the total effect (Schreiber, Nora, Stage, Barlow & King, 2006).

Following the suggestion of Shrout and Bolger (2002), mediation analysis employed bootstrapping techniques, using 2,000 bootstrap samples, to generate the bootstrapped ab term, as well as the corresponding p-values. The bootstrapping method has been applied by multiple authors to test mediation in the field of Knowledge Sharing Behaviour (Liou, Chih, Yuan & Lin, 2016) and Individual Innovative Behaviour (Du, Liu, Straub, & Knight, 2017). More recently, Cheung, Gong, Wang, Zhou and Shi (2016) applied bootstrapping in studies involving both KSB and IIB. This study employed the parametric bootstrap method, which involves measurement of the parameter estimates between the independent variable and the mediator variable (Knowledge Sharing Behaviour), in addition to the relationship between the mediator variable and the dependent variable of Innovative Behaviour.

Table 2. Standardized Total, Direct and Indirect Effects and corresponding Standardized Two Tailed Significance bias corrected (BC) confidence intervals after bootstrapping

		Course Design Characteristics	Self-Regulated Learning	Knowledge Sharing
Knowledge Sharing Behaviour	Total Effects	.531**	.316**	.000
	Direct Effects	.664**	.435**	.000
	Indirect Effects	.000	.000	.000
Individual Innovative Behaviour	Total Effects	.552**	.261**	.872**
	Direct Effects	-2.04	-.035	.846**
	Indirect Effects	.439**	.261**	.000

4. DISCUSSION OF RESULTS

The main finding of the present study was that Knowledge Sharing Behaviour partially mediated the effect of Course Design Characteristics on Innovative Behaviour, and fully mediated the effect of Self-Regulated Learning on IIB. Further, KSB had a significant direct effect on IIB. Hence, the study reveals that both CDC and SRL have a significant positive indirect effect on innovative behaviour. The study thus contributes to KSB and innovative behaviour literature by examining the mediating mechanisms through which both CDC and SRL ultimately influence innovative behaviour. The present study generated empirical evidence that bands CDC and SLR at the contextual and individual level respectively, and how these two drivers impact technology students' KSB and IIB.

5. CONCLUSION

The findings are summated in a knowledge sharing-innovative behaviour SEM, with the results largely supporting all hypotheses. The findings lend support to the positive effect of course design characteristics in fostering technology students' innovative behaviour. The indirect relationship between course design characteristics and innovative behaviour was significant and partially mediated by knowledge sharing behaviour. The results also suggest a significant indirect relationship between self-regulated learning and innovative behaviour, which is fully mediated by knowledge sharing behaviour. The results of the research reveal that both course design characteristics and self-regulated learning act as significant drivers of knowledge sharing and innovative behaviour among undergraduate technology students. In terms of an overall conclusion for the research, key recommendations are provided for managers involved in university education, on how to leverage the attributes of self-regulated learning and course design characteristics at individual and contextual level, to trigger innovative behaviour.

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