



The Relationships between Technology and Different Teaching Role Attributes of Instructors in Malaysia

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Abstract

The present study seeks to examine the influence of technology on these four roles. Two hundred and ninety two lecturers teaching in Malaysian tertiary educations were involved in this study. They were using different level of technologies for teaching. Questionnaires were used to solicit their responses which were distributed using various means; online, personal visits and regular mails. The measurement items were mainly adapted from Job Diagnostic Survey developed by Hackman and Oldham. The results from the findings revealed that technology was found giving significant positive impacts on technical and managerial roles. There is no evidence to support the significant influence of technology on the other two roles. The significant findings suggest that lecturers perceive their roles in managing the course and dealing with technical aspect of the job have been enhanced with the use of technology. However, the insignificant findings imply several major issues that are worth contemplating. The main implications of the study are discussed in terms of lecturers' teaching job design, training and performance appraisals.

Keywords: Technology, Education, Instructors, Job characteristics, Teaching roles

1. Introduction

Teachers' roles are becoming more demanding nowadays as they have to use various types of technology to aid the teaching and learning process. It is a fact that technology comes in various levels and features. Traditional instructional technology includes writing boards, writing tools and films; while new technology include computers, the internet and multimedia resources (Laurillard, 2006). In the past, numerous studies examining the use of new instructional technologies in education found mixed feelings and perceptions among instructors in tertiary education (Neo and Neo, 2009; Gratton-Lavoie and Stanley, 2009; Mitchell, 2009; Marlia, 2007; Agbonlahor, 2006; Hacifazlioglu, Sacli and Yengin, 2005; Ryan, Carlton and Ali, 2004; Hanson, 2003; Kewell and Beeby, 2003). These studies, however, did not explore how exactly the teaching job of instructors changed with the use of the technology. Teaching job is mainly made up of distinct roles that include course planning, designing, implementing and finally assessing students' progress. Each of these roles may differ in terms of autonomy, skill variety, feedback, significance and identity. Therefore, given the complexity in each role, examining the influence of technology on the whole teaching job is rather insufficient and

thus warrant a specific study that looks into the smaller components that make up the teaching job. In the context of the present study, the smaller components of instructors' job are reflected in the form of teaching roles.

In measuring the impact of technology on different teacher roles, one important premise is the ability to operationalize the teacher roles using measurable constructs. The literature provides ample evidence of research done by scholars identifying distinct roles of teachers. Among the important roles discussed in the literature revolves around four major ones: pedagogical, managerial, technical and subject-designing (Berge, 2008; Ryan, Carlton and Ali, 2004; Bennet and Lockyer, 2004; Jaffee, 2003; Barker, 2002; Goodyear, Salmon, Spector, Steeples and Tickner, 2001). Thus far, there were no empirical studies to assess these roles attributes. In the present study, in line with the objective to measure the distinct characteristics of each role, validated measurement instruments are used to operationalize all the four teacher roles. Ultimately, this study aimed to examine the relationships between technology level used by instructors and their teaching roles in order to determine the extent of technology influence on teaching job.

2. Literature Review

2.1 Technology and Job Attributes

Prior research showed mixed findings on the impacts of technology on employees' work attributes. In their studies, Bartel et al (2007) indicated technology has positive influence on employees' skill requirements particularly in technical and problem solving skills. However, there are studies that found contradicting results. Technology has been cited a significant factor that reduce the degree of job characteristics mainly in skill and autonomy (Feldberg and Glenn, 1987; Kraft, 1977; Shaiken, 1984; Zimbalist, 1979; Menzies, 1982; Glenn and Feldberg, 1977; Braverman, 1974).

In the education arena, instructors have been reported as being optimistic with the technology potential to enhance their teaching practice quality (Shen et al, 2008; Siragusa and Dixon, 2006; Ryan et al, 2004) despite their positive and negative comments about technology impact on their job (Marlia, 2007; Hacifazlioglu et al, 2005; Poon et al, 2004). Given the inconsistency in the influence of technology on job characteristics, it is interesting to examine the impact on instructors who are using different levels of technology that range from low to high level sophistication. More importantly, it is pertinent to find out whether technology has different degree of impact on the four major roles which are proposed as unique from each other.

2.2 The Roles of Instructors

The literature on the roles of instructors/teachers revolves around four major ones; *pedagogical, managerial, technical* and *subject designing* (Ryan, Carlton and Ali, 2004; Bennet and Lockyer, 2004; Jaffee, 2003; Barker, 2002; Goodyear, Salmon, Spector, Steeples and Tickner, 2001, McMann, 1994). These roles prevail regardless of the type of learning environment; traditional or online method, and thus suggesting that these roles may be distinct from each other in terms of its characteristics (Bennett and Lockyer, 2004; Goodyear et al, 2001; McMann, 1994). For instance, the design of the subject content and the technical role attribute in a traditional learning environment may differ from the one in an e-learning context. It is thus fair to claim that the four roles may have their own unique attributes in terms of skill complexity, autonomy, significance, identity and level of feedback. As suggested by Hackman and Oldham (1976, 1980), each job has its own attributes and the level of attributes may differ from one employee to another. Given the complexity of teaching, instead of examining the "whole teaching job" attributes, the present study sought to examine the attributes of the four major roles that make up the 'whole teaching job'. The following section explains further the individual roles of teachers in both environments; traditional and e-learning.

2.2.1 Pedagogical Role

Miller and King (2003) noted that the key to success in any course, whether technology-based or not, is the instructors' pedagogical skill. Being a teacher, the person is responsible to explain, provide reinforcement and support, make announcements, gives directions, discipline students and many others that are related to imparting to students what the teacher possesses. In the traditional environment, most instructions are given face-to-face. There are human contact and personal touch from the instructors. The presence of verbal communication such as intonation and nonverbal communication like body language help to enrich the conveyance of messages. A teacher can always use different verbal and nonverbal communication style to express his or her opinion, to give remarks to students or even to encourage students to interact in the classroom. Such a luxury is absent in an online tutorial. Nonverbal communication like eye contact, gestures, facial expressions and other body languages are not visible to students. And most importantly, students are feeling isolated due to limited physical interaction. According to Newble and Cannon (1994), an instructor who uses the same approach in an online class will face difficulty as he has to find alternative ways to overcome the absence of nonverbal communication.

2.2.2 Managerial Role

According to Sadker and Sadker (1991), an effective teacher must also be a good manager who is able to organize the academic content and instruction. Educators are no longer focusing on controlling student behavior, instead they have

moved to creating and maintaining an environment that supports learning (Evertson and Harris, 1992). Franklin (1988) and Hanson (1991) contend that teachers strongly feel that they are qualified to organize the learning process according to their own method. Despite the impersonal school rules that regulate the academic processes, once the teachers enter the classroom, the learning facilitation will accord their methods as they deem fit.

On the other hand, Flakes, Kuhs, Donnelly and Ebert (1995) mentioned the importance of time management to an instructor. Time management is about setting the timeframe to plan, implement and evaluate the course. The need to manage time is even more important in e-learning as students are given the freedom to be independent and the amount of face-to-face meetings is rather limited. In order to keep students on track, a structured schedule indicating important activities such as online or face-to-face discussion, meetings and deadlines must be planned ahead and communicated to students. The fact that students are geographically dispersed makes managing the course even more challenging.

Major significant difference between traditional and e-learning in respect of class management is mainly contributed by the type of technology used to facilitate the learning processes and activities. In the traditional environment, when the physical interaction is there, the instructors can always communicate and remind the students on the activities of the course. But in e-learning environment, the instructors have to rely on various tools such as electronic bulletin board and email to communicate messages to students about new activities, feedback on students' work, changes and latest update.

2.2.3 Technical Role

Given the various techniques and media, instructors need to choose the one that is most appropriate depending on the learning outcomes, practicality and the costs to develop or to use the method. Being the one who determines which technology or tools to be used in the classroom, the instructor should be able to assist and guide the students in using the equipment in such a way that facilitate learning. Inability to provide necessary assistance will lead to frustration among students. Everett (1998) points out that students' motivation to learn partly depends on their ability to persevere with technical problems and how these problems are resolved. Goodyear et al (2001) assert that instructors should have adequate technical skills and understand the capabilities and limitations of available technologies and tools.

In e-learning, Barker (2002) mentioned that online instructors should have the ability to use a range of different tools such as email, word processor, spreadsheet, database and Web page authoring tools. Bennet and Lockyer (2004) added that online instructors should develop skills to create and integrate electronic subject resources. Miller and King (2003) stressed that the instructor should be competent in using the technology so that he can decrease students' anxiety during the course and address technology issues that might arise.

2.2.4 Subject Designer Role

Jaffee (2003) who wrote on the transformation of pedagogical style from traditional environment to Web-based approach noted that in the former environment, the instructor will play as the 'sage on the stage' whose task is to actively deliver and the students to passively receive the information. Student-centered learning however, requires the students to be actively involved and be given the opportunity to apply their own understanding about the subject in order to come up with new ideas or knowledge. Under this environment, the course design should allow interactivity, collaboration and reflection. It also requires the instructor to rethink the course outcomes, content, assignments, supporting materials and evaluation methods. Bennet and Lockyer (2004) stated that the designer role of instructors in both settings; traditional and online, is basically the same. Instructors need to develop the overall design, identify assessment tasks and plan a sequence of activities and specific resources. In online settings, the instructors are expected to do more in order to make use of technology by integrating it in their designer roles to enhance learning. Here, the ability of instructors to design the course in such a way that creates learning and the same time utilizing the available resources is crucial.

3. Research Methodology

3.1 Samples and Data Collection

All public and private institutions of higher learning in Malaysia were identified and samples were drawn from faculties/department of interest. In each faculty, lecturers were chosen using simple random sampling. As this study was about teaching roles and responsibilities, only those academic staff or faculty members who have a teaching load of at least 50 percent of their total work load were included in the study.

Questionnaires were distributed through online, regular mail and personal visits. Online survey yielded the lowest response rate (only 80 online responses) and thus regular mail survey had to be employed. This method generated 137 responses. The subsequent method used was to personally distribute the questionnaire and this technique resulted in 75 responses. In total, 292 responses were collected and it took about 6 months to complete.

3.2 Measurement Instruments and Statistical Techniques

Prior studies examining the influence of technology on the roles of instructor mainly used qualitative research method. This study chose to employ a quantitative approach which could provide empirical evidence about technology influence. In this study, the levels of technology was operationalized using several sources such as Gavin (2003), Fallon and Brown (2003) and, Roberts and Jones (2000). These scholars suggested several levels of e-learning technology ranging from the lowest to the most sophisticated technology. In this study, we added a new level that indicates a stage of learning that uses traditional method with minimum or no technology application. This traditional stage of learning precedes the lowest e-learning method. Table 1 below describes the five levels of technology used in teaching.

The four teaching role attributes (pedagogical, managerial, technical and subject designing) were measured using the items in the Job Diagnostic Survey (JDS) developed by Hackman and Oldham (1980). Each teaching role attribute was measured using 15 items adopted from the JDS that reflect skill variety, task significance, task identity, autonomy and knowledge of work results. All the items are expressed on 7-point scales, where 1 is low and 7 is high. Brief explanations on each of the four roles were provided to ensure respondents understood the survey objectives and to make it clear to the potential respondents that they were required to evaluate the role characteristics individually based on the 15 items. The other section of the questionnaire asked for the demographic information of the respondents.

Statistical Package for the Social Sciences (SPSS) 15.0 for Windows was used to analyze the data. Pearson correlation tests and one-way ANOVA test were used to examine the relationships between variables.

4. Data Analysis

4.1 Respondents' Demographic Analysis

A total of 292 university instructors participated in the survey. The majority of the respondents were from public universities (47 percent, 28 percent were from private university colleges, 23 percent from private universities and the rest (2 percent) were from public university colleges. In terms of teaching experience, 29% of the instructors had more than 11 years, 36 percent have between 6 to 10 years and 35 percent have 1 to 5 years. Out of the 292 respondents, 176 of them (60 percent) possessed Master degree, 20 percent with doctorate, and 20 percent with bachelor degree. Majority of the respondents were from the age group of 30 to 39 years old (52 percent), 21% in age group of 40 to 49 years, 20 percent were between 20 to 29 years old and only 7 percent were those above 50 years of age.

4.2 Factor Analysis and Reliability Tests

The factor analysis output on the sixty items that measured instructors' four teaching role attributes resulted in 11 factors, which explained 71.21% of the total variance. The Bartlett test of sphericity is significant and that the Kaiser-Meyer-Olkin measure of sampling adequacy is 0.917 which was far greater than 0.6. Inspection of the anti-image correlation matrix revealed that all the measures of sampling adequacy were well above the acceptable level of 0.5. In selecting items for each scale, two criteria were used. First, items on a single factor with factor loading of .3 or less were dropped (Hair et al, 1998), and second to improve scale reliability, items with less than 0.3 item-to-total correlations were deleted from the scales (Nunnally, 1978).

The factor analysis output indicated unclear cut factor loadings and the items did not appropriately loaded in the expected groups. Several factors were found containing items from different teaching roles. Nevertheless, for the sake of the present study, regardless of the dimensionality, four factors with items which indicate common teaching role were used and seven others were dropped as they did not provide meaningful interpretation. Despite the high loadings, since all the items within the respective factors did not appropriately loaded in the expected group, all these factors had to be dropped for further analyses. Subsequently, reliability tests were conducted to measure the Cronbach's coefficient alpha for each factor items. Factor 1 consisted 10 items was labeled *subject design role attributes* with Cronbach's coefficient alpha of 0.936. Factor 2 that contained 8 items was named *pedagogical role attributes* and the reliability coefficient for the scale was 0.907. Factor 3 was labeled *technical role attributes* had 6 items with Cronbach's coefficient of 0.885. Factor 5 consisted of 8 items with reliability coefficient of 0.894 was labeled *managerial role attributes*.

4.3 Analysis of Variance across Different Technology Levels

One-way ANOVA tests were used to determine if there exist significant differences of role attributes in terms of technology used by the respondents. Based on the output in Table 2, significant difference was only found in *technical role attributes* across the five levels of technology ($F=4.289$, $p=0.002$). It could be concluded that technology level used by instructor exerted an influence on the *technical role attributes* for at least 2 of the 5 technology levels. However, the effects of technology level on *pedagogical role attributes*, *managerial role attributes*, and *subject design role attributes* were found to be insignificant.

A post hoc multiple comparisons was carried out to examine which level of technology significantly influenced *technical role attributes*. The results of the Tukey's test indicated that *traditional* users had significantly different

technical role attributes means with *medium technology* users (mean difference of -0.52511, $p=0.014$). Tukey's test also showed a significant difference between *traditional* level and *pure e-learning* users (mean difference of -1.47348, $p=0.022$). There were no significant differences in *technical role attributes* between *traditional* and *low technology* users as well as between *traditional* and *high technology* users. Table 4.6 details the result.

4.4 Correlations between Technology Levels and the Four Teaching Roles Attributes

The relationships between technology levels and the four role attributes were assessed using Pearson Product Moment correlation as shown in Table 3 below.

As shown in Table 3, two role attributes (*managerial role attributes* and *technical role attributes*) were found to be significant and positively related to technology levels. The correlation between *managerial role attributes* and technology levels had an r-value of 0.122 and p-value of 0.019. A significant positive relationship was also found between technology level and *technical role attributes* with an r-value of 0.215 ($p= 0.000$). Technology levels were not significantly related to *pedagogical role attributes* and *subject design role attributes*. Despite the insignificant relationship, however, it was observed that technology level was negatively related to the two role attributes.

5. Discussion of Findings

The study's findings generally did not support the notion that there exist differences in terms of teaching role attributes across different technology levels used by instructors. The teaching role attributes in *pedagogical, managerial and subject-design role* did not indicate any significant differences despite the diverse levels of technology applied. The findings were inconsistent with the ideas proposed by most scholars that asserted that these three roles should differ significantly in terms of their degree of characteristics (Newble and Cannon, 1994; Mason, 1991; Kerr, 1986, Goodyear et al., 2001). However, significant differences were found in different technology levels in terms of *technical role* attributes. The significant difference captured in this study conformed to the views of the majority of scholars (Bennet and Lockyer, 2004; Goodyear et al., 2001; Miller and King, 2003; Kerr, 1986; Davie and Palmer, 1985). The findings further indicated that users of traditional technology for teaching were significantly different from those in medium and pure e-learning technologies. The former group of users was found to have relatively lower scores of *technical* attributes. Thus, it could be inferred that the higher the level of technology used in teaching, the higher would be the degree of characteristics in the *technical* aspect.

The insignificant findings in the other three teaching role attributes across the 5 levels of technology revealed an interesting fact. Despite the diverse technology used in their teaching practices, instructors do not differ much in terms of their pedagogical, managerial and subject design role attributes. This may be due to the fact that in most Malaysian higher learning institutions which are committed to adopting various technologies in teaching and learning, the major emphasis is only to ensure that they have the systems that enable information gathering, management, access, and communication in various forms (Hassan, 2002). The other crucial aspects like upgrading ICT knowledge and skills as well as redesigning the instructors' jobs are neglected. With less emphasis in those aspects, the instructors fail to acknowledge the fact that there are significant differences between the traditional teaching method and the technology-based methods.

Other major findings obtained by the study are the relationships between the four teaching role attributes and the technology level. The findings showed that only *managerial* and *technical role attributes* are significantly related to technology levels and the relationships are positive. The significant findings suggest that the higher the level of technology employed by instructors, the higher the degree of attributes in managerial and technical aspects of their teaching job. The findings are consistent with the majority views that state the more sophisticated the technology used in the teaching job, the higher would be the demand to manage instructors' job. Better management of communication among students in e-learning particularly in monitoring the flow of conversation, encouraging comments, synchronizing and handling information overload (Zafeiriou, 2000). In terms of the influence of technology levels on technical aspects of the job, the positive significant relationship signified that the higher the technology levels, the more would be the degree of technical aspect required from the job. This is also in line with the opinions that the higher level of technology used, the more would be the technical skills and competence required among the instructors (Bennet and Lockyer, 2004; Goodyear et al., 2001; Miller and King, 2003; Kerr, 1986; Davie and Palmer, 1985).

A possible explanation for the insignificant relationship between pedagogical and subject design roles lies in the fact that technology adopted by educational institutions is done without proper assessment on the needs and readiness of the instructors. Instructors may have low awareness in their changing roles in these two aspects and thus resulting in the old ways of doing things.

6. Implications of the Study on Policy Makers

The study's findings have three major implications relevant to policy makers in higher educational institutions and national regulatory bodies. First, to deal with lack of knowledge and skills among instructors in using higher technology in teaching, needs assessment has to be conducted to determine the type of training instructor needs with respect to their

readiness and competencies. Second, attention must be directed towards re-examining the instructors' jobs that involve higher technology use. Failure to redesign the job in accordance with the type of technology used would render the lecturers having low awareness of how their teaching job should change. Finally, there should be a clear link between the changing natures of teaching job with the performance evaluation scheme. Without clear association between the nature of the job and the reinforcement scheme, lecturers are unlikely to acknowledge the fact that they have to change the way they perform in line with the teaching methods used.

7. Conclusion

This study provides a better understanding about the impact of technology on teaching roles. The emphasis on the four teaching roles is timely given the diverse impacts that technology has on the role attributes. Based on the findings, policy makers could benefit by examining how the teaching job could be redesigned and re-evaluated. As for future research implications, further studies could be carried out to examine how non-teaching aspects like such research and publication as well as administrative duties are affected by technology.

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Table 1. Measuring the Level of Technology Use among Instructors

Independent Variable: Level of Technology	Descriptions:
Traditional	In performing my role as a teaching instructor...
Low technology	... I use no / very minimal computer applications or other related technology. We use face-to-face meetings and teaching aids used are like white/blackboard, overhead projector, and printed handouts/documents.
Medium technology	...sometimes I use word processing, power point presentation and Internet. I only use face-to-face meetings and asynchronous communication channels. I do not use synchronous communication channels at all.
High technology	...I use word processing, power point presentation and Internet. I use both synchronous and asynchronous communication channels. Learning materials are available to students at our institution's website and also in digital forms. Face-to-face meetings are still extensively used.
Pure e-learning	...I only use synchronous and asynchronous communication channels. Students are learning independently. Learning materials are available to students at our institution's website and also in digital forms. There is no face-to-face meeting at all .

Sources: Adapted from: (1) Fallon, C. and Brown, S. (2003) *E-Learning Standards: A Guide to Purchasing, Developing, and Deploying Standards Conformant E-Learning*, St. Lucie Press: Florida. (2) Gavin, T. (2003) "Industry Report", Training, 21 – 45. (3) Roberts, T. S. and Jones, D. T. (2000) "Crossroads of the New Millennium: Four Models of Online Teaching," TEND 2000 in Proceedings of the Technological Education and National Development Conference on the April 8-10, Abu Dhabi, UAE.

Table 2. Analysis of Variance of Instructors' Roles Attributes Across Five Levels of Technology

		Sum of Squares	df	Mean Square	F	Sig.
Pedagogical role attributes	Between Groups	5.432	4	1.358	2.024	.091
	Within Groups	192.517	287	.671		
	Total	197.949	291			
Managerial role attributes	Between Groups	5.191	4	1.298	2.175	.072
	Within Groups	171.248	287	.597		
	Total	176.439	291			
Technical role attributes	Between Groups	14.813	4	3.703	4.289	.002
	Within Groups	247.791	287	.863		
	Total	262.605	291			
Subject design role attributes	Between Groups	5.045	4	1.261	1.309	.267
	Within Groups	276.616	287	.964		
	Total	281.662	291			

Table 3. Relationship between Technology Levels and the Four Teaching Role Attributes

	Pedagogical role attributes	Managerial role attributes	Technical role attributes	Subject design role attributes
Technology level	Pearson Correlation	-.002	.122(*)	.215(**)
	Sig. (1-tailed)	.483	.019	.000
	N	292	292	292