

The Use of Education Management Information Systems in Higher Education Institutions: An Empirical Investigation of the Effect of Degree of Interactivity

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Keywords

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Technology is capable of revolutionizing the management of higher education institutions and improving services they provide. However, this does not happen in many cases because, either the appropriate technology is not available, or because technology is simply not used. The last decade has seen substantial investments in technology infrastructure for higher education enterprises. Resource constraints and accreditations requirements oblige higher education institutions to set their technology priority and select the most appropriate systems. This paper suggests and empirically evaluates a predicting Higher Education Management Information Systems (HEMIS) use model. Built on well-established information systems user's behavioural models, the model suggested by this research hypothesizes that degree of interactivity have significant effect on HEMIS use, where user's attitude and intension to use are mediator factors. The paper reports the findings of an experiential survey study, conducted over 110 higher education administration staff of different managerial levels, in 7 different higher education entities, looking at their use of three types of HEMIS. Structural Equation Modelling is employed to evaluate the goodness-to-fit of the suggested model. The results provide empirical evidence on how interactivity affects user behaviour in HEMIS context. Furthermore, the study reports some interesting findings concerning the use of HEMIS highly interactive tools within the environment of higher education entities. Implications and suggestions for future research for both researchers and practitioners are discussed.

1. Introduction

Higher education institutions are increasingly using the information they accumulate about their students to take decisions and gain insights into urgent and important concerns, such as students' retention and graduation rate (Sanyal, 1994; Goldstein, 2005). Accreditation bodies, governmental entities, and boards are all requesting more data-based reporting on institutions effectiveness. Therefore, there is an increasing demand for efficient Higher Education Management Information Systems (HEMIS), while ensuring the positive attitude and willingness to use of higher education administration staff for such system.

Little doubt is now considered concerning the important role of information system's features on user attitude. Extensive literature looked at system's features that would guarantee positive attitude and willingness to use for users in different context such as training and learning (Giardina, 1992; Kettanurak, Ramamurthy, and Haseman, 2001; El Said, 2014). Nevertheless, there is a severe shortage in similar literature in the context of higher education management (Goldstein, 2005). Little is known about HEMIS design concepts, systems features,

and user preferences. Information Systems designers need to consider whether systems designed in, and for, one context, will work for other contexts; therefore, the interest for the field of context-based in information systems design has witnessed a steady increase during the last years. This research is aiming to provide recommendations for information systems designers targeting the higher education context. The research could be considered as one of the few in-depth empirical studies that provide descriptive findings on design features in the context of higher education. Practical implications for the ways in which HEMIS designers might increase user attitude and willingness to use their institution systems are provided by this research.

2. Research Setting and Result Analysis

2.1 Background Theory

Research on system's use is mainly based on a number of theories that describe human behaviour: the Theories of Reasoned Action (Fishbein and Ajzen, 1975), and the Theory of Planned Behaviour (Ajzen, 1985). According to the Theory of Reasoned Action, TRA, (Fishbein and Ajzen, 1975), behavioural intention is determined by attitude toward behaviour, which refers to the person's judgement about whether performing the behaviour is good or bad. A believe that performing certain behaviour will render positive results, triggers a positive attitude toward that behaviour. This result also happened when a person believes that other people with whom s/he is motivated to comply think s/he should perform that behaviour. The Theory of Planned Behaviour, TPB, (Ajzen, 1985) complimented the TRA by adding the perceived behavioural control as a supplementary factor affecting behavioural intention. Perceived behavioural control reflects the degree to which an individual feels that successfully engaging in the behaviour is completely up to her/him. Many of the currently existing information systems user's behavioural models are based on the TRA and TPB theories, where a user's intention to use an information system is preceded by the user's attitudes toward the system. Additionally, there is a general consensus within researchers that the degree to which people express their intentions to use an information system is a reasonable predictor of actual systems' use (Ajzen, 1985).

Degree of interactivity is commonly perceived in information systems research as the degree to which the users can adjust the system's output to their information needs, preferences, and capabilities. Literature suggests three aspects of interactivity: Frequency, Range, and Significance (Zack, 1993). While frequency refers to the measure of how often a user input is enabled; range is the measure of variety of choices available for the user, and significance refers to the impact of user's choices on system's output. *Modality* is an additional aspect of interactivity added by Kettanurak *et al* (2001), which presents the multimedia aspect of the system. Modality includes various means of communication between user and the system, where input and output to the system can be in the form of text, audio, animation. According to Zack (1993), multimedia systems are rich medium and are, thus, capable of simulating face-to-face communication, the highest form of interactivity.

In training and learning contexts, it is suggested that systems with higher frequency of interaction and larger range of choices and modality would actively engage the user. Additional, the extent that the system clarifies the bond between user choices and the consequent outcomes

motivates the user, hence generates positive attitude towards the system (Kettanurak *et al*, 2001). Previous empirical investigation of the effect of degree of interactivity on user attitude reported significant differences between users' attitude to different degree of interactivity within the context of learning information system, where higher degree of system's interactivity results of a favourable attitude for users (Giardina, 1992; Kettanurak *et al*, 2001). Little is known about the importance of interactivity of information systems in the context of higher education institutions. Furthermore, there might be, worth taking into account, considerations for the application of interactive education management information systems in higher education. On the basis of the discussion above, this research investigates the effect of information system's degree of interactivity on actual system use, for administrative users from higher education institutions in Egypt.

2.2 Model Designing Process

The hypothetical model of this research, illustrated in **Figure 1**, suggests that degree of interactivity of HEMIS have significant effect on user's attitude, intension to use, and actual use of the system. It is also hypothesizes that attitude influences the actual use through intension to use, and that intention to use has a significant effect on actual use. The main constructs of the hypothetical model are used in this research as follows: Intention to use (ITU) and actual use (AU) are dependent constructs, with attitude (ATT) as a mediating construct, are believed to be predicted by independent construct: perceived degree of interactivity (PDI). ATT plays a dual role here, where it is dependent on the effect of PDI, while it acts as an independent construct, affecting both ITU and AU. Similarly ITU is considered as a dependent construct for PDI and ATT, while it acts as an independent construct for AU.

Construct 1: Perceived Degree of Interactivity: In this research, Perceived Degree of Interactivity (PDI) reflects the extent to which the HEMIS allows users to adjust systems' output and features to conform to their needs and preferences (Zack, 1993). In this study varying levels of the aspects constituting the degree of interactivity (*Frequency, Range, Significance, and Modality*) were built into three different prototypes of HEMIS that were implemented and considered for investigation. In this research, the user perception of the HEMIS degree of interactivity is measured by 4-item scale, covering the four aspects of interactivity: how often user input is available, how many choices user has, the extent to which user's input has impact on system's output impact, and the amount of using multimedia elements in the system. The PDI 4-item scale is designed in a Likert-style format.

Construct 2, 3&4: Attitude, Intension to Use & Actual Use: The Theory of Reasoned Action, TRA, (Fishbein and Ajzen, 1975) and the Theory of Planned Behaviour, TPB, (Ajzen, 1985), assert that behaviour is influenced by behavioural intention, and that a major determinant of intentions is the actor's attitudes towards the behaviour. According to the two theories, beliefs affect the person's attitudes; and attitudes in turn influence behavioural intention, which is a good predictor of actual behaviour. There is a general consensus within information systems researchers to assume that the degree to which users express their intentions to use a system is a reasonable predictor of the actual usage behaviour and that a user's intention to use is preceded by the user's attitudes toward the system (Gefen, 2003).

In this research, ATT construct reflects the general feeling of favourableness or unfavourableness towards using the system. According to Taylor and Todd (1995), ATT is measured by 4-item scale, covering four types of positive attitude: the attitude of finding that using the system is (good/bad), (wise/foolish), (pleasant/unpleasant), and (like/dislike). The ATT 4-item scale, designed in a Likert-style format, was reported to be reliable with a Cronbach's alpha of .85. ITU construct reflects the strength on one's intentions to use the system in the future. According to Taylor and Todd (1995), ITU is measured by 2-item scale, designed in a Likert-style format, was reported to be reliable with a Cronbach's alpha of .91. In this research, AU construct reflects the amount of usage over a fixed unit of time the system. According to Davis (1989), AU is self reported hours of use in a specific amount of time. While self reported measures hold some limitation, it is often used in information system research when measurable items are not available (Morris and Dillon, 1997). With the 5 point Likert scale, respondents indicate their extent of agreement with a statement from a scale of 1 to 5 (1 = strongly agree and 5 = strongly disagree).

Hypothesis 1, 2 & 3: Interactivity -> Attitude, Intension to Use & Actual Use: Previous research investigating the effect of system's interactivity and users' attitude suggests that higher degree of interactivity positively influences users' attitude (Kettanurak *et al*, 2001). This research hypothesizes that the degree of interactivity of an information system will play a positive significant role in building positive attitude, intension to use, and actual use of that system, as stated in the following hypotheses:

Hypothesis 1: Perceived Degree of Interactivity of HEMIS will have a significant effect on User's Attitude towards that System

Hypothesis 2: Perceived Degree of Interactivity of HEMIS will have a significant effect on User's Intention to Use that System

Hypothesis 3: Perceived Degree of Interactivity of HEMIS will have a significant effect on User's Actual Use of that System

Hypothesis 4 & 5: Attitude -> Intension to Use-> Actual Use: According to Davis (1989) user's intention to a system is preceded by the user's attitudes towards that system, this research postulates the following hypothesis:

Hypothesis 4: User's attitude towards HEMIS will have a significant effect on the Intention to Use that System.

Hypothesis 5: The user's Intension to Use HEMIS will have a significant effect on the Actual Use of that System.

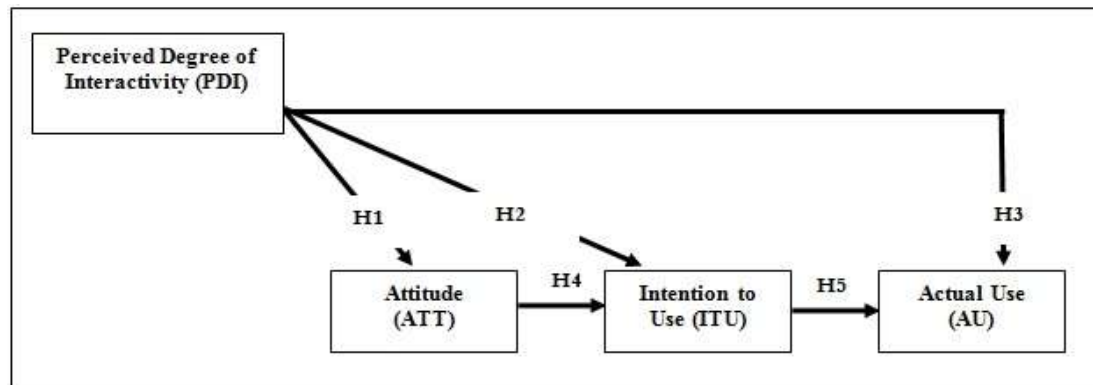


Figure 1: The Research Hypothetical Model

2.3 Implementation of Three HEMIS Different in Degree of Interactivity

The design of the three HEMIS was drawn from the interactivity aspects (*Frequency, Range, Significance, and Modality*) discussed earlier in this paper. These broader aspects are translated into specific design features which, in turn, are implemented as three HEMIS prototypes, as listed in **Table 1**.

In the *non-interactive prototype*, related fields (data of undergraduate/ cohort) are grouped and included in sequence of screens, where participants could browse screen by screen in a linear fashion, using *Next* (right arrow) and *Previous* (left arrow). Modality is limited to text, images, and graphics. User selects from number of pre-prepared reports list, where content and format of reports are fixed. In the search module, user type search keyword(s) with no support/correction from the system. In case of no match items, an error message appears with a suggestion to try different keyword(s) or to check spelling of keyword(s) used.

The *low-interactive prototype* includes all features of the *non-interactive prototype*, with the following additions: The *Previous* arrow is dimmed on the first screen and the *Next* arrow is dimmed on the last screen. *First* and *Last* buttons are provided to go directly to the start and end of the screens. A line of text at the bottom of the screen indicates how many screens available and which screen the current one was. User can go directly to a particular screen by pressing the screen number instead of browsing using the *Next* and *Previous* Button. Modality is limited to text, images, graphics, and videos. User selects from number of pre-prepared reports list, where content and format of reports can be edited. User can delete fields, change layout, fonts and spacing, adding logos and sub- titles. In the search module, user types search keyword(s) with a spelling auto-correction and advanced search features enabling search by combination of fields. System reports all search results matching with all or part of keyword(s), sorting descending by percentage of matching. *Clickable Texts* for terms, thesaurus, and abbreviations are marked in blue, once clicked; a pop-up small yellow label appears with short definition and explanation. Frequency of the clickable texts is few.

Interactivity Aspects	HEMIS Design Features
Interactive Frequency	<ul style="list-style-type: none"> ▪ Wizard for report templates design ▪ Drag and drop feature ▪ Correction and suggestion for search keyword(s)
Interactive Range	<ul style="list-style-type: none"> ▪ User Control over content: sequencing or branching of data ▪ Enable different paths of navigation: buttons, menus, arrows and tabs ▪ Integration of Resources: insert objects from other tools such as Excel ▪ Advanced Search feature
Interactive Significance	<ul style="list-style-type: none"> ▪ Feedback: verification/ confirmation error reporting including reasons for occurrence and correction actions
Interactive Modality	<ul style="list-style-type: none"> ▪ Clickable Text ▪ Integrate Multimedia elements ▪ Hypermedia discovery-based navigation

Table 1: Mapping Interactivity Aspects to HEMIS Features

In the *high-interactive prototype*, related fields are grouped and included in different tabs presented in one screen. When moving the mouse over the top of each tab, list of data included in the tab pops up. Participants can select between tabs based on information needs, with the possibility to select any tab at any order. Modality did not lack any of the multimedia elements. User has the option to either use a pre-prepared template of report, or design a new one. In designing a new template, a wizard tool supports the user by providing the list of fields to drag and drop from. Drawing menu is also available for users to draw lines, borders, and titles. User can import statistics and figures from other tools such as MS-Excel. User can save the report as template to be reused. In the search module, user type search keyword(s) with a spelling auto-correction and advanced search features enabling search by combination of fields. The system stores search keyword(s)/ text previous used by users, and has the capability to suggest accurate search text. While typing a keyword(s) / text, the system provides instant suggestions from keyword(s) previously used by the user, and/or the most possible matching keyword(s) based on the content of the system. In case of no typical matching, a message appears with system's suggestions for more accurate search. The System reports all search results matching with all or part of keyword(s), sorting descending by percentage of matching. The *Clickable Texts* are more widely used. *Hyperlinks* for some topics are available for more in-depth discovery-based analysis. For example in the retention rate report, hyperlinks to the term definition and equation are provided; in addition to international standards on retention rate and statistics of other higher education institution.

2.4 The Experiential Survey

This research is based on *experiential survey method* (Gefen, 2000), where participants are introduced to different information retrieval systems and they are asked to perform predefined tasks (to browse the system, and search for set of information) and subsequently report on their perception of information use by filling out a survey, while the interaction with the system is fresh in their minds.

The use of experiential survey method was found to be a valid empirical tool for hypothesis testing by providing credible evidence of relationship among the research constructs

(Gefen, 2000). According to Gefen and Straub (2003) experiential survey method simulates *real-world* use with a *live* environment, ensuring a *natural* reaction of user, which increases the external validity of the research. A common argument about experimental settings is that it might affect participants' perception and attitude, giving a feeling that participants are being tested in a laboratory. In the current research, all sessions were conducted in the users' actual work place, during their working hours, and with real work-related information and systems. Steps were taken to provide a more real-life situation, thereby making the participants' responses more natural.

2.4.1 Structural Equation Modelling

Structural Equation Modelling (SEM) is the main model analysis tool in this research. SEM technique investigates the *goodness-to-fit* of the assumed research model with all its paths, representing the observed data in terms of a number of *structural* parameters, hence bringing data and theory together (Tabachnick and Fidell, 2000). While statistical tools such as regression, correlation, and factor analysis have the limitation of analyzing only one layer of linkages between independent and dependent variables at a time, SEM models relationships among multiple independent and dependent constructs simultaneously (*structural model analysis*), and also calculates the loadings of measurements on constructs (*measurement model analysis*). Thus, in SEM, factor analysis and hypotheses are tested in the same step (Chin, 1998). Lately, SEM has been increasingly used in Information Systems and behavioural science studies (Gefen, 2000). Consequently, several software packages are now available to perform SEM such as LISREL, AMOS and PLS-Graph. Structural Equation Modelling (SEM) and PLS-Graph software are applied in the model testing of this research, aiming to confirm the hypothesized relationships between the model's constructs.

2.4.2 PLS Analysis

Partial least squares method (PLS) is the statistical method used in this study. PLS allows optimal empirical assessment of the measurement model and the structural model. The measurement model links each construct with the set of items measuring that construct, while the structural model includes a network of causal relationships linking multiple constructs (Keil, Tan, Wei, Saarinen, Tuunainen, and Wassenaar, 2000). The PLS-Graph calculates high R^2 and significant T-values, consequently rejecting the null hypothesis of no-effect, and show the goodness to fit of the assumed research model with all its paths (Thompson, Barclay and Higgins, 1995). Partial least squares (PLS) performs an iterative set of path analyses combined with factor analyses until the difference in the average R^2 of the constructs becomes insignificant. Path coefficients and correlations among the latent variables are estimated together with the individual R^2 and AVE (Average Variance Extracted) of each of the latent constructs. Once the measurement and structural paths have been estimated in this way, PLS applies either a Jack-Knife or a Bootstrap approach to estimate the significance T-values of the paths (Thompson *et al*, 1995). In Partial least squares (PLS), a good model fit is recognized with significant path coefficients, acceptably high R^2 and internal consistency (construct reliability) being above 0.70 for each construct. Assessing the confirmatory factor analysis in PLS is then

done by verifying constructs' convergent and discriminant validity by checking that the AVE of each construct is larger than its correlation with the other constructs, and that each item has a higher loading on its assigned construct than on the other constructs.

2.4.3 The Sample

The sampling method in this study is based on convenience sampling technique. The convenience sampling method, also called the *grab* method, is "*undoubtedly the most commonly used non-probability technique*" (Krathwohl, 1997: p.171). Participants were employed on the bases of *Within-Subject Testing* (Nielsen, 1993), means same participants will be evaluating the three HEMIS prototypes. While the three prototypes share some features, participants might form a perception of interactivity while using a specific prototype, which will transfer to the other prototypes. Therefore, the three prototypes were open on the computer's desktop for participants to select with which they prefer to start.

Participation in the study was voluntary. The sample size depended on the number of volunteers who were willing to participate in the experiment. The sample includes 110 administration staff with different managerial levels and responsibilities (registrar, academic advisors, alumina coordinators, secretaries, human resources and public relations) from seven higher education institutions in Egypt. They are all permanent staff, working in their higher education institutions for at least three years. They all own a university degree in different disciplines, and within the age range of 30 to 50 years. All participants show either intermediate or high technology familiarity, and with intermediate or high Internet usage. Males represent 40% of the sample and females represent 60%.

2.4.5 Session Administration

Experiential sessions were conducted in the seven different higher education institutions under similar conditions. All sessions took place in the computer lab of the institutions where participant are working. Consistency of computers settings was ensured in all labs, in terms of computers configuration, operating systems, Internet speed, and Internet browsers.

Participants of the experiential sessions were asked to perform tasks representing the most common queries performed on HEMIS in general. Participants were asked to complete two tasks. First: search for an under graduate, track his/her year-to-year grades, calculate length of time to graduation, print an undergraduate report card with tracked data from first year to date. Second: query for a specific cohort of graduates, track the cohort input (students quality and diversity), support (student retention, academic success, grade point average), and output (graduation rates, job placement).The experiential task were meant to be short, simple, within the practical information needs of the participants, representing a typical of what a higher education administrative staff might routinely perform.

Participants were given an introductory session with information about purpose, duration, and tasks of the session. Participants were introduced to the three different prototypes of HEMIS and were asked to select one prototype to start with, and were given as much time as they need to browse the first selected prototype of the HEMIS, and then they were asked to start to perform the pre-set tasks. Following, participants were asked to fill the post-experiential

survey based on their interaction with the selected HEMIS. Participants were asked to select the second, then the third HEMIS prototype and repeat the previously listed steps in each time.

Most participants took about 30 minutes to complete tasks on each prototype. Since the session was relatively short, no breaks were scheduled. After handing the survey to the experimenter, participants were thanked and dismissed. Participants were asked to record their use of the three prototypes for two weeks period. After two weeks, same participants reported to the researcher, by email, the number of hours spent on each system over the two weeks interval.

2.5 Analysis and Results

The measurement model links each construct with the set of items measuring that construct. Analysis of the measurement model is done through assessing reliability of item and construct, construct validity, and item correlations.

2.5.1 Measurement Model Analysis

2.5.1.1 Item Reliability and Correlations

Item reliability was checked in the current research through assessment of items loading, as well as the correlation between each item and its corresponding construct (Chin, 1998). In the current research, all items loading and all item-construct correlation exceeded 0.65, which matches the acceptable level of item reliability of 0.60 for items loading and item-construct correlation (Chin, 1998). Correlations between items measuring same construct were computed through discriminant validity of items, in which an item would correlates more highly with other items measuring the same construct than with items measuring other constructs (Keil *et al*, 2000). A further item correlation analysis is done in PLS, using bootstrap technique to generate the T-value of item loadings. In PLS loading of an item in the factor analysis would be much higher on its assigned construct than on the other constructs (Gefen, 2000). In the current research, all items were found to have much higher loadings in their assigned constructs than in the other constructs.

2.5.1.2 Construct Reliability and Validity

According to Keil *et al* (2000), Cronbach's Alpha assess how well a set of items measures a single construct; hence assessing construct validity. Cronbach's Alpha value of 0.6 is considered satisfactory, while a value of 0.8 or higher is preferred. In the current research, Cronbach's Alpha scores, exceed 0.6. Construct validity is measured through the correlation coefficient between each construct and its assigned items, using Pearson Correlation Coefficient (Krauthwohl, 1997). In the current research, a significant correlation was found between all construct of the research model and all their assigned items.

2.5.3 Structural Model Analysis

The structural model includes a network of causal relationships linking multiple constructs. Analysis of the structural model is done through calculation of the percentage with which the independent variables explain the variation in the dependent variable (R^2 Value), as well as Path Coefficients and T-Value.

PLS uses a Bootstrap technique to obtain T-values for each path in the structural model. Support for each hypothesis is assessed by examining the sign and statistical significance of the T-value for its corresponding path. The acceptable T-value is 2.326 with a significance level of 0.01 (Keil *et al*, 2000). **Table 2** shows the path coefficients and T-values for the three degree of HEMIS interactivity.

For the overall dataset and the three HEMIS prototypes, the value of R² is highest in ATT, followed by ITU, and finally by AU. This suggests that the model mainly provides explanation of the variation of attitude on the largest degree, followed by explanation of the variation of the intention to use on a less degree, and finally explanation of the variation of the actual use. Furthermore, the PDI->ATT path is particularly valid, where they explain 58% of the variation in ATT. Followed by the paths of PDI->ITU where they explain 52% of variation in ITU. Followed by the paths of PDI->AU where they explain 48% of variation in AU. This again suggests the strength of model in explaining mainly the variation of the attitude construct, more than the other two dependent constructs.

For the non-interactive, low-interactive, and high-interactive systems, the results propose that perceived degree of interactivity has a positive effect on attitude ($t = 5.745$, $p < 0.01$; $t = 5.216$, $p < 0.01$; and $t = 4.212$, $p < 0.01$ respectively); and perceived degree of interactivity has a positive effect on intention to use ($t = 5.744$, $p < 0.01$; $t = 5.455$, $p < 0.01$; and $t = 5.465$, $p < 0.01$ respectively). While only for the low-interactive and high-interactive systems, the results propose that perceived degree of interactivity has a positive effect on actual use ($t = 4.44$, $p < 0.01$; $t = 4.831$, $p < 0.01$). This suggests that the higher the level of perceived interactivity of the HEMIS system, the higher is the positive attitude, and the strongest is the intention to use the system. Thus H1 and H2 are supported. In the case of low and high interactive systems, the higher the level of perceived interactivity, the higher is the reported actual use of the system. Thus H3 is supported for low and high interactive systems.

The results also propose that for the non-interactive, low-interactive, and high-interactive systems, the greater the user's positive attitude towards HEMIS, the higher is the user's intention to use the system ($t = 15.15$, $p < 0.01$; $t = 9.45$, $p < 0.01$; $t = 9.46$, $p < 0.01$ respectively). This suggests that users with positive attitude toward HEMIS tend to show willingness to use that system. Thus H4 supported. Furthermore, for the three prototypes, intention to use the system has a positive direct effect on its actual use ($t = 4.10$, $p < 0.01$; $t = 10.03$, $p < 0.01$; $t = 10.03$, $p < 0.01$), thus H5 is supported.

Structural Model Path	Non-interactive system			Low-interactive system			High-Interactive system		
	Path Coef.	T-Value	R ²	Path Coef.	T-Value	R ²	Path Coef.	T-Value	R ²
PDI-> ITU	0.235	5.7447▶	0.511	0.261	5.4556▶	0.452	0.262	5.4656▶	0.522
ATT -> ITU	0.564	15.155▶		0.487	9.4567▶		0.489	9.4665▶	
PDI -> AU	0.132	4.4443▶	0.232	0.095	1.8314	0.303	0.094	4.8312▶	0.481
ITU -> AU	0.312	4.1041▶		0.507	10.031▶		0.508	10.031▶	
PDI-> ATT	0.614	5.7451▶		0.645	5.2160▶		0.567	4.2122▶	

▶ Acceptable T-value > 2.326 with a significance level $p < 0.01$

Table 2: Path Coefficient (p), T-Value, and R² of the Structural Model

2.6 PLS Analysis Results

The Effect of Interactivity on Attitude, Intension to Use, and Actual Use

According to the PLS results, perceived degree of interactivity was found to be significantly related to attitude, intention to use, and actual use; thus providing support to H1, H2, and H3; the higher the level of interactivity, the strongest is the positive attitude, the willingness to use, and the actual use. This important role of interactivity as an antecedent of attitude has rarely been emphasized in the higher education context, though widely used, in other environments. The result mainly agrees with existing computer-based learning model which empirically confirm the significant effect of the system's interactivity on the learner's attitude (Kettanurak *et al*, 2001). The current research contributes by validating these findings in the context of higher education.

The Effect of Attitude on Intension to Use and Actual Use

According to the PLS results, attitude was found to be significantly related to intention to use, meanwhile intension to use was found to be significantly related to actual use; thus providing support to H4 and H5; the strongest the positive attitude, the higher is the willingness to use, and subsequently, the higher is the actual use. The effect of attitude on HEMIS use suggested by this research provides support to extensive previous work on the effect of user's attitude on system use, in several contexts (Davis, 1989; Gefen, 2000; Gefen and Straub, 2003; El Said, 2014). Still, this important role of attitude has rarely been emphasized in the higher education context, though widely used, in other environments.

In general, the result of this research offers empirical support to the effect of system's interface design and features, namely interactivity, in building positive attitude and willingness to use for information systems; Hence providing evidence to many researchers who investigate same phenomena and argue that it needs to be further investigated. This research mainly provides an additional starting point for future research in this area for Higher Education Management Information Systems.

3. Discussion and Implications

With the increasing importance of Higher Education Management Information Systems (HEMIS), it is essential to understand how aspects of system's design may help to engender positive user's behaviour. The results of this research provide support for the model illustrated in **Figure 1** and for the hypotheses presented by the paths among the model constructs. The model holds for the three HEMIS prototypes used in the study, supporting the robustness of the model. In summary, the current research owns the following contributions:

A Suggested HEMIS Use Model: This research contributes to the understanding of the drivers of HEMIS use. The research has succeeded in developing a model that enriches current research by offering specification, justification, and empirical validation of a set of interrelationships between important factors that tend to be associated with HEMIS use. This research stresses on the role of interactivity in HEMIS design, empirically validating the study's hypotheses that interactivity influences the actual use through attitude towards the system and the intention to us the system. In terms of theory building, the research integrates and extends well-accepted models and then applies the revised model in the higher education context.

A Validation of Existing E-Learning and Human Behaviour Models: This research supports previous E-Learning model holding evidence for the role that system's interactivity play in shaping attitude and motivation to use that system (Kettanurak *et al*, 2001). It also validates, within the context of HEMIS, well established human behaviour theories which were not largely verified in the higher education technology domain (Fishbein and Ajzen, 1975; Ajzen, 1985; Davis, 1989). The research mainly contributes by adding more support to these models, and most notably, by validating these previous user behaviour models for higher education information systems' users.

Practical HEMIS Design Implications: This research has practical implications for the ways in which HEMIS designers might increase users' attitude and thereby increase their willingness to use the system through increased degree of interactivity. System's design would emphasis the use of interactive features such as: drag and drop, wizards, clickable text, integration with other tools, and hypermedia discovery-based navigation. High degree of interactivity can also be achieved by encouraging user control over content, enabling sequencing and branching of data, and facilitating different paths of navigation (ex: buttons, menus, arrows, and tabs). Feedback is a major element of system's interactivity, where verification and confirmation of error reporting would include reasons for occurrence and correction action. Online help, correction and suggestions, and advanced search feature are interactive tools for user's support. Integration is an additional concept of interactivity, establish links between related information, and integrating resources and tools and various Multimedia elements (ex: text, image, graph, voice, video, hyperlinks).

On the other hand there are likely to be a number of other factors that affect HEMIS users' behaviour such as content structure, search design, general interface appearance, and ease of use. While all these speculations need empirical validation; still, the finding of this research could provide an understanding of the characteristics and behaviour of the higher education users and can thus provide the foundation for future work to specify design guidelines for information systems designers attempting to target them. These results could be a robust starting point for further related theoretical and empirical work in this area.

4. Limitations and Future Work

Due to time limitation, this research was conducted on one-shot basis, where actual use (AU) construct was measured by self-reported hours of use over a fixed unit of time (2 weeks). The researcher recognizes the limitations associated with self-reported measures of usage. Still, self-reported usage measure has often been used in information system research to operationalize system use (Davis, 1989; Morris and Dillon, 1997). Future longitudinal research would trace the HEMIS use of the same participants over extended period of time, to investigate the long-term impacts of interactivity on the sustained use of the system. It may also be interesting to monitor to what extent the information provided by the HEMIS was used on the long-run, and to investigate how the user attitude changes over time toward similar interactive systems.

This research was also limited to the type of administration information reporting systems in higher education context. The effect of interactivity on attitude, intention to use, and

actual use may not be the same for different type of information retrieval and query. More interactive systems may not be necessarily better in other context such as structural training, problem solving, and/or procedural instruction context. Future research may be carried out to check the suggested model for different types of information systems.

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