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A COMPARISON OF CHANGE MANAGEMENT GUIDELINES TO ADDRESS TECHNOLOGY ADOPTION BARRIERS: A CASE STUDY OF HIGHER EDUCATIONAL INSTITUTIONS

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ABSTRACT

Emerging technologies are bolstering the development in the world in all the domains of the world. Education sector is an example of such innovation, by basing on which new means of pedagogy and andragogy are being explored with suitable models. The present study aims to know the difference in such models and the change management guidelines in addressing the barriers of Technology Enhanced Learning (TEL) in Higher Educational Institutions (HEI). The students of the Department of Electrical, Electronic and Computer Engineering (DEECE) of 1st year are selected from the Cape Peninsula University of Technology (CPUT) are selected for the study using purposive random sampling. They are divided into two groups and are made to participate in a survey after providing some level of orientation about the change management models and the role of the model such as UTAUT and ADKAR. The opinion of the students is collected regarding the ability of the models to hedge against the barriers in the process of technology enhanced learning. The collected data is analyzed to check the means and standard deviation of scores and hence the difference between the opinion of the groups. To achieve this, t-test for difference of means with unequal variance is used. The results led to the acceptance of the null hypotheses that are framed basing on the research questions. Among the two groups of students surveyed, it is proved that the group that got exposed to TEL approach is able to understand the barriers in a better manner than their counterparts. In addition to the results, the draw backs of the study like limited sample size, clarity about the causality and ineffective participation of students are identified. Hence it is advocated to the future research works to overcome the limitations and to understand the role of the change management guidelines to address the barriers in the technology adopting as per the setting.

Keywords: *Technology Enhanced Learning (TEL); Areas of Tension (AOT); Unified Theory of Acceptance and Use of Technology (UTAUT); Adoption of Learning Technology (ALT); Awareness/Desire/Knowledge/Ability/Reinforcement (ADKAR); Higher Education Institution (HEI)*

1. INTRODUCTION

The intervention of technology in education has raised curtain for new era and erased the geographical boundaries. This change not only narrowed the digital divide but also made voluminous data available, facilitated by technology to all with ease irrespective of their domains and terrains. As the means of learning and education are increasing ubiquitously, educational institutions are also etching the channels for the imparting such knowledge. As learning is associated with many constructs related human behavior, there are impediments in this process like any other developmental venture. Researchers have been developing various models to understand the changes in the process of learning with all the latest pedagogy and to design management approach in order to overcome the barriers.

The current status of the technology enhanced learning is detailed by many research works and journals. These set of procedures included in the pedagogy are referred to as "Holistic and multidisciplinary collaboration" and highlighted the following five areas that are vita for Technology Enhanced Learning (TEL) - TEL as an emerging

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episteme, TEL theories, TEL technologies, TEL practices and TEL Application in domains [1][2][3][4]. Thus the scope of this research would incorporate elements of all five of the International Journal of Technology Enhanced Learning (IJTEL) identified key areas as tools to develop a test technology enhanced classroom environment. The steps that are planned for enhancing the practical details of TEL towards effective implementation and overcoming the process hurdles are aimed at the proliferation of the awareness and understanding about the TEL activities.

The present study also aims to develop a set of change management guidelines for the implementation of Technology enhanced Learning initiate within a Higher Education Intuition context. The idea of framing the guideline is to understand all the barriers in adopting the technology (both old and new) by the student community and searching a viable approach with the help of the theories and models evolved in these lines. This research work tests the guidelines using online class from a group of students. Also, to know the actual opinion of the stakeholders of learning process, a survey is conducted for the students belonging to the Department of Electrical, Electronic and Computer Engineering at the Cape Peninsula University of Technology in South Africa.

The flow of the research is carried out with the help of literature review, that dealt with the famous theories and models progressed in this context. The methodology explains the framework of sample selection, data collection and analysis. A comparison among the existing models is done with respect to the important constraints and conclusions are drawn to suggest the approach to incorporate the changes in the Higher Education Institutions.

The following Figure 1, and figure 2 represents the current domains of deployment of ICT in education.

Figure 1. Typical deployment of a TEL implementation

Source: Adapted from IJTEL key areas 2015

Figure 2. Scope of this research

Source: Adapted from IJTEL key areas 2015.

From the above two figures it can be understood that the four quadrants of TEL – Theory, Technique, Practices and Applications in Domains are influencing and supporting the emerging episteme of technology oriented education. In order to achieve the aim of the study, four objectives are formed considering the role of the four dimensions mentioned about.

They are –

- Appreciating the status quo of the TEL in the context of HEI
- Understanding the extent of influence of the barriers that arise for students in this process of deployment of technology and to know the intervention of the relevant models such as UTAUT
- Assessing the ability and role of the existing frameworks for change management in managing the bottle necks for advanced pedagogy
- Deploying and monitoring the appropriate change management framework for hedging against the barriers for TEL implementation

The concept 'Technology Enhanced learning' though appears to be a trivial concept, is not actually so, as it can be realized only with interdisciplinary intervention. That is authors perceive TEL as a combination of the three domains – management, education and ICT [5][6][7][8] . So, the research questions for this study are framed by establishing a connectivity among these fields. Thus the research questions framed to meet the objectives of the study are

1) What are the actual technology barriers that are experienced when attempting to integrate technology into a learning environment?

2) How can a change management model be adapted to address the identified barriers to technology adoption during a technology based learning implementation?

3) To what extent can a change management model adapted to address barriers to technology adoption in a learning environmental context be effective?

4) What techniques integrated into a change management model to facilitate technology adoption in a learning environment will increase adoption rates?

1.1 Technology Enhanced Learning - Issues Related To Implementation

Technology Enhanced Learning is perceived as an interface between the technology and higher education [9][10][11]. The significance of the Technology Enhanced Learning can be known quantitatively from the data given by Google Scholar in the year 2013 that, 1510 documents using online and learning, 1120 documents using

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technology and learning, 702 documents with virtual and learning, 307 using web-based and learning and 257 documents with Information and Communication Technologies (ICT) and learning in their title are published [12]. TEL being an evolving discipline has many bottle necks in the process of implementation [13][14][15][16][17]. These bottle necks are due to multiple reasons like lack of teaching resources for faculty, unavailability of improvised material and qualified faculty [18][19].

The study conducted among 16 educational institutions in Europe revealed five differing views about the barriers of Technology Enhanced Learning. They are - Data tracking for personalized learning versus data privacy; Technology spread reducing the digital divide versus even increasing it; Ubiquitous learning opportunities versus focused and critical processing of information; Continuous innovation in the classroom versus approved practices (Source: Issues extracted from Computers & Education 2013). In addition to these, lack of technological support, financial and infrastructural challenges pose more obstructions for technology Enhanced learning [2][21][22]. The solutions mentioned by [23] is that the measures like collaborative working with all the stake holders, addressing the software and hardware requirements of the facilities, reinforcement of the implementation of efficient pedagogy and andragogy and others.

[24] from his study done in Sakarya University revealed that the providing the pedagogical methods through vendors makes the organizations concealed for the service provider. This prevents the organizations to modify their strategies as per the dynamic requirements of the society. Around the world, the technology design issues are organizational specific and hence uniqueness of the technology implementation strategy is not possible [25]. [26] listed out some of the most preferable approaches that are generally used in the context of technology Enhanced learning environment. They are - The Change management approach, An Information technology framework based change and A project management approach are to name a few.

As there are differences among the situations that demand the technology intervention, many technology acceptance models have been developed accordingly. Thus there are models such as TAM1, TAM2, TAM3 and UTAUT [27] that are helping to understand the role of behaviour in selecting the apt method of technology for learning. The drawback is that the above said models mostly explain the behavioural aspects involved in the TEL management process, but the role of the issues related to information technology or management are not given enough significance [28][29][30]. It is opined by [31] that because of interdisciplinary nature of the TEL structure, adhering to few models and applying the strategies according is very cumbersome for realizing the actual benefits of the constructs. The TEL can only reap positive results, if an only if fair means are practiced in the process of disseminating information and assessing the students through technological aids [9][32][33].

In addition to the above To the other side of the coin, technology enhanced learning is leads to many competitive situations and challenges in organizations as there will be always discrepancy between the ever-changing technology and organizational practices [34]. In the same vein, the adverse effects of this technological interventions are mushrooming in all disciplines, especially in education and research sector. Some examples of the drawbacks are plagiarism, misuse of intellectual property rights and other ethics related issues [35] [36][37]. On the whole, world is enjoying more benefits than the negative outcomes and hence the role of ICT is being preferred in the learning process through pedagogy and andragogy [38][39].

1.2. Change Management – Necessity And Utilities

Change management refers to the approaches that are carried by the management to harness the new methods, models and technologies for the development of the competitive edge for the organizations [34]. The role of human values in encouraging change management in any system is undeniable. [40] explained in their paper as to how the human orientation can be incorporated while encouraging the change management in any system. [41] discussed about the concept ‘cyberloafing’, which is detrimental to the implementation of any transformation in organizations. On one hand, the cyberloafing is perceived as a barrier for e-learning and on the other, it is found to have inverse relation with organizational commitment. Hence the social cognitive theory has been given enough prominence either in change management and technology adoption in the context of higher education [42][34]. The change management is more evident in organizational and Academic settings than other domains.

1.3. Organizational Change Management

In general, the organizations are subjected to many turbulances in the process of adopting change

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management thoughout various streams of operations. This not only efffectss the lower and middle level personnel but also the higher level [43]. This choatic situation is because of the friction between the legacy and new systems and/or practices [44]. So, it is always advisable to understand the system requirements and unique features of the entities before enforcing the change management in the process [45].

Researchers have developed many change management models that facilitate the transitions with ease and hedge against the barriers of change management for enabling TEL. Around the world, there are different views about the process of adoption of new ways of technology. [46] felt that adoption and adaptation are to be nurtured among the organizations to welcome the transition of the systems. On the other hand, [47] argue that rather mere adoption of the new policies at a stretch, reorientation of the existing streams should be given primarily importance. Thus the strengths of the existing practices can be proved and the weakness of the practices can be overruled by the change agents [48].

1.4. Academic Institutional Change Management

[49] mentioned from their research study on technology enhanced learning that the change management should occur in the academic institutions in such a way that quality of the content is given more prominence than quantity. It is also added that innovative educational designs and e-learning practices as per the requirement of the stakeholders can fulfil the requirements of the community and society to a greater extent. These changes are majorly possible with the support of the management at all levels of the institution [5]. As in the case of many academic institutions, complete change management is not taking place, new CM models are emerging to provide support to the organizations, especially in higher educational institution context. One of such efficient CM model is ADKAR model [51][52].

During the implementation of e-learning projects at an enterprise level, intervention of external factors can disturb the very purpose of the development initiatives [53]. [54] add that improper implementation of the change management models by the managers without having through knowledge of the process leads to erroneous results of implementation. On the whole, there are many encounters highlighted by the researchers for executing TEL strategies in the context of higher education. They are - paucity of common consensus about the TEL strategies; difficulty to understand the cumbersome ness of higher education domain; the duties to be discharged by the respective in-charges in implementing the change management in the stream of education technology stream; diffusing human orientation in the process of technology development and practices [49][50] [53].

Table 1- Literature review factors and sources

The following table details the differences between the UTAUT and ADKAR MODELS with respect to their components and their definitions

Table 2 - UTAUT/ADKAR components and their definitions

2. METHODOLOGY

Having understood the significance of various influential factors and areas of tension, the following research questions are proposed for furtherance of the analysis. To achieve the objective of the study through the research questions, the null hypotheses are framed, which are stated below the respective research question.

- Are there actual technology barriers that are experienced when attempting to integrate technology into a learning environment?

H01: Barriers to technology adoption will not be unique within a learning environment.

- How can a change management model be adapted to address the identified barriers to technology adoption during a technology based learning implementation?

H02: A change management model cannot be adapted to address barriers to technology adoption through the integration of technology enablers at freeze points

- To what extent can a change management model adapted to address barriers to technology adoption in a learning environmental context be effective?

H03: Adapting a change management model to integrate techniques for addressing barriers to technology adoption will be less effective than either a CM model or technology adoption model alone

- What techniques integrated into a change management model to facilitate technology adoption in a learning environment will increase adoption rates?

H04: Adapting a change management model to integrate techniques for addressing barriers to technology adoption will be less effective than either a CM model or technology adoption model alone.

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The two models UTAUT and ADKAR are compared to test whether there is any influence of the ten constructs between the two different groups of students. The first five constructs are framed as per the UTAUT model and the second five are as per the ADKAR model. These constructs are well defined in advanced prior to data collection. Thus the list of constructs that are selected with the help of literature review are Student Demographic Profile (SD), User Response to Change Management (CM), User Acceptance (UT), User satisfaction with the TEL experience (US), Perceived Usefulness (PU) and feedback (FB) about the online course. The following table illustrates the categories chosen and the reason for the specific choice.

Table 3 Categories of survey and reasons for choice

2.1 Data Required

The data for the study is collected using the study tool questionnaire. The questions in the tool are designed by keeping the constructs of both the models (UTAUT and ADKAR). Thus, five constructs per each model that can contribute to the technology usage behavior are identified for the former model and the constructs related to the phases of the latter model are considered to assess the influence of TEL in higher education context. The study could not consider the effect of learner situation such as language of communication, socio-cultural, demographic, managerial and technological conditions. This limitation can be overruled by the future research works with a greater sample and other relevant inclusion and exclusion criteria.

On the whole, the data collected using the constructs yielded the information relating to the following:

- Demographics of the participants
- Any existing change management activity
- The perceived levels of user acceptance and use of constructs against UTAUT
- Any structural constraints that remained after the VLE is created such as:
  - Location
  - Available bandwidth
  - Connectivity restrictions
  - Help files
  - Availability of trained facilitators
  - Support for BYOD
- Satisfaction levels of the TEL course
- Perceived usefulness of course

2.2 Study Sample

The study sample constitutes 44 students belonging to the Department of Electrical, Electronic and Computer Engg. (DEECE) of 1st year, selected from the Cape Peninsula University of Technology (CPUT), a public university in South Africa. This group is selected using purposive non-probabilistic procedure. During the process of selection, enough care is taken to avoid the inequalities to a greater extent [80]. The students are divided into two groups by following the class roster and every alternate student is selected into the first group-A and the remaining students into the second group-B. Thus there are 22 students in each group. Upon the permission from the respective authorities, hard copies of Information and Consent forms are distributed to the students. After taking the consent, the students are guided to Moodle platform to take part in the survey. Err free coding of the students is done in the platform to avoid redundancy in answering the questionnaires. There are 31 questions and one open ended question given in the questionnaire.

The survey categories are done as per the inputs provided by the works of [81] and [82]. Considering the suggestions found in the literature related to similar studies, it is decided to frame 31 questions as per the guidance provided by [83]. Except the UA construct, the categories (SD, UR, US and PU) had questions formulated against ADKAR model. Then followed the questions related to UR and UT. The questionnaire thus prepared is tested using the Question Understanding Aid tool. Except for the questions related to the demographic profile of the students (SA), the data for the other questions is collected using a use five point Likert scale and an open ended feedback question is given at the end of the questionnaire. The data is collected using excel sheets and the statistical test like mean, standard deviation and t-test are applied on the data. Table 4 below illustrates the categories, their questions, purpose of question.

Table 4 - Survey questions and targets constructed

3. STATISTICAL ANALYSIS

A fully functional Moodle is designed and hosted on the World Wide Web for access by the students

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to answer the online questionnaire. The Moodle is a web based platform that is used to collect the data for the study. The class instructor and an administrator are trained in its use and all other tools are made available to manage the site.

3.1 Group-A Implementation

As mentioned above, Group-A constitutes the students that are chosen in alternate manner from the class roster. The objective is to present a TEL experience to them in the form of a set of revision exercise presented in an online Moodle class using internet connectivity on their device of choice. The instructor of the class required the students to access the VLE, select and read resources, discuss academic material and take an online quiz over the duration of a week. The demographic profile of the students reveal that among 22 students, 19 students only participated in the survey. The question related to feedback, being optional is filled by six students only. This group is comprised of all male students in the 18-24 age group. All the participants are not South African citizens. Their studies are mostly funded by parents with a mix of public and personal transport indicating good support structures and access to ICT services.

The objective of Group-A is to introduce the TEL experience with only the most basic consideration of a change project with the minimum required actions to generate an awareness of the TEL environment as a change. The participants, prior to the TEL experience had only used other VLE resources at the university in the form of a Blackboard based system and this is their first exposure to the Moodle platform.

Table 5 - CM approach to Group-A (ADKAR with no Barrier enablers)

3.2. Group-B Implementation With CM Guidelines And ALT Model

Group-B is also chosen in the same manner as Group-A is chosen from the class roster, but mutually exclusive. The objective is to present a TEL experience to them in the form of the same set of revision exercises presented in an identical online Moodle class using internet connectivity on their device of choice. The students completed the participant information sheet, consent form and completed the survey. The ten synthesized barrier enabler CM guidelines are tested with Group-B in an actual TEL environment using ADKAR as a delivery and measurement guide. The student profile of Group-B reveals that out of the 22 students selected, 16 students only participated in the survey. All the students completed the survey except the optional feedback. This group has both male and female students with variation in the age. Statistical tests are applied on the data of Groups – A and B to find the mean and standard deviation of the scored marked on the Likert Scale. In addition to this, t-test for unequal variances is used to know the difference in the means of the groups A and group B for all the ten constructs individually.

4. RESULTS AND EVALUATION

The survey is completed by the two groups in such a manner that the first group (group-A) with standard change implementation techniques got introduced to the Moodle TEL course and the second group also got introduced to, with a change process including the proposed guidelines and barrier enablers. The survey results of Group-A are used to examine perceptions and attitudes to the TEL experience using (CM and UT). Other categories (US, PU, SD and FB) are additional to the guidelines and are created for further understanding the characteristics of the group. As mentioned above, the CM and UT categories are analyzed using MS-Excel. The results are tabulated with pictorial representations for better understanding. The data thus captured in excel sheets is checked for redundancy and accuracy and then processed to know the perceptions about the TEL experience against the Likert scale questions for the categories CM and UT. The optional qualitative questions are interpreted and are tabulated after the possible grammar correction.

4.1 Group-A

The mean scores or the Likert averages to know the attitude towards technology adoption given in the following table 6 explains that, students rated the Performance Expectancy as a high yielding score (4.26) and the Effort Expectancy and facilitating conditions both with a less score (3.79). This reveals the attitude of the students regarding the enablers. Also, the perception towards change management got reflected with the highest score of Reinforcement (4.21) for a belief that the organization would support the CM platform; Knowledge with lowest score (2.74) makes it clear

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that the knowledge that is vital for CM, is actually low among the students.

Also, it can be observed from the table that Performance expectancy and Reinforcement got highest scores respectively (4.26) and (4.21), but their standard deviations are lowest. Contrasting the score of Reinforcement (4.21) with Facilitating conditions (3.79) indicates that the technological help to attain goals is not necessarily closely related to institutional support in new technology such as the TEL implementation. The lowest scores are attained for the constructs, knowledge (2.74) and voluntariness (2.89) which indicates that as participation using technology is optional, students did not show much inclination. So, better information and orientation towards the TEL environment would have resulted in better outputs.

Table 6 - CM/UT survey results across Group-A (N = 19)

Figure 3. Mean averages for Group-A for UTAUT and ADKAR

4.2. Interpretation - Categories (US, PU and FB)

The sections of the survey related to US and PU are not given much prominence in interpretation because of the models selected, but FB is examined for any qualitative extremes and any feedback that can be taken into account for the implementation. All the feedback of the students is given in table 9. Overall, though little support is provided to Group-A to encounter the technological barriers, they exhibited eagerness towards TEL. Mutual help and positive attitude for technological orientation made this possible for the group.

4.3. Group-B

After the change management guidelines are been implemented, the survey results are examined in the form of to the Likert averages in table 7 for attitude towards technology adoption. The results revealed that Performance Expectancy got highest score (4.5) spreading a belief that the system approach will help the individuals to know about the utilities of technology and the construct Voluntariness got lowest score (3.12), indicating that perceptions about the use of educational technology being optional are not perceived as significant. The following figure details about the relative mean values and the standard deviation values of the constructs diagrammatically.

Table 7 - CM/UT survey results across Group-B (N = 16)

Figure 4. Mean averages for Group-B for UTAUT and ADKAR

4.4. Categories (US, PU and FB)

The sections of the survey related to US and PU are not given much prominence in interpretation because of the models selected, but FB is examined for any qualitative extremes and any feedback that can be taken into account for the implementation. All the feedback of the students is given in table 9. The students of Group-B apparently benefited through the phases of ADKAR model with respect to the strategies and the means of management.

4.5. Group A/B

After individual testing for both the groups, comparison between the mean and the standard deviation of scores is done between the groups to know relative response of the students. That is the role of the technological intervention is understood from the comparison table given below. In addition, to the apparent comparison and for the interpretation of the results of the Likert question averages from the same survey between group-A and Group-B, two-tail t-test analysis with unequal variances is conducted. But none of the t-values are found to be significant. This could be because of the limited sample size.

Table 8 - CM/UT survey results across Group-A/B (N=35)

Figure2 5. Mean averages comparison for Group-A/B for UTAUT and ADKAR

The relative examination between the mean and standard deviation of the scores between the two groups disclose that except for the constructs, Voluntariness and Knowledge, the Group – B's averages are higher than that of Group-a. Examining the difference between Groups A. The two constructs Voluntariness and Knowledge has different impact in both the groups. Though Group -B is pro towards the technology orientation and new information, much variation in the knowledge

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levels is found in group-B than group-A. Addressing the technological and intellectual needs of the students can resolve this dilemma and helps to minimise the variation among the scores of the students.

On the other hand, the role of the construct Social influence and its impact in creating awareness among the users is inconclusive. Though Group-B had lower scores for this construct, the reason behind the dynamics in this situation (opinion between the instructor and the group or the group collaboration) are uncertain. The approaches designed to address this situation to understand the undercurrents like group discussions and technology meets/gatherings can reorient the students towards the new ventures.

The following table synthesises the feedback of the students for the open-ended question. The gist of the feedback created more critical stance to understand the stand of the students about the technology. Between the two groups studied (Group-A and Group-B), the latter group seems to have more clarity in though than the former group. That is the feedback of the group-B is substantiated with apt reasoning. This kind of approach can foster the technology orientation and can help them to adopt the TEL in the Higher Education Context.

Table 9 - Group-A/B survey results for (US, PU and FB) categories

5. DISCUSSION - RESEARCH QUESTIONS

The analysis performed on the scores given by the students for various constructs not only provided a detail idea about the mean and standard deviation values and relative comparison, but also provided good support to accept or reject the null hypotheses framed as per the research questions of the study.

- Are there unique actual technology barriers that experienced when attempting to integrate technology into a learning environment?

H01: Barriers to technology adoption will not be unique within a learning environment.
It is quite evident from the literature review, the analysis and the feedback that barriers of technology are not unique to any environment. In addition, the Likert average values for the five constructs of UTAUT did not show any significance and hence the null hypothesis is accepted for this research question.

- How can a change management model be adapted to address the identified barriers to technology adoption during a technology based learning implementation?

H02: A Change management model cannot be adapted to address barriers to technology adoption through the integration of technology enablers

The perceptions of Group- B after the intervention of the proposed CM guidelines showed an attitude response to all elements of CM and technology barrier constructs. Therefore, it is understood by this context that individualistic approach works better than a particular change management model for the barriers and hence, the null in this case is accepted for this research question.

- To what extent can a change management model adapted to address barriers to technology adoption in a learning environmental context be effective?

H03: Adapting a change management model to integrate techniques for addressing barriers to technology adoption will be less effective than either a CM model or technology adoption model alone

After the literature is investigated, it is clear that CM in a student environment and HE context is not widely implemented. In addition to this the specific adapting of a CM model to address technology adoption barriers provided a challenge. This is because these models focus on change projects and perceptions of users in an organizational context and not on technology adoption. Hence, it is found by examining the constructs of technology adoption and CM models that rather adapting a CM model, it is more logical to combine elements of each into a new proposed theoretical model for technology adoption enhancement. So, the null hypothesis is accepted for this research question.

- What techniques integrated into a change management model to facilitate technology adoption in a learning environment will increase adoption rates?

H04: By including enablers to technology self-efficacy and perceived usefulness whilst minimising structural constraints, a change management model will not increase adoption rates.

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By using a CM model paradigm, including By using a CM model paradigm, including elements of the UTAUT and ADKAR models, an approach is proposed to increase adoption rates and implement these using a change management project approach. The response to both CM approach using guidelines and barrier enablers through using the proposed ALT model appeared favorable in terms of attitude to technology adoption in a TEL environment. This lead to the acceptance of the null hypothesis.

6. CONCLUSIONS

The aim of the study is to check the barriers to technology adoption and provide change management guidelines to support the adoption of technology in higher education context. The change management approach and the guidelines that are incorporated in technology enhanced learning concept through adoption of learning technology provided many inputs that are applicable for various situations, ubiquitously. Though Group -B is pro towards the technology orientation and new information, much variation in the knowledge levels is found in group-B than group-A. Addressing the technological and intellectual needs of the students can resolve this dilemma and helps to minimize the variation among the scores of the students.

In some cases, the constructs like Voluntariness and Knowledge has shown the results that led to indecisive situation. The combination of UTAUT and ADKAR model constructs for technology-enhanced learning in higher education context has disclosed the facts that the change management cannot be applied to any environment as it may not yield positive results all the times. So, a thorough understanding of the context and the requirements are highly needed to make any technological intervention to be realized. It can also be understood from the work that there is much requirement for the suitable strategies that can be applied for TEL initiatives. Though, there are ten constructs (five for UTAUT and five for ADKAR) tried to explain the behavioral and developmental phases in the process of adopting a new technology, they are not able to reach a common consensus regarding the ALT and AOTs. Further exploring in these areas can certainly fill the gaps in the study.

6.1. Academic Application

Academically this work has resulted in an approach at unifying a highly complex and controversial emerging episteme of TEL. A technique: Contrasting two or more existing theoretical models that are not directly associated has been proposed as one avenue to move forward in the discipline. Creating new relationships or theoretical constructs through abstract conceptual modelling by Linking, association or path-finding when comparing semantics, definitions and interoperability is a second proposed approach to unifying the complexity of TEL environments. This is achieved by suggesting a process where by any two or more models are first classified according to their components and then the definitions and meanings of these components are documented. Source characteristics and target intent are then specified and if any compatible matches are found, these can be conceptually modelled into a new theoretical model for testing.

6.2. Business Application

The business applications and limitations of TEL initiatives are in many instances unclear in the literature as well as are highlighted by this study to have complex influence paradigms. There appears to be an emerging episteme in TEL and the three domains of business, education and technology that can be suggested is far more focused on exploring the outer boundaries or inner specifics of how TEL can work pedagogically as opposed to making distinct choices against a unified approach that can drive the industry forward. Implementations of TEL that are highly successful in a competitive industry are in many cases held as proprietary information within academic institution infrastructures and therefore not beneficial to the general populous.

6.3. Limitations And Scope For Future Studies

A long with the positive insights, the study also had its own areas of tension. That is, a technology initiated study with larger sample size and covering many constructs can supplement more dimensions in this area. As there is growing need for new management approaches in the pedagogy and andragogy in the present day competitive environment (Baggaley, 2014), the coming research works can concentrate on these gaps. Another area of relevance to future work is the determination of the impact of the AoT's as outlined by (Plesch, et al., 2013). Although the guidelines in the ALT theoretical model serve to create awareness of the

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influence of the AOT's, definitive strategy would benefit from increased knowledge as to their specific impact on TEL initiatives as well as findings of comparisons between institutions implementing collective application of one or the other of the opposing viewpoints. Though, there are ten constructs (five for UTAUT and five for ADKAR) tried to explain the behavioural and developmental phases in the process of adopting a new technology, they are not able to reach a common consensus regarding the ALT and AOTs. Further exploring in these areas can certainly fill the gaps in the study.

The limitations of the work relate to the contextual complexity and differences in opinion within academia and the HE education domain. The researchers own professional involvement for 15 years as a higher education practitioner may have influenced the approach through an insider view to the industry as well as specific experiences of TEL initiatives. Although a great deal of effort to avoid this is practiced, as well as informal discussions with numerous colleagues academics as to the direction of the work, the fragmentation of academic opinion and approach in the industry became even more apparent. The conflicting opinions , positivist, constructivist, dedicated and generic theory expressed by professional educators over the course of the work served as an influence to even further remove the approach of the project from the specialist in TEL to generic to the industry in order to attempt to maintain a balanced and objective view.

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Tables and Figures

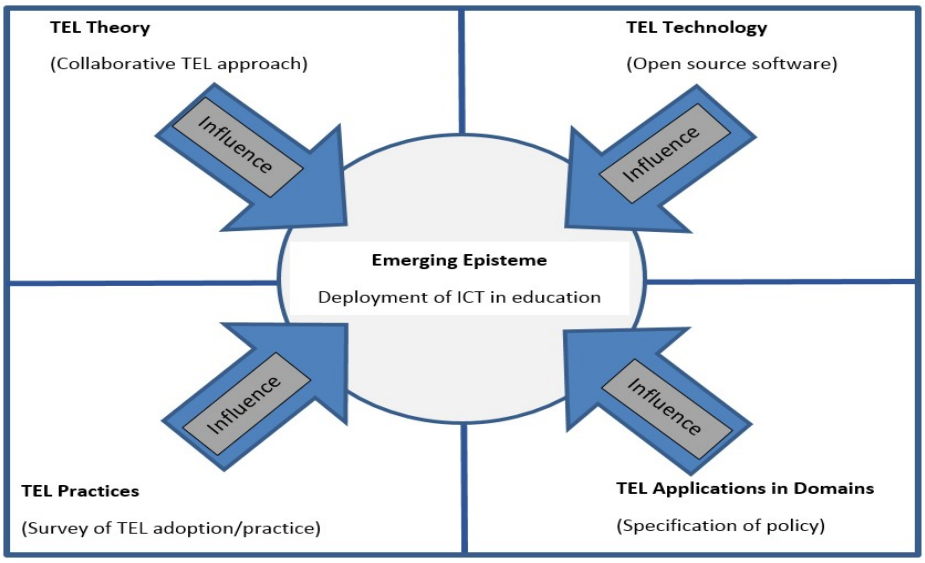

Figure 1. Typical deployment of a TEL implementation

Source: Adapted from IJTEL key areas 2015

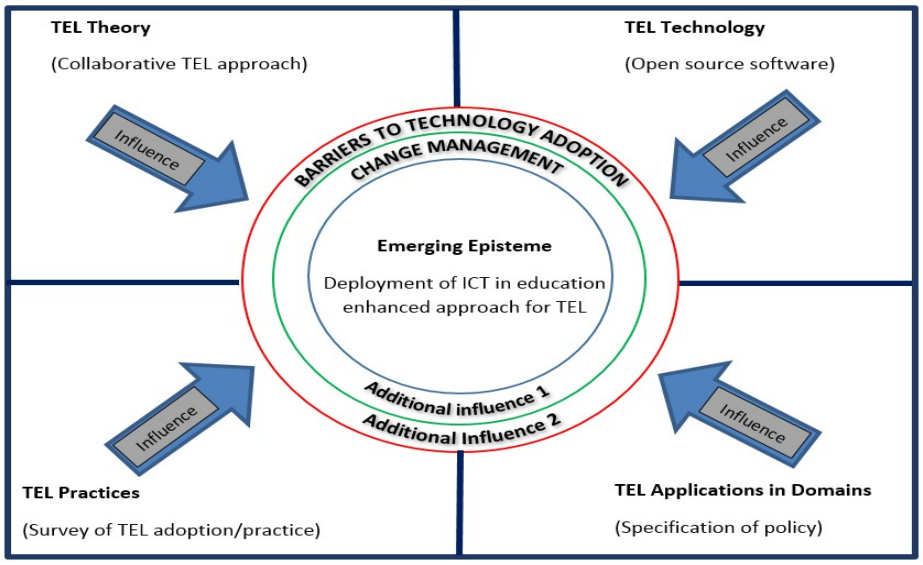

Figure 1. Scope of this research

Source: Adapted from IJTEL key areas 2015.

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 1- Literature review factors and sources

Domain of influence	Reason for use	Related to	Author/s
Technology adoption	Baselines for understanding the human dimension of technology adoption. Accepted model descriptive of technology adoption	Additional barriers that could be experienced outside of technology adoption models. Empirically validated foundations on which to base further work	[42] [34] [40][55] [56] [57][58][59]
Ethical issues relating to Technology Enhanced Learning research	Technology use and ease of access can cause ethical considerations unique to technology use in learning	Management approaches to TEL that consider the broader scope of the influence of a technology project	[26] [42][33] [60] [60] [62] [63] [64]
Change Management in education	Change leadership under competitive pressure	Implementation of TEL Adapting a CM model for use in education, and proposed competency settings	[51][40][41][65][66] [67]
TEL	The core issue of implementing TEL is not a pedagogical one	Enhancing the technology in higher educational context	[9] [12][14][68] [69] [70]
Human approach to organizational technological development	Dynamics can be used for creating and enhancement of organizational strategies, fostering self-efficacy through technology	Possible new individualistic approaches for enhancing technology adoption.	[50][53][49] [71][72][73]
New management approaches	Existing practices and research is too narrowly focused on adaptation and adoption of current practice	New approach to management innovation practice	[46][47] [48] [74] [75][76]
Failure of existing TEL education management approaches and a need for new approaches	Current education management paradigms are being challenged	Current approaches to online education management are both are insufficient and need change	[53] [54] [47] [77] [78]
Technology barriers in E-Learning initiatives	Support of key enablers, with management found to be most influential	Using Change Management strategy to overcome barriers to implementation	[41] [43] [45] [44] [79]

Table 2 - UTAUT/ADKAR components and their definitions

Definitions of UTAUT constructs (Venkatesh, 2003)		Definitions of the ADKAR phases of change (Prosci, 2015)	
Social influence:	The degree to which an individual perceives that important others believe he or she should use the new system.	Awareness	Of the need to change.
Performance expectancy:	The degree to which an individual believes that using the system will help him or her to attain gains in job performance.	Desire	To participate and support the change.
Voluntariness:	The extent to which potential adopters perceive the adoption decision to be non-mandatory.	Knowledge	Of how to change (and what the change looks like).
Effort expectancy:	The degree of ease associated with the use of the system.	Ability	To implement the change on a day-to-day basis.
Facilitating conditions:	The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.	Reinforcement	To keep the change in place.

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Table 3 Categories of survey and reasons for choice

Category	Description	Factors of study related to
SD	Student Demographic Profile	Relates to UTAUT, Resources, Motivation, Access to technology
CM	User Response to Change Management	Awareness of CM phases or ADKAR constructs during TEL class, Capability
UT	User Acceptance	UTAUT constructs
US	User satisfaction with the TEL experience	Experience of the TEL class of the study
PU	Perceived Usefulness of the online course	Perception of the experience in the TEL class
FB	Open	Any/Feedback

Table 4 - Survey questions and targets constructed

Category	Question	Target
SD/UT	Please state your age group	Age/Influence/experience
	Please state your gender	Influence/experience
SD	How do you access the Internet the most?	Income group/resources
	How do you pay for your studies	Income/Motivation
	How do you travel to university?	Income
	How much do you spend on Internet access per month?	Income/ Technology access
	I feel that studying is too expensive	Income/Perception/Motivation
	Did you pass your Computer Skills subject on the first attempt	Experience
CM	How well are you informed about the process of participating in an online learning class?	(Awareness)
	Are any checks conducted beforehand or during the online course that made your online interaction easier?	(Knowledge)
	How well are you given the opportunity to express your opinion and concerns about attempting online activities?	(Desire)
	How much assistance is provided to you to prepare for the online class?	(Ability)
	To what extent are you aware of online educational facilities available to you?	(Awareness)
	How much opportunity do you have to take part in facilitated online learning?	(Ability)
	Do you feel you would receive benefits from learning	(Reinforcement)

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	online?	
UT	How much experience do you have with computer technology including Internet, games, office programmes, simulators, social media, and smart devices?	(Experience)
	When learning to use a new technology or computer software program, how much training did you seek?	(Experience)
	How well are you supported to learn and participate in new computer and smartphone technologies?	(Social Influence)
	I find access to the internet, devices and learning new software to be:	(Facilitating Conditions)
	I am nervous when I am asked to use a new internet technology or device:	(Effort Expectancy)
	When asked to learn I prefer using:	(Voluntariness)
	I consider the use of computer technology for learning	(Performance Expectancy)
US	I found the online course easy to locate and participate in	(Moodle design)
	There are times during the online course where help is needed	(intervention)
	I would like the online course to include collaboration with others via social media	(Cultural/Social/need)
	I collaborate via social media for academic activities with my classmates:	(Cultural/Social/collaboration/Willingness)
	How often did you require online support when answering questions in an online class	(Online help design)
	I would prefer to participate in an online course	(Environment suitability)
PU	The way the quiz presented the results afterwards is:	(Immediate feedback)
	Using an online course more often would improve my academic results	(Value of TEL)
	I would like more than one way to participate in an online class	(Effectiveness/appeal of single platforms)
	I would like to participate online again in the same class:	(Ease of use of the presented Moodle design)
	My opinion of online learning after this class is more positive	(Use behavior result/perception)
FB	Add any additional comments you wish to make here about your online experience.	Feedback

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Table 5 - CM approach to Group-A (ADKAR with no Barrier enablers)

Phase of change/ Creating	Approach taken
Awareness	Informing by email of the need for a revision course
Desire	Asking them to optionally participate
Knowledge	Stating that it would be new and online
Ability	Asking for cooperation
Reinforcement	That the platform would be used for future revision

Table 6 - CM/UT survey results across Group-A (N = 19)

Descriptive statistics		
CME Model: Guidelines	Group A	
	Mean Likert Values	S.D.
1 Social influence	3.68	1.06
2 Performance expectancy	4.26	0.99
3 Voluntariness	2.89	1.24
4 Effort Expectancy	3.79	1.47
5 Facilitating conditions	3.79	1.23
6 Awareness	3.16	1.14
7 Desire	3.05	1.51
8 Knowledge	2.74	1.05
9 Ability	3.1	1.15
10 Reinforcement	4.21	0.79
Overall Index	3.46	1.163

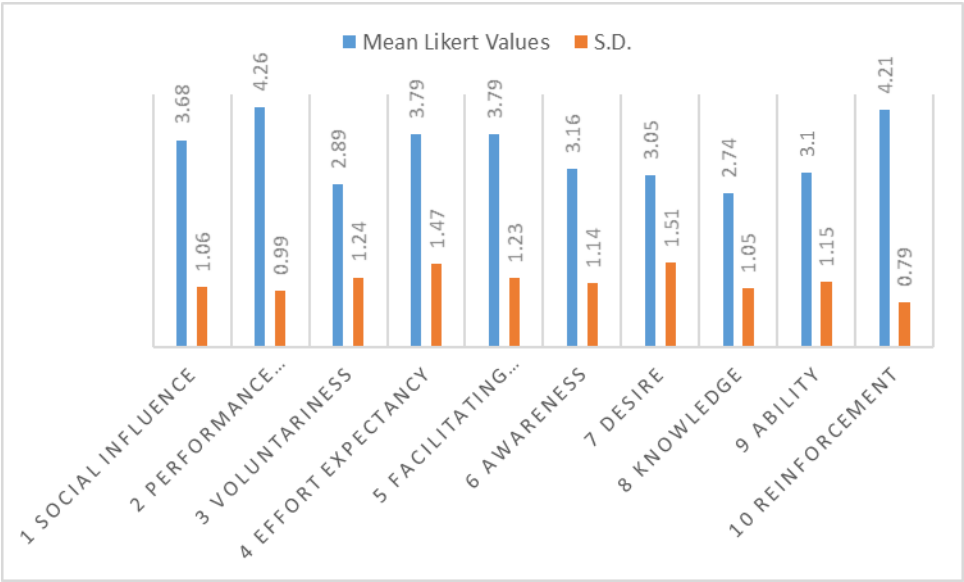

Figure 3. Mean averages for Group-A for UTAUT and ADKAR

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Table 7 - CM/UT survey results across Group-B (N = 16)

Descriptive statistics		
CME Model: Guidelines	Group B	
	Mean Likert Values	S.D.
1 Social influence	3.5	0.82
2 Performance expectancy	4.5	0.73
3 Voluntariness	3.12	1.41
4 Effort Expectancy	4	1.21
5 Facilitating conditions	4.12	0.81
6 Awareness	3.62	0.88
7 Desire	3.37	1.41
8 Knowledge	3.44	1.31
9 Ability	3.37	0.93
10 Reinforcement	4.44	0.63
Overall Index	3.748	1.014

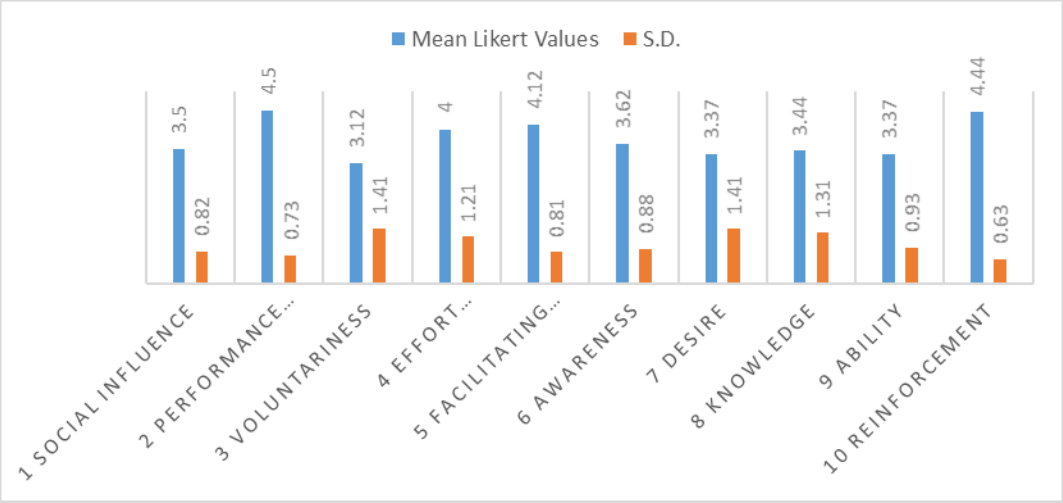

Figure 4. Mean averages for Group-B for UTAUT and ADKAR

Table 8 - CM/UT survey results across Group-A/B (N=35)

Descriptive statistics					
CME Model: Guidelines	Group A		Group B		
	Mean Likert Values	S.D.	Mean Likert Values	S.D.	t-Values (p)
1 Social influence	3.68	1.06	3.5	0.82	0.58 (0.56)
2 Performance expectancy	4.26	0.99	4.5	0.73	0.81 (0.42)
3 Voluntariness	2.89	1.24	3.12	1.41	0.51 (0.61)

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4 Effort Expectancy	3.79	1.47	4	1.21	0.46 (0.64)
5 Facilitating conditions	3.79	1.23	4.12	0.81	0.97 (0.34)
6 Awareness	3.16	1.14	3.62	0.88	1.36 (0.18)
7 Desire	3.05	1.51	3.37	1.41	0.65 (0.52)
8 Knowledge	2.74	1.05	3.44	1.31	1.72 (0.1)
9 Ability	3.1	1.15	3.37	0.93	0.76 (0.45)
10 Reinforcement	4.21	0.79	4.44	0.63	0.95 (0.35)
Overall Index	3.47	1.16	3.75	1.01	

P < 0.05 – Significant Level

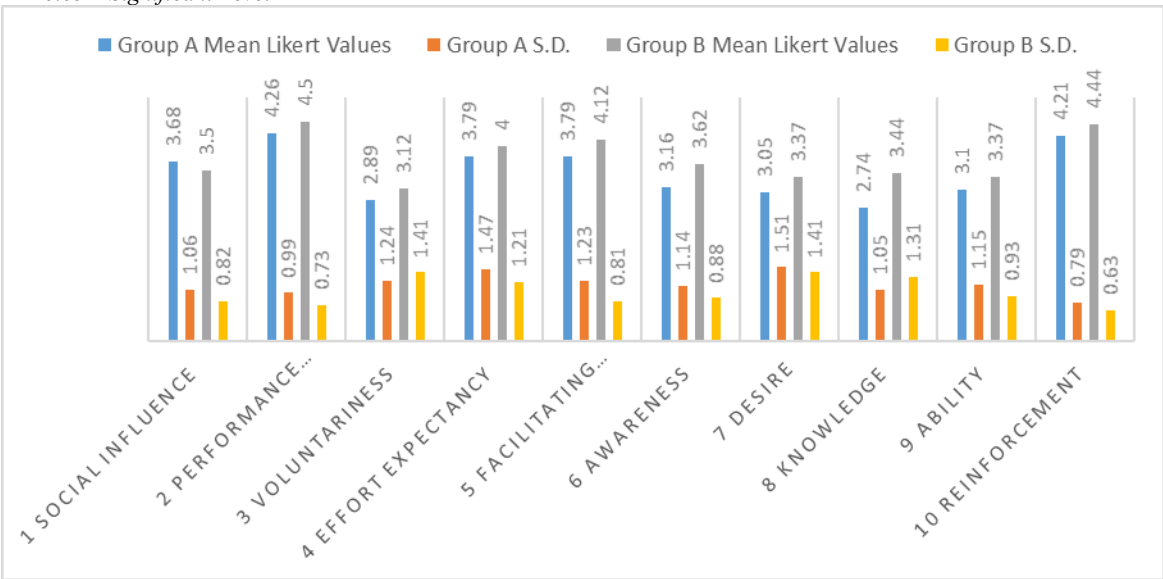

FIGURE 5. MEAN AVERAGES COMPARISON FOR GROUP-A/B FOR UTAUT AND ADKAR

Table 9 - Group-A/B survey results for (US, PU and FB) categories

Qualitative feedback analysis groups A/B on open ended comment (Additional comments)	
Group-A feedback	Group-B feedback
1) *Online learning had been experienced in two other courses*, potentially showing that the student perceived all online learning as the same. 2) *That this is a good way of learning and conducting class* – no elaboration is made. 3) *That for engineering students the online software lacked relevant symbols that are needed* – This is a valid concern with generic VLE interface design for engineering students. *4) That 21 century learning should always combine online and traditional learning*	1) *The online experience is very interesting and exciting when you have guidance and they learned a lot and would like to participate like this all the time.* This revealed a perception of the enabler support provided during the ADKAR phases as being a different approach. *2) Online is the way to go but do not take away the face to face communication as it is very important.* This could indicate a preference for blended learning (partial use of technology). As this student clearly stated both a preference for online and face to face and using the words "I love doing my work online". This could further indicate that the added guidelines could potentially be swaying an entrenched preference towards technology in a student that enjoys a traditional paper based

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– Indicating this student prefers blended learning (partial use of technology). 5) *I would like to become experienced in online learning* – indicating a desire to learn a new platform (Need for technology ability). 6) *That the student really liked participating in online tests and exams* – indicating a like for eLearning (Already has technology ability).	environment. 1) *That the online experience is "successful" because the student learned things in this class that are not known before.* The recommendation is to go forward with this type of online class. This could indicate both an ability increase and performance expectancy change from both the VLE and the CM guidelines. 2) *This is a very good program and the student would like to use it more often.* This is inconclusive as the meaning of "program" as course or software is undetermined 3) *This is a good initiative which opened the students mind, and that it is a good experience with good support.* This could indicate an impact of both performance expectancy and voluntariness from the guidelines. 4) *That the online experience is good although it began as challenging, towards the end the student liked it.* This could indicate a reduction of nervousness , increase of overall behavioural intention and an increase in desire from the guidelines 5) *The students experience has improved over the years as well as technology is improving and that using online learning would be great start from now on.* This could relate to a general increase in behavioural intention.