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A conceptual framework highlighting e-learning implementation barriers

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A CONCEPTUAL FRAMEWORK HIGHLIGHTING E-LEARNING IMPLEMENTATION BARRIERS

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A CONCEPTUAL FRAMEWORK HIGHLIGHTING E-LEARNING IMPLEMENTATION BARRIERS

ABSTRACT

Purpose– E-learning has gained much focus from educators and researchers, with many extolling e-learning over traditional learning. Despite this focus, implementation of e-learning systems often fails. Literature considers a range of barriers, impacting the success of e-learning implementations, yet to the best of our knowledge no conceptual framework is able to consolidate existing research.

Design/methodology/approach– This paper undertook an in-depth review of literature concerning e-learning implementation barriers. Papers were extracted from established peer-reviewed journals and open sources. Articles not related to e-learning implementation barriers were discarded. A total of 259 papers were identified, published between 1990 and 2016. Hermeneutics and data-driven qualitative content analysis was used to define 68 unique barriers.

Findings– The 68 unique barriers were thematically grouped into four conceptual categories, i.e. Technology (T), Individual (I), Pedagogy (P) and Enabling Conditions (EC). These 4 categories led to the conceptualization of 'TIPEC' Framework, which highlights the key concepts hindering e-learning implementation and delivery. Results show that most articles only consider a narrow range of success barriers.

Practical implications– The proposed TIPEC framework acts as a guide for education practitioners, system developers, policy makers and researchers. It provides stakeholders with a summary of e-learning barriers.

Originality/Value– This paper fulfils an identified need for a conceptual framework that consolidates all current research related to E-learning implementation barriers.

KEYWORDS

E-Learning, Barriers, Challenges, Conceptual Framework, Hermeneutic, Technologies in Education/Workplace.

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INTRODUCTION

E-learning relates to the use of electronic systems and applications within learning processes. E-learning facilitates the potential for remote interaction between students and experienced teachers/professors (Wang et al.,2009). Learning content is delivered remotely via an electronic solution, e.g. internet, satellite TV, radio, CD-ROM etc. (Bates, 2005), and includes consideration of electronic based learning systems; for example digital collaboration and virtual classrooms. E-learning is transforming the map of both global education and corporate training (Bell et al.,2004). The ubiquitous accessibility afforded by e-learning, especially in developing countries, has gained much attention from researchers across a range of diverse cultures and contexts (Lin,2010); with many researchers extolling e-learning over traditional learning due to its blend of synchronous and asynchronous structures (Zengin et al.,2011). Vast development has been made in the provision of e-learning solutions, driving expectations concerning e-learning's potential (Bell et al.,2004). Despite such rhetoric the long-term adoption, diffusion, and exploitation of e-learning solutions has been much less successful than originally projected (Bell et al.,2004).

Asia, for example, currently has the highest demand growth rate (17.3% per annum), yet high implementation failure rates, and high student drop-out statistics is risking long-term use by Higher Educational Institutions. In Pakistan, for example, e-learning is widely adopted across the entire education system, yet institutions are facing a complex combination of barriers that is limiting the long-term success of e-learning solutions. This paradox between growing public demand, yet failing implementation/acceptance, has resulted in researchers and practitioners focusing on e-learning implementation failure barriers (Lee et al.,2009). Although extensive work has been done to understand e-learning implementation barriers (Kwofie and Henten,2011), limited work has been done to consolidate this understanding. The aim of this paper is to highlight e-learning implementation barriers, by undertaking an in-depth review of e-learning literature. In addition, barriers will be categorized; to facilitate the proposition of an e-learning barrier framework; supporting education stakeholders with systems development and implementation.

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METHODOLOGY

In our research, literature was sorted using a two-step process. The first step related to sourcing relevant literature articles. Well-established peer-reviewed international journals were sourced, from relevant and reputable publishers; including EmeraldInsight, IEEE, Jstor, ScienceDirect, SpringerLink, Wiley etc. Search terms (including E-learning, Technology Based Learning, Technology Mediated Learning, Technology Enhanced Learning, Virtual Learning, Online Learning, Distance Learning, Distance Education, Virtual Education, ICT based Learning) were used in combination with a range of synonyms that expressed the semantics 'barrier'; e.g. Issues, Barriers, Hurdles, Problems, Success Factors, Obstacles, Challenges, Difficulties, Failure, Success. Additional peer-reviewed articles were also sourced using Google Scholar to increase the diversity and scope of papers identified in our search. Both qualitative and quantitative research was reviewed. No limitations were applied as a result of country of study and/or educational level; accordingly literature from all learning domains, i.e. higher education, vocational training, and corporate training, were included in our review. All papers were written in English and were available from peer reviewed or open sources. The search timeline was limited to between 1990 to 2016; since the existence of the world wide web was deemed essential to most modern e-learning solutions. In the second step of our sorting process, the authors reviewed the title, abstract, introduction, and conclusion for each article. Articles that were found not to be related to e-learning implementation barriers were discarded. Articles that focusing only on e-learning systems algorithms, coding, or protocols were discarded.

After the initial screening, a total of 259 papers were identified. A list of 104 barriers were created, however it was observed that a number of identified barriers, despite using different terms, semantically expressed the same barrier. The authors studied all remaining papers, using hermeneutic phenomenology and content analysis to interpret the underlying coherence and structure from the textual object of study (Taylor,1976; Hsieh & Shannon,2005). Literature advised using the following questions to analyse artefacts: How are barriers defined? What is the data population? What is the experimental context? What are the boundaries of the analysis? What does paper conclusion infer? By coding the inference categories, and by removing duplications, 68 unique barriers to e-learning implementation were defined (see tables 1-4 for barrier definitions, descriptions, and literature links). Barriers identified in multiple papers were also highlighted (see

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tables 1-4 AUTHOR column), which allows the authors to demonstrate overlap in existing literature.

Table 1: Barriers in literature related to E-learning: Technology

BARRIERS	AUTHOR	DESCRIPTION
1.Technology infrastructure	Davie & Wells,1991; Soong et al.,2001; Wild et al.,2002; Little,2003; Vrasidas,2004; Surry et al.,2005; Voogt,2009; Goyal et al.,2010; Meyer & Barefield,2010; Purohit & Bhagat,2010; Waycott et al.,2010; Shelton,2011; Teo,2011; Alshwaier et al.,2012; Chang'ach, & Sang,2012; Guy,2012; Kipsoi et al.,2012; Qureshi et al.,2012; Reeves & Li,2012; Alsabawy et al.,2013; Graham et al.,2013; Nwabufo et al.,2013; Gutiérrez-Santiuste & Gallego-Arrufat,2016; Güllü et al.,2016; Ozudogru & Hismanoglu,2016	Refers to the hardware, software, facilities, and network capabilities within the college/institution.
2.Technical support	Venkatesh,2000; Soong et al.,2001; De Freitas & Oliver,2005; Pagram & Pagram,2006; Sife et al.,2007; Nwabufo et al.,2013; Poon & Koo,2010	Unavailability of technical staff and lack of facilities to perform various activities (installation, operation, maintenance, network administration and security).
3.Bandwidth Issue And Connectivity	Ali,2004; Homan & Macpherson,2005; Poon & Koo,2010; Mahanta & Ahmed,2012; Reilly et al.,2012; Nor & Mohamad,2013; Gutiérrez-Santiuste & Gallego-Arrufat,2016; Vencatachellum, & Munusami, 2006	Slow speed of Internet and high internet traffic during e-learning experience.
4.Software and interface design	Swan,2004; Andersson & Grönlund,2009; Kwofie & Henten,2011; Marzilli, et al.,2014	Less user friendly software and interface design during e-learning experience.
5.Compatible technology	Koller et al.,2008; Gudanescu,2010; Marzilli, et al.,2014	Incompatibility of content with a variety of learning management systems/technology.
6.Poor quality of computers	Radijeng,2010	Low quality computers that freeze frequently and outdated computer systems.
7.Virus attacks	Nikoi & Edirisingha,2008; Qureshi et al.,2012; Prakasam,2013; Shonola & Joy,2014	Virus attacks on e-learning systems during e-learning experience.

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Table 2: Barriers in literature related to E-learning: Individual

BARRIERS	AUTHOR	DESCRIPTION
8.Prior knowledge	Hölscher & Strube,2000; Brusilovsky,2003; Paul & Chen,2003; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Student having background knowledge related to course.
9.Student Motivation	Bates,1990; Pintrich & De Groot,1990; Ostwald,1992; Mason & Weller,2000; Alexander,2001; Wu & Hiltz,2004; Pagram & Pagram,2006; Johns & Woolf,2006; Andersson & Grönlund,2009; Lanzilotti et al.,2009; Blignaut & Els,2010; Kwofie & Henten,2011; Miliszewska,2011; Bozkaya & Kumtepe,2012; Yoo et al.,2012; Medárová et al.,2012; Hepworth & Duvigneau,2013; Nwabufo et al.,2013; Alajmi, 2014; Callinan,2014; Gutiérrez-Santiuste & Gallego-Arrufat,2016;	Students' Motivation on the basis of their skills, attitudes, interest, behaviour and activity.
10.Technological difficulty	Schrum & Hong,2002; Arbaugh,2002; Thurmond et al.,2002; Ocak,2011; Pituch & Lee,2006; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Students facing technological difficulty in using e-learning technologies.
11.Technology experience	Schrum & Hong,2002; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Students lacking technology experience in solving problems and accomplishing basic tasks.
12.Awareness and attitude towards ICT	Becking, et al.,2004; De Freitas & Oliver,2005; Inglis,2007; Klasnić et al.,2008; Anwar & Niwaz,2011; Bozkaya & Kumtepe,2012; Nagunwa & Lwoga,2012; Alajmi,2014; Nwabufo et al.,2013	Students lacking awareness of internet skills and reluctance of students in taking responsibility for their own e-learning.
13.Computer literacy	Eisenberg & Johnson,1996; Fyfe,2000; Sharma,2003; Andersson & Grönlund,2009; Kwofie & Henten,2011; Nor & Mohamad,2013; Karaman, Kucuk, & Aydemir,2014	Lack of computer literacy in students.
14.Perceived usefulness and ease of use perceptions	Venkatesh,2000; Wong, Nguyen, Chang, & Jayaratna,2003; Cantoni et al.,2004; Lu & Chen,2007; Liao, Liu et al.,2011; Digión & Sosa,2012; Tao et al.,2012	Students' intentions to carry on e-learning lifelong and his/her usage behaviour of ICTs.
15.Students Support	Galusha,1998; Elango et al.,2008; Lewis & Chen,2009; Chen,2009; Stansfield, et al.,2009; Yaghoubi et al.,2008; Anohina-Naumeca & Grundspenkis,2012	Support provided by students in successful implementation of e-learning system.
16.Computer anxiety	Wiksten et al.,1998; Venkatesh,2000; Piccoli et al.,2001; Sun et al.,2008; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Students' early misperceptions about the ease of use of an e-learning system.
17.Sense of isolation due less face to face interaction	Bates,1990; Galusha,1998; Daugherty & Funke,1998; Campbell et al.,2000; Schott et al.,2003; Vonderwell,2003; Sweeney et al.,2004; McInnerney & Roberts,2004; De Freitas & Oliver,2005; Tham & Werner,2005; Jensen et al.,2009; Anwar & Niwaz,2011; Chatzara et al.,2012; Reynolds et al.,2013; Callinan,2014; Muhammad et al.,2015	Absence of face to face/social interaction between individual learner and instructor endorsing sense of isolation.
18.Conflicting priorities	Andersson,2008; Andersson & Grönlund,2009; Kwofie & Henten,2011	Time devoted to e-learning causes priority conflict.

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19.Social support	Andersson & Grönlund,2009; Kwofie & Henten,2011; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Support from family and employers for e-learning, conducive environment and devoid of distraction during e-learning sessions.
20.Social loafing	Rutkowski, Vogel et al.,2002; Koller et al.,2008; Wheeler et al.,2008; Gudanescu,2010; Loh & Smyth,2010; Ryu & Parsons,2012	Students working less diligently because of the relative absence of instructor- learner and learner-learner interaction.
21.Student's economy	Andersson & Grönlund,2009; Iqbal & Ahmad,2010	Financial difficulty for taking up e-learning courses.
22.Academic confidence	Andersson,2008; Andersson & Grönlund,2009	Academic experience and qualification of student.
23.Self-efficacy	Joo et al.,2000; Andersson & Grönlund,2009; Liaw,2008; Bozkaya & Kumtepe,2012; Maki & Charalambous,2014; Gutiérrez-Santiuste & Gallego-Arrufat,2016; Ozudogru & Hismanoglu,2016	Student's confidence in using e-learning technologies and believe in completion of e-learning course.
24.Lack of ICT skills	Carr,1999; Voyler & Lord,2000; Oliver,2001; Jarvis & Szymczyk,2010; Qureshi et al.,2011; Qureshi, Ilyas, Yasmin, & Whitty,2012; Nagunwa & Lwoga,2012; Gutiérrez-Santiuste & Gallego-Arrufat,2016	It includes training in multimedia related skills and Impact of technology on learning.
25.Family commitments	Schott et al.,2003	Family commitments taking up most time and resources of the e-learners
26.Work commitment	Schott et al.,2003	E-learners giving excuse of their work commitments for skipping exams, assignments etc.
27.Student readiness	McCausland,2005; Goyal et al.,2010; Ünal et al,2013	Students possessing inconsistent E-learning readiness over time, among institutions or instruments.
28.Response to change	Jager & Lokman,1999; Song & Keller,2001	Students' slow response to changing e-learning.
29.Inequality in access to internet connectivity	Mackintosh,2005; Salaway et al.,2008; Gudanescu,2010; Okine et al.,2012; Farid et al.,2014	Inequalities in access to the internet & few people have internet connection.
30.Inequality in Access to technology	Nwabufo et al.,2013; Anderson et al.,2005; Salaway et al.,2008; Pegrum,2009; Gudanescu,2010; Kipsoi et al.,2012; Guy,2012; Pegrum, et al.,2013; Dudeney et al.,2013	Inequality of access to the technology itself by all the students.
31.Technophobia	Nwabufo et al.,2013	Students' having afraid of operating e-learning systems/technologies.
32.Cost of using technology	Sambrook,2003; Andersson & Grönlund,2009; Nor & Mohamad,2013; Becker et al.,2013; Callinan,2014;	Students facing high cost of using technologies.
33.Individual Culture	Pratt,1991; Alavi & Leidner,2001; Kolb,2005; McCausland,2005; Chroust,2007; Economides,2008; Joy & Kolb,2009; Azer & El-Sherbini,2011; Adeoye,2012	Student's overall individual culture distresses attitude towards distance learning. Each individual have different learning style and expectation, which should be consider while designing e-learning.

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Table 3: Barriers in literature related to E-learning: Pedagogy

BARRIERS	AUTHOR	DESCRIPTION
34.Faculty effort	Black,1992; Miller & Schlosberg,1997; Surry et al., 2005; Inglis,2007; Bailey & Card,2009; Meyer & Barefield,2010; Teo,2011; Pegrum, et al.,2013; Teo & Wong,2013; Güllü, et al.,2016	Lack of effort and support being put by faculty members in use of e-learning.
35.Faculty development	Willis,1994; Higgs,1997; Sife et al.,2007; Inglis,2007; Kaleta et al.,2007; Collopy & Arnold,2009; Lareki et al.,2010; Lim et al.,2011; Reilly et al.,2012; Yaakop,2015	Lack of training and development in faculty and limited change in teaching methodology of faculty in response to ICT developments.
36.Lack of ownership	Forman & Nyatanga,2002; Ertmer,2005; Mayo eet al.,2005; Omwenga,2006; Sife et al.,2007; Naismith,2007; Chua,2009; Masalela,2011; Qureshi et al.,2011; Duveskog et al.,2014	Faculty not taking ownership of successful implementation of e-learning technologies and lack of interest in meeting e-learning challenges.
37.Lack of feedback	Hiemstra,1994; Andersson & Grönlund,2009; Guy,2012	Faculty putting little effort in giving feedback, making students drop out or fail.
38.Quality Course Content	Tricker et al.,2001; Drago et al.,2002; Saadé,2003; Ali,2004; De Freitas & Oliver,2005; Stahl et al.,2006; Picciano & Seaman,2007; Rhode,2009; Voogt,2009; Veeramani,2010; Meyer & Barefield,2010; Masoumi,2010; Mtebe & Raisamo,2014	Course content having less quality in terms of interactivity.
39.Engaging Students Online	Ali,2004; Lester & Perini,2010; Guy,2012	Faculty facing difficulty in engaging students online.
40.Pedagogical model	Burge & Lenksyj,1990; Andersson,2008; Kwofie & Henten,2011; Bozkaya & Kumtepe,2012; Ngimwa & Wilson,2012; Parrish et al.,2012; Pegrum et al.,2013; Güllü, et al.,2016; Govender & Chitanana,2016	Use of instructor/learner centred approach in teaching.
41.Localization of content	Pagram & Pagram,2006; Hylén,2006; Andersson,2008	Lack of Customisation/Adaptability of course content according to local culture, language and religious beliefs.
42.Flexibility in delivery mode	Gibson & Graff,1992; Andersson,2008	Lack of student empowerment concerning the decisions related to taking exam, selection of medium of content delivery, etc.
43.Course content	Kelly,1990; Saadé,2003; Ivergård & Hunt,2005; Inglis,2007; Voogt,2009; Lester & Perini,2010; Kwofie & Henten,2011; Ozudogru & Hismanoglu,2016	Lack of relevance, accuracy of course content and misalignment of course content with future employers' need.
44.Faculty Training	Trippe,2002; Kosak, et al.,2004; Muir-Herzig,2004; Keramidas et al.,2007; Gulati,2008; Eliason & Holmes,2010; Ray,2009; Kipsoi et al.,2012	Lack of teaching material and courses for teachers in the fields of learning technology.
45.Lack of Credibility	Gudanescu,2010; Kwofie & Henten,2011	Less likely to hire someone with a TBL certificate unless provided by an accredited institution.
46.Additional time needed to communicate with students	Arabasz et al.,2003	Increased communication time principally on e-mail.
47.Insufficient computers	Mokhtar,2005; Park & Son,2009; Radijeng,2010; Tedre et al.,2010; Nagunwa & Lwoga,2012; Nwabufo et al.,2013; Qureshi et al.,2012	Few computers available as compared to the number of students.
48.IT skills of Faculty members	Hackley,1997; Levy,2003; Darabi et al.,2006; Lopes,2007; Gulati,2008; Iqbal & Ahmad,2010;	Weak IT skills of faculty members.

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	Radijeng,2010; Nawaz & Khan,2012; Webster et al.,2014	
49.Hard to access digital libraries	Berryman,2004; Sana & Mariam,2013	Problems faced in having access to digital libraries.
50.Cost of multimedia learning materials	Sambrook,2003; Attwell,2004; Elloumi,2004	Cost of producing high quality multimedia learning materials.
51.Mode of delivery	Gibson & Graff,1992; Saadé,2003	Barriers related to mode of delivery selected for E learning.
52.Weak Learning Management System	Timmerman & Kruepke,2006; Pratas & Marques,2012; Güllü, et al.,2016	Learning management systems lack interactivity and have vague features.
53.Reliability of online measuring instrument	Inglis,2007; van't Hooft,2008; Oh & Park,2009; Arnold,2014	Lack of reliability of online assessment process.
54.Lack of top-level commitment	Tusubira & Mulira,2004; Shaikh,2009; Marshall,2010; Ocak,2011	Insufficient support from top-level management.
55.Material accessibility	Roy & Raymond,2005	Reach of student to material.
56.Pre-course orientation	Frank, Kurtz, & Levin,2002; Ashby,2004	Lack of Pre course orientation sessions by instructor.
57.Tutor support counselling sessions	Ashby,2004	Lack of support/counselling sessions conducted by instructor.
58.Absence of real-time feedback	Davie & Wells,1991; Arbaugh,2002; Thurmond et al.,2002; Kim et al.,2005	Students lacking immediate/prompt response from instructors to get answer of the query.
59.Less focus on technical requirements of Content	Kay,2006; Alvan et al.,2013	Technical requirements of course content available online (e.g. size of web pages, font, colours, quality of images) are not met.
60.Faculty's acceptance of e-learning technologies	Weaver et al.,2008; Teo,2011; Ocak,2011; Parrish et al.,2012	Teachers' lacking Technology Acceptance.
61.Level of knowledge of teacher	Sharma,2003; van Leusen & Millard,2013; Marzilli, et al.,2014; Dogan,2015	Teachers lacking grip on course content while delivering an e-learning session.

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Table 4: Barriers in literature related to E-learning: Enabling Conditions

BARRIERS	AUTHOR	DESCRIPTION
62.Administrative support	Garrison & Kanuka,2004; De Freitas & Oliver,2005; Sife et al.,2007; Boezerooij et al.,2007; Cook et al.,2007; Holt & Challis,2007; Inglis,2007; Weaver et al.,2008; Jara & Mellar,2009; Czerniewicz & Brown,2009; Ocak,2011; Mahmoodi-Shahrebabaki,2014; Gutiérrez-Santiuste & Gallego-Arrufat,2016	Lack of administrative support in crafting e-learning related policies, incentives and resources. Institutional policy and organisational culture are crucial to the way e-learning is adopted or embedded in universities.
63.Setup Cost/Limited Funds	Timmerman & Kruepke,2006; Selim,2007; Sife et al.,2007; Sun & Cheng,2007; Andersson & Grönlund,2009; Liu et al.,2009; Kukulska-Hulme,2009; Gudanescu,2010; Tedre et al.,2010; Kwofie & Henten,2011; Kipsoi et al.,2012; Callinan,2014; Marzilli, et al.,2014; Dogan,2015	High cost of setting up the e-learning system and unavailability of low-cost ICT alternatives.
64.Security	Brown & Snow,1999; Ong et al.,2004; Cárdenas & Sánchez,2005; Sharples et al.,2005; Aïmeur et al.,2007; van't Hooft,2008; Pachler et al.,2009; Stahl et al.,2009; Gudanescu,2010; Traxler,2010; Veeramani,2010; Mircea & Andreescu,2011; Zamzuri et al.,2011; Bryer & Chen,2012; Levy et al.,2013; Saxena & Yadav,2013; Yang et al.,2013	Openness of e-learning systems challenging security of personal information of students/staff/faculty.
65.Language Barrier	Sharma,2003; Ali,2004; McCausland,2005	Lack of conversion of e-learning content in other languages.
66.Rules and regulation	Valcke,2004; Traina et al.,2005; Selwyn,2007; Andersson & Grönlund,2009; Kwofie & Henten,2011; Güllü, et al.,2016	Surety that all relevant laws are taken into consideration while crafting policies related to e-learning to prevent government regulations. Limitations in national and institutional policies and management practices.
67.Load shedding of electricity	Pedrelli,2001; Hussain,2007; Sangi,2008; Voogt,2009; Nagunwa & Lwoga,2012; Sana & Mariam,2013; Nwabufo et al.,2013	Problems related to Power cuts, power fluctuations and Power distribution while having e-learning experiencing.
68.Ethical barriers	Olt,2002; Scanlon,2003; Baruchson-Arbib & Yaari,2004; Foulger et al.,2009; Pachler et al.,2009; Staats et al.,2009; Stahl et al.,2009; Bozkaya & Kumtepe,2012; Esposito,2012; Bryer & Chen,2012; Sana & Mariam,2013; Levy et al.,2013; Pegrum et al.,2013; Egi et al.,2014; Bhat & Shetty,2015; Muhammad et al.,2015	Lack of written permission from participants and absence of maintaining confidentiality by the e-learning services providers.

PROPOSED TIPEC FRAMEWORK

The majority of existing research (see tables 1-4) focuses on specific barriers and/or considers barriers from a fine focus (e.g. concerning teachers/students/administrator perspectives). Although this focus is crucial to managing systems development and research experimentation, stakeholders need to maintain a contextual awareness of how activity fits in context of general literature. A combined multi-dimensional framework, incorporating all e-learning implementation success barriers, is needed to help practitioners and researchers contextualize their current/future activities.

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The most extensive summary of e-learning barriers (to date) was presented by Andersson and Grönlund(2009), which considered 60 articles related to the area of e-learning barriers, and divided barriers thematically into four conceptual categories: Technological, Course related, Individual, and Context related issues. Although many of our 259 papers fitted within the Andersson and Grönlund framework, numerous did not fit into any of the defined categories. Accordingly, the TIPEC framework was proposed, to facilitate the structuring of all e-learning barrier research into Technological, Individual, Pedagogical barriers and Enabling conceptual categories (see figure 1).

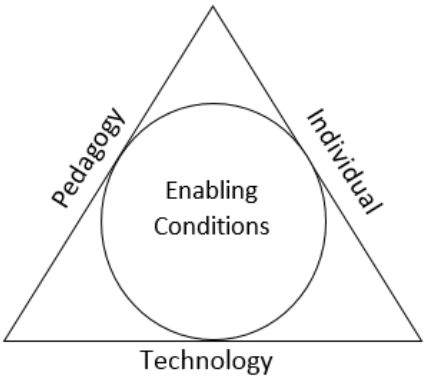

Figure 1. TIPEC framework – Structuring Technological, Individual, Pedagogical barriers and Enabling Conditions.

The 'Technological' category, in the Andersson and Grönlund (2009) framework, contained four barriers, i.e. Access, Cost, Software and Interface Design, and Localisation. Our review identified seven barriers that related specifically to Technology: Technology Infrastructure, Technical Support, Bandwith and Connectivity Issue, Software and Interface Desgin, Compatible Technology, Poor Quality of Computers, and Virus attack. Although unique barrier names were revised, to adapt for changes in type and use of education technology, definition and inclusion of a 'Technology' conceptual category (barriers relating to technology concepts and components within the E learning system) was deemed to be of value – see Table 1 for full details concerning barriers 1 – 7.

Andersson and Grönlund mentioned twelve barriers relating to the individual; with 8 barriers relating directly to the student, i.e. Motivation, Conflicting priorities, Economy, Academic confidence, Technological confidence, Social support (support from home and employers), Gender and Age. Teacher related barriers found by Andersson and Grönlund(2009), i.e.

Technological Confidence, Motivation and Commitment, Qualification and Competence and Time, were placed within the Pedagogy category of our proposed model, which means that only 8 individual student focused barriers remained. The authors, however, identified many additional individual barriers (with scope of individual barriers restricted to student related barriers) including: Prior Knowledge, Computer Anxiety, Social Loafing, Awareness and Attitude Towards ICT, Student's Support, Student's Individual Culture, Computer Literacy. In total the proposed TIPEC framework contained twenty-six unique barriers relating to the individual student – see Table 2 for full details concerning barriers 8 – 33.

Andersson and Grönlund's 'Course related issues' framework category included: Curriculum, Pedagogical Model, Subject Content, Teaching and Learning Activities, Localisation, Flexibility, Support provided for students, and Support provided for faculty. Course related issues, as a category, did not however facilitate consideration of all unique barriers highlighted in our literature review. Accordingly, we proposed the use of the term 'Pedagogy' as an umbrella concept; encapsulating both teaching methodology and faculty/staff related barriers. Although our Pedagogy category (concerning barriers related to teaching methodology, faculty, supporting staff, and course content) included Andersson & Grönlund's 'course related issues', it also amalgamates twenty additional barriers identified from our review – see Table 3 for full details concerning barriers 34 – 61.

Interestingly some unique barriers were identified that do not relate to any category discussed within the Andersson and Grönlund framework. It was noted that these barriers do not fit within any single category, yet instead support multiple categories, e.g. administrative support. As a result a new central category, entitled 'Enabling Conditions', was added for barriers that impact all three other specific dimensions (see figure 1). Enabling Conditions(barriers that have an overall impact on multiple T/I/P categories) include: Administrative support, Limited funds, Security, Rules and regulation, Language Barrier, Load shedding of electricity and Ethical issues - see Table 4 for full details concerning barriers 62 – 68. In the TIPEC framework 'Cost' is considered under the title 'Limited funds' within the Enabling Conditions category. Figure 2 presents the TIPEC framework, which acts as a conceptual framework consolidating research; helping researchers and practitioners contxtualise their research, and understand the interplay between implementation success barriers.

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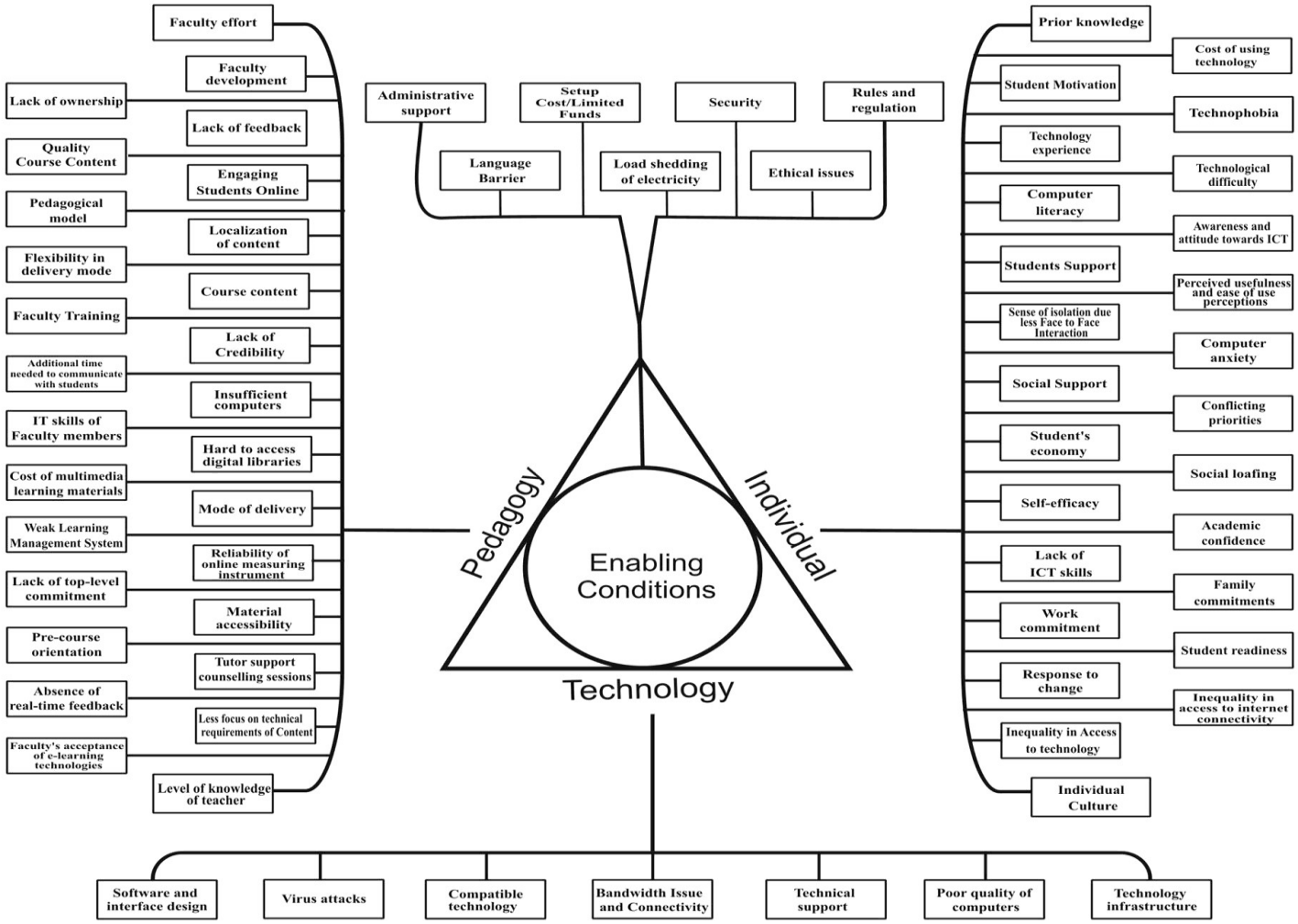

Figure 2. 68 barriers in TIPEC framework (Technology, Individual, Pedagogical, and Enabling Conditions)

CONCLUSION

Literature concerning the e-learning systems implementation success is extensive, however to date no framework effectively consolidates literature concerning the interplay of e-learning system implementation barriers. The proposed TIPEC framework aims to structure literature concerning e-learning implementation barriers, by undertaking an in-depth qualitative review of e-learning literature; dated between 1990 to 2016. By aligning the findings of 259 articles, from multiple learning domains (i.e. higher education, vocational training, and corporate training), the authors identify 68 unique e-learning implementation barriers; categorized using four TIPEC concept categories (i.e. Technology, Individual, Pedagogical, and Enabling Conditions) adapted and extended from the work of Andersson and Grönlund (2009). Accordingly, the TIPEC framework is proposed to help contextualize current domain activity and support key education stakeholders better understand the barriers that impact e-learning implementation success.

Although considerable effort was made to include a wide range of articles, the authors do not claim the TIPEC framework to be 'static', 'finished' and/or 'exhaustive'. The TIPEC framework is based on qualitative analysis of validated literature, so the authors appreciate a need, over time, to quantitatively evaluate, and systematically adapt, TIPEC structures; i.e. to highlight new factors and/or propose changes between factors. Whilst developing the TIPEC framework the authors noted a shift in the literature away from a focus on technological barriers, towards a wider range of TIPEC dimensions. If updated regularly, or personalised within a specific learning domain, identified changes will help stakeholder understand variation in the importance of implementation barriers as a result of changes in education technology/infrastructure/government policy etc. The authors, suggest development of a practical questionnaire, to support quantitative evaluation of the TIPEC framework; i.e. to help stakeholders consider and explore how barriers are contextually relevant. The authors suggest that, over a range of studies, multiple statements should be tested for each barrier, to ensure that only statements that effectively cross-load are used in the final practical questionnaire; supporting identification of issues within both e-learning systems implementation and reengineering.

Much additional work is required to maximize the practical application of the TIPEC framework, however identification of the unique 68 barriers, and the structuring of these barriers in T/I/P/EC

Information Technology & People

(Technology, Individual, Pedagogy & Enabling Conditions) categories, aids education stakeholders by highlighting current critical e-learning barriers. The framework helps in highlighting implementation success barriers, from both academic and commercial e-learning studies, and acts as a conceptual framework consolidating identified research (to date); allowing researchers and practitioners to appreciate the interplay of implementation success barriers.

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