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The Necessity for Developing Higher Educational Institutions to Infuse Technology in Learning and Teaching

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Abstract: The world is witnessing tremendous and rapid technological development, making modern technology indispensable in life. The infusion of technologies into the educational practice has significantly improved and modernised established educational systems. The quest to ascertain whether the infusion is a necessity is considered. This paper, therefore, sought to review whether developing HEI needs to infuse technology in learning and teaching. Thus, the Technological Pedagogical Content Knowledge (TPACK) framework will be adopted to support and strengthen this review paper. TPACK was adopted for this article because of the need to enhance content knowledge. The framework is a recommendation for 21st-century learning to develop technological and digital literacy. Learning is directed at technology utilisation to increase the effectiveness and quality of education. This contributed to the successful infusion of technology with content. The theoretical framework for this study and materials were sourced from journals, websites, and other academic materials. The present study also explores the policy, benefits, and barriers involved in the infusion of technologies in developing HEIs. A systematic approach was applied in the methodology for this study through sources such as e-journals, peer-reviewed books, google scholar, and other resource articles. The gap this study sought to fill centred on the influence, effectiveness, and barriers associated with the infusion of technology to developing HEIs in learning and teaching for positive educational outcomes. Hence, this paper recommends resolving the obstacles encountered in the infusion of technology in learning and teaching. Suggestions for future research will be centred on the infusion and implementation of information technology in the curriculum of the HEIs.

Keywords: Academia, Education Delivery, Higher Educational Institutions (HEIs), Learning and Teaching

1. Introduction

The appropriate infusion technology has aided technological advancement in the twenty-first century. Technology is a potent instrument that welcomes infusion and transformation to learning and teaching and is the only way to enhance the quality of our education in HEI. The infusion technology in learning and teaching incorporates adopting technologies for actualising meaningful results. Education is regarded as a process of interaction and interpersonal communication. The considerations related to these constructs greatly influence the educators' approach to technology-assisted teaching, which has an informative and instructional focus. Meaningful learning and teaching require tasks that conform to teaching strategies and outcomes without neglecting the learner's prior competencies, knowledge, and technologies.

A significant consideration for learning and teaching with technologies should be premised on the accomplishment of meaningful learning and teaching by interrogating learning strategies, asking pedagogical questions, and assessing available technologies to support this end [3]. Thus, technology is indistinguishable in well-structured learning and teaching environments because students are less concerned about the required tools for accomplishing tasks. Instead, they are more focused on the task at hand. Hence, emphasis must be placed on technology-aided teaching, although technology-aided learning often involves learning about technology. Consequently, the utilisation of technology always produced groundbreaking learning results. However, learning with technology is often confused with learning about technology or learning technology instead of focusing on the technical features of these tools and their significant effects. The focus is on devices or tools that generate inefficient transformative learning outcomes [12]. On

this premise, this study's systematic review of the uncertainty towards developing Higher Education institutions to infuse technology in learning and teaching.

2. Aim of Study

This study aims to review if is it necessary for developing Higher Education institutions to infuse technology in learning and teaching.

3. Problem Statement

This study reviews the necessity to enforce the infusion of technology in developing higher education institutions (HEIs). Further, scholars' empirical literature had been observed, and their studies focused on the reasons influencing the adoption and infusion of technology in various divisions of the developed HEIs [29]. Technology is fruitful and manages to drive change in HEIs [5]. However, developing HEI find it challenging to cope with infusion technology due to the lack of necessary resources [18].

The research gap in this study was prompted because of the institutional and individual factors that negatively affect the proper infusion of technology in HEI. Also, few studies have been conducted concerning infusion technology in developing HEI. Furthermore, to address the gap in this study, the HEIs must recognise what drives the infusion of technology among lecturers and learners in developing HEIs, their limitations concerning rigorous research, and accessibility challenges to technological utilisation in many developing HEIs To back up the research gap, the Technological Pedagogical Content Knowledge (TPACK) framework [29], was adopted to strengthen and encourages the infusion of technological contents with pedagogical knowledge into learning and teaching settings.

4. The Theoretical Framework for the Study

Education must be based on knowledge of how students are best educated and developed. The technological Pedagogical Content Knowledge (TPACK) framework is adopted to support this review article. TPACK drives infusing technologies for efficient pedagogy and eTools [25]. Despite these bottlenecks, applications of TPACK in technology-aided learning in developing HEIs are evident in research, learning and teaching practices, collaborative efforts and community engagement. Furthermore, applications of TPACK have been demonstrated in management, curriculum assessment, special education programmes and in the learning and teaching of language arts methods [34]. who examined the development of TPACK. The advent of TPACK in developing HEIs stems from the need to enhance content instruction. Hence, the utilisation of TPACK gave rise to the infusion of technology with content under five primary considerations, namely: (a) The need to align technology with content but not yet incorporating technology into the content of teaching, (b) The acceptance of technology in the teaching of specific content (c) The adoption of technology in enhancing the teaching of a content area (d) The actual implementation of infusing technology into teaching (e) The evaluation of results from instructional technology integration efforts.

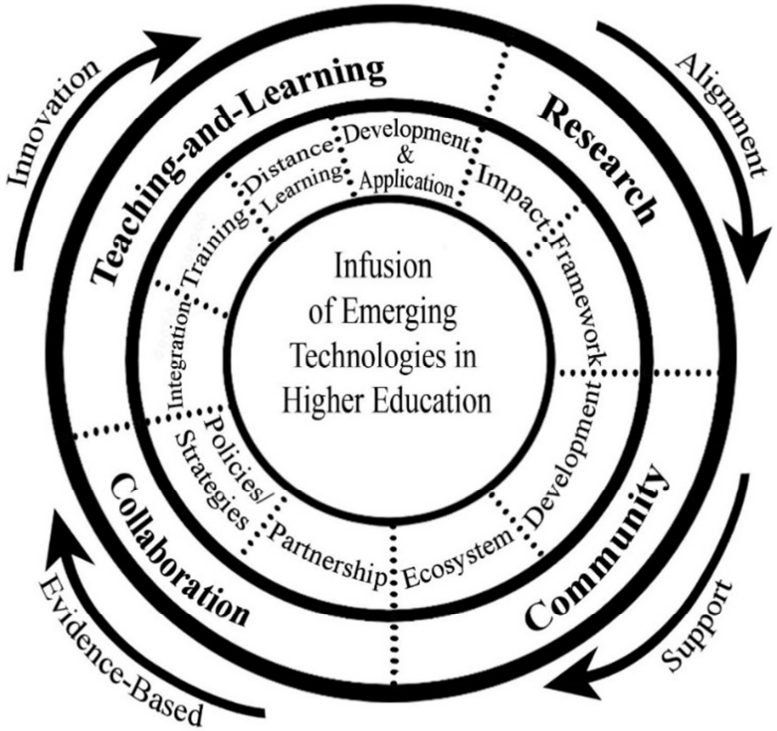

Figure 1. *TPACK as a contextual framework in the actualisation of technologically-aided learning and teaching in HEI settings (Stoltenkamp, 2014).*

Additionally, it is imperative to assess how the infusion of technology influences chosen vocations to develop learning and teaching in developing HEIs [25]. The influence of TPACK as a contextual framework in actualising technologically-aided learning and teaching in developing HEI settings is further explained in Figure 1. Furthermore, TPACK encourages technological initiatives through e-learning while harnessing the official activities of lecturers with growing student numbers.

TPACK assertion was supported by Centre Innovation in Education and Communication Technologies, which was established to drive emerging technologies to apply eTools effectively and epedagogy [25], through their influence in promoting e-education through technology [39], which was borne out of the need to ease the challenges faced by students in developing HEIs [51]. Furthermore, students who study through technologically aided learning courses were discovered to have much higher pass rates in their classes [51]. As depicted in Figure 1, it is reasonable for developing HEIs to widen their access to learning opportunities via flexible and innovative technological practices [51]. Furthermore, applications of TPACK are indicative of approaches and processes associated with learning, teaching, research, community engagement, and collaboration.

5. Literature Review

Developing HEIs worldwide has shifted from discussing digital information technology skills to infusion of technology, which are now globally accepted as a primary requirement for students in developing HEIs [16]. It is also essential to state that some developing HEIs, such as Nigeria and South Africa (to mention a few), have experienced accessibility challenges in using technology in learning and teaching [13]. Nevertheless, although technology is a fundamental component in ICT literacy, students must be competent enough to optimally utilise technology in their academic pursuits and ultimately become producers of technologically-aided resources, not merely consuming online content. Hence, technology is a form of technology literacy in creating, planning, and designing students' academic, personal, and future career prospects in developing HEIs [4].

Conversely, It is imperative for learners and lecturers in developing HEIs to infuse technology consciousness across various platforms [29]. Several scholars have assessed the utilisation of infusing technology in learning and teaching [6], while other scholars have focused on the infusion of technology comparability to the traditional method in learning and teaching in specific formats, such as editing and filming with smartphones [18]; visual arts design [35]; blogging [11]; wikis [43]; video production and editing [7]; music-making [24], as well as technology-aided storytelling [3]. Additionally, developing HEIs in the Province of the Eastern Cape are beginning to embrace the infusion of technology in learning and teaching [48]. These institutions include Walter Sisulu University, and the University of Fort Hare, just to mention a few. However, there is still a lot to be done by the developing HEIs, as discussed above, to adopt technology-aided practices for learning and teaching entirely.

Several studies have elucidated the infusion of technology in learning and teaching. For instance, there is the need for developing HEIs to infuse and reconceptualise technology practices, such as infusion of technology in their technology tools for academic work, social activities, communication, etc., further stated the infusion will assist the students in developing HEIs get information for their academic career through smartphones or mobile technologies, instant messaging, WhatsApp, Facebook, etc. Additionally, the use of social media has widened the potential and prospects for infusing technologies to enhance learning and teaching practices [24]. Also, facebook for engagement purposes between lecturers and their students at the University of Capetown [29], while the utilisation of social interaction among University of South Africa (UNISA) distance learning students have been assessed through their use of South Africa's mobile chat platform called Mxit [50].

Furthermore, [the infusion technology tools for authentic learning have been experimented [50]. Also, facebook has been utilized in the mediation of studio-centred knowledge among employees at the Cape Peninsula University of Technology (CPUT) [30], as well as the use of mobile phones in the learning and teaching of mathematics for students who had repeatedly failed the course [8]. Also, scholars have examined the utilisation of WhatsApp among the University of the Free State (UFS) students for enhancing learning [5], while other researchers have evaluated the usage of WhatsApp for the improvement of seamless learning [40]. The case mentioned above illustrates the enhancement of knowledge practices through the infusion of technology by the students for academic, communication and socialisation purposes. Hence, the notion that technology has enhanced the speed, effectiveness and scale of learning and teaching processes since the 1980s is a fact and not just an opinion. Thus, technology is sine-qua-non for rapid and productive results in academic and administrative operations of learning and teaching in developing HEIs. According to [20], their infused technology enhances every aspect of developing HEIs in administration, admissions, extra-curricular activities, housing, and other officials/ social activities. In addition, the efficiency of operations regarding student unionism, stadium or financial aid office, as well as from shopping to recreation and in the halls of residence, have been harnessed with an infusion of technology. Hence, it is a fact that infused technology has culminated in unrivalled achievements in qualitative learning and teaching (L&T) in the operations of developing HEIs.

In contrast, some academics are opposed to using infused technology in L&T and have disputed that infusion technology is not beneficial or necessary. Other opponents have insisted, correctly, that curricular revision in the name of infusion technology may well be counter-productive. Faculty proponents of infusion technology note the real

problem is faculty are generally not prepared to accept the challenges forced upon them by technology [22]. Although administrators and faculty boast infusion technology is contributing to instructional effectiveness and transforming learning, in reality, the surface is still being scratched. Revision is slow for all of the visibility and "talk" of instructional change. This slow adaptation in learning and teaching raises three questions [14]. Is it essential to infuse technology into the curriculum? What are the barriers inhibiting the infusion process? Are there successful models of infusion technology?

It is important to note initially that infusion technology instruction is not always preferred over time-tested methods such as a lecture. When a presenter has renowned subject-matter expertise, is the description of personal experiences, or is sharing relevant subjective information, the lecture method may be the most effective means to facilitate learning. However, one problem associated with this traditional teaching style (e.g. lectures) is that the individual students are treated alike, even though the student body is diverse [36]. Even the time-honoured tradition of lecturing can be enhanced through several infusion techniques such as videotaping and previewing before class [44]. Infused technology in L&T may not be vital in all classes, but it largely enhances it. Thus, infused technology aids L&T by providing pertinent demonstrations and examples, increasing access, changing the L&T environments, increasing delivery flexibility, preparing students for employment, and ensuring that public demands for efficiency are met. While infusion technology may not be necessary for every lecture room, the reason for infusion is clear. According to Tularam, G. A. [50], one of the major ways to give better value to developing HEI students is by infusing technology into learning and teaching. That value is recognised through the enabling of L&T. When considered in conjunction with curriculum design, and technology can increase student cooperation, faculty expectations, student-faculty contact, collaboration, active learning, diversity and prompt feedback. Vicarious learning, which can take place in a non-intrusive way through case studies utilising video clips, is often less "artificial" than injecting live observers into clinical settings. "Scaffolded" text links directly to a wide range of "just-in-time" tutoring prompt and greatly enhances comprehension. To be able to go to specific video clips, a thesaurus, a dictionary, and parallel quotes from other sources while reading Shakespeare immensely augments both appreciation and comprehension. While it may be true nothing can replace the human touch, it also may be true that nothing can replace the timeliness and situation-specific appropriateness of tutoring and virtual learning experiences provided through technology. Whether such instructional enhancements are necessary may be debatable, but their enhancement value is clear. Another way to examine the necessity of infusion technology in learning and teaching is to consider the need to modify the faculty's overall approach to teaching. One of the problems associated with the typical contemporary lecture room is that the curriculum is designed more for the teacher's teaching than for the student's learning. In the teacher-centred lecture room, a common scenario finds the teacher dispersing knowledge while multiple students are gathered for the intended purpose of knowledge collection. It is also expedient to state that the American curriculum remains teacher-centred because the U.S. system is wedded to the technologies of real-time teaching [14]. Another reason the system is teacher-oriented is institutions, and individual faculty have huge amounts of time and resources invested in the status quo. For example, faculty have ample time, learning, and experience invested in teacher-oriented approaches. Restructuring a student-centred infusion technology lecture room requires similar investments. One of the by-products of infusion technology is the decision to "re-engineer" courses causes faulty members to comprehensively re-evaluate the way they teach, from the objectives to the summative evaluation. The student-centred paradigm focuses on learning by the individual student, not the mass teaching of the faculty member. Technology can facilitate student-oriented instruction by causing the instructor to re-evaluate student needs and desired outcomes. The re-evaluation process cuts to the very core of the course. As students are broadly educated, they are simultaneously preparing for entrance into the workplace. It has been predicted that, by the year 2000, 95% of all employees will utilise the infusion of technology elements in their jobs' performance [41]. Graduates ill-prepared to utilize technology will find themselves at an extreme disadvantage when competing for available career employment opportunities [37]. The infusion of technology into courses provides modelling and application opportunities. Instruction must meet multiple learning needs and not simply add courses on top of courses in degree requirements. Infused technology is necessary to provide experiences simultaneous with content learning. In addition to modifying what is taught and how it is taught, technology can greatly change who is taught and when they are taught. One of the most debated uses of technology in distance education, the obvious advantage of which is access. Access allows students to learn where, when, and how they are most able. Technological delivery clearly can increase access and reduce location problems and time constraints. "With online classes, if students prefer to work in the wee hours of the night, they can access lectures and even a class discussion at any time. Access to academia and other students can be improved using e-mail and chat rooms. Access to review materials is increased because students can keep a written record of online lectures, discussions, and feedback. The utilisation of technology in academic curricula can expedite qualitative L&T by providing more pertinent learning prospects and changing the orientation of L&T to be student-centred, among many other benefits [42].

6. The Barriers to Infusion Technology

There are several tangible reasons why the infusion of technology into the lecture room has not occurred at an acceptable rate. Barriers to infusion can be divided into two

broad categories: organisational barriers and individual resistance. Organisational obstacles such as inflexible institutional culture and lack of skilled leadership can impede the positive results of infused technology in developing HEIs. Perhaps the most critical organisational barrier is the lack of adequate incentive for change. Incentives are needed if faculty are expected to value teaching and experiment with technology. Restructuring reward systems is essential to create incentives since developing HEI will likely place increased importance upon rewarded things. Generally speaking, the reward structure of most developing HEIs fails to recognise innovative and effective teaching in any form. When the incentive to improve teaching increases, the priority faculty assigns to teaching will increase. Exemplary teaching needs to be rewarded and valued. One component of exemplary performance should be modifying instructional approaches to meet the current needs of students. This greatest barrier is the lack of sufficient institutional recognition and reward for those who improve learning and teaching by infusing technology. Such changes will require visionary leadership and real partnerships between the administration and developing HEI. Technological literacy and the competency of faculty members are also key components when considering infusion technology into the curriculum. Developing HEIs must be able to utilise technological innovation themselves if an intended university outcome is to ensure students' technological competence. Universities and colleges have often made minimal commitments to systematically upgrading faculty competency [46]. The challenges associated with investing in technology equipment in South African HEIs because they relied on the government funding the sector. In addition, technologically literate academia is needed; many faculty admit they feel unqualified to utilise technology in the lecture room because they have received inadequate training [39]. Evidences supporting the notion that teachers feel inadequately trained to use the technologies [34]. The simultaneous lack of technical familiarity and competence contributes to the fear of using new technological advances in the lecture room [34]. The developing HEI must provide administrators and management with the necessary training to alleviate negative perceptions from a fear of the unknown. It is certainly true for more experienced academics with a greater long-term investment in "status quo" methodologies and who did not grow up with today's technology. Technology instruction requires institutions to re-direct significant resources to support the new delivery systems. On several accounts, this isn't easy for developing HEIs largely vested in face-to-face instruction. Perhaps this is why institutions that have been most active with technology-centred curricula face problems of distance, time, or space in meeting student needs, have propriety financial models, or have little invested in "bricks and mortar." When institutions are spending their limited resources to support status quo instruction, it is difficult for them to find funds to leverage change. Huge investments have been made over centuries to support contemporary instruction with buildings, faculty salaries, hard copy libraries, and physical plant staff. Finding resources to support the status quo and create change is problematic. Regarding individual resistance, many academics in developing HEIs still believe that the most effective form of education is "face-to-face" instruction. Still, research indicates infusion technology in learning is effective [23]. In many cases, instruction with technological infusion is more effective than conventional methods. However, even when faculty understand that infusion of technology is beneficial, they do not know "exactly what to do, where to start, or how to go about it. Developing HEI members who might benefit the most" from technology may be reluctant to adopt a new technology with which their students are more comfortable and knowledgeable than they are. Some developing HEIs are afraid to attempt new teaching styles [21] or to look foolish in front of their students [9]. Therefore, they resist departure from past methods and topics. This individual resistance is also increased exponentially by the previously noted institutional barriers of lack of incentives and previous investment in our status quo. Another source of individual resistance to the infusion is satisfaction. Re-engineering courses for infusion technology delivery forces academia to plan in extensive detail. Infusion Technological imposes "a discipline and organisational rigour on instructors that is not required in the looser structure of the conventional classroom [19]. Just as some faculty teach from the same notes they created 20 or 30 years ago, while others constantly refresh and renew their content, some faculty add new methodologies to their repertoire. In contrast, others are overcome by complacency and stick to a single delivery. When these sources of individual resistance are coupled with barriers, it is easy to understand why technology has not been infused into the learning and teaching process with sufficient dispatch. Nevertheless, there are growing numbers of success stories. Thus, despite barriers, there are also extensive opportunities. Individuals, institutions, and systems have produced exemplary projects, making it clear that infusion technology for student learning can occur, and the barriers can be overcome.

7. Prerequisites for Infusion Technology in Learning and Teaching (L&T) at Developing HEIs

Technology has conveyed development into a new era, which is fast becoming a trend and has impacted every aspect of human existence, including L&T, which is also affecting learning and teaching due to the expansion of knowledge and globalisation. The latest technology tools may noticeably contribute to all segments of educational practices. Technology must be infused into the education system to improve learning and teaching, especially in the teacher training curriculum. Infused technology in L&T incorporates techniques and resources, such as communication, collaborative work, remote instrumentation access, network-based data transmission/retrieval and internet-based research.

It is also important to note that a significant prerequisite for ensuring efficiency in infused technology in L&T in developing HEIs has to be routinary, seamless, effective, and successfully harness the visions and missions of the developing HEIs.

Even though infused technology in L&T in developing HEIs has enormously increased, the proficiency of many lecturers in developing HEIs in utilising them effectively in enhancing student learning has not. For example, over 75% of lecturers utilised technology for administrative purposes daily, over 40% used technology in monitoring student progress daily, 32% for instructional purposes, 37% for informational research, and 29% for educational preparation and planning.

Also, compatibility issues regarding technology tools have impeded the efficient delivery of infused technology in L&T in developing HEIs. As an explanation, it is worthy of note that the situation as caused by inconsistency in cultures or values on innovation and the needs of prospective beneficiaries. This problem is usually attributable to older academics who have a phobia of interacting with modern technology tools and prefer the chalk-and-talk system of L&T with their students [28]. Further, students and lecturers in disadvantaged HEIs are seemingly adjudged to be academically incompetent in their utilisation of modern technology either for L&T. It is on this premise that scholars elucidated the likelihood of a drastic decrease in the number of teaching staff necessary to interact with the students as one of the demerits to the successful implementation of infused-technology in L&T [34]. Thus, old academics who have adhered to such adverse outcomes could vehemently oppose the institutionalisation of technology in L&T, thereby obstructing the actualisation of transformation. In the same vein, a researcher highlighted some constraints to implementing infused technology in L&T in developing HEIs, including educational disparity, physical infrastructure, poor/high cost of internet connectivity and poverty [14]. Other adjudged bottlenecks include inexperience, inadequate infrastructure, and inhibiting the institutionalisation of infused technology from teaching staff in developing HEIs [23]. Hence, this article advocates offering technology as a compulsory course in developing HEIs. The infused technology in of L&T approach will grow techno-pedagogy to unimaginable heights [47, 15]. Likewise, it is reasonable for developing HEI administrators to carefully consider the necessary prerequisites for effective infused-technology in L&T initiatives in the development of academic curricula, during the conduct of examinations, and for the issuance of incentives for academic staff, as this will significantly enhance better working conditions and promote academic operations between teacher education curricula and the developing HEIs. Hence, it is expedient to have a mixture of technology and traditional pedagogy in L&T [31], and academic staff are encouraged to incorporate infusion of technology into L&T [49, 26] and improve on their skill of utilising technology to access information for academic development initiatives [1]. Therefore, developing HEIs must adopt innovative ideas and numerous approaches and create time for educational development. Students face many challenges in their utilisation of technology in the course of pursuing their academic careers. Thus, they require a lot of support and ditto for lecturers. Support for academic staff who create novel ideas with infused technology in L&T may be expedited through public recognition, promotions, training benefits, better salary packages, etc. Furthermore, research has shown that infused technology in L&T can advance students' learning outcomes when supported by quality instructions and good instructors [27]. Thus, the availability of specific and adequate technological tools with pedagogical skills should be the norm.

Infused technology on L&T promotes operational sustainability and efficiency and essentially grooms graduates for the numerous opportunities provided [51]. They can utilise them effectively to create opportunities and solve problems by the fourth industrial revolution (4IR) and beyond. Hence, infused technology in L&T must be adopted by all academic institutions as a veritable tool in community engagement, administration, innovation/ research, and the overall well-being of the citadels of higher learning. Further, technology can be utilised to create electronic platforms for administration, and vast amounts of information and services can be processed and provided, thus abolishing queueing [42]. Course materials can also be accessed; student assignments can be submitted electronically, assessed, and returned through the applicable learning management platforms. Also, intelligent lecture rooms can be facilitated through distance learning or online lectures delivered by foreign experts who participate in distance-based programmes and modules offered by various developing HEIs [32]. Courses can be electronically stored and listened to at the students' convenience. Laboratory projects and research findings can be expedited and shared through electronic devices, while voluminous data can be accessed and processed accordingly. Accessibility to e-journals and the internationalisation of academic collaboration can also be nurtured [5].

8. Policy Interventions Institutionalising Technology-Infused Learning and Teaching (L&T) in Developing HEIs

The need for infused technology in L&T to be backed up by national-recognised policies, guided by country-based research and experiences, is pertinent to achieving the desired results. Also, HEIs have no authority to promote country-wide infused technology in L&T practices without ratified national policy framework on technology utilisation in education [13]. Some developed economies, such as the British and Singaporeans, adopt well-structured technology-centred L&T policies, which can be referenced for providing quality leadership in this regard. It has been discovered without the support mentioned above that academic staff who chose to adopt infused technology in L&T have only done so of their free will. In contrast, many others who do not use the technology cannot be forced against their decision. Hence, it is recommended that academic staff be encouraged to adopt

infused technology in L&T through incentives as a veritable strategy for successfully actualising HEI development [3]. For example, promotion and pay rise are used as encouragement strategies for academics who utilise appropriate infused technology in L&T in Britain, Korea, Singapore and the Netherlands [17, 52].

It is necessary for developing HEIs to increase the level of infusion of technologies to support learning and teaching [45, 10]. Further, the government of Afghanistan's policy distributed laptop computers to all students in their developing HEIs to enhance infused technology in learning [51]. This initiative is essential in developing institutions mostly bedevilled with poverty, illiteracy, inequality, etc. In addition, there are a need to expand and diversify access, qualification structure, programs, and curricula articulated and developed for L&T students in the higher education system. The policy will also promote the development of an articulated flexible learning system with a design that improves the responsiveness of the developing HEIs to meet academic, economic, and social needs in the present and futuristic times.

9. Conclusion

Technology is forcing developmental changes in developing HEIs across the globe, which cannot be overemphasised, thus, the traditional teaching method needs to embrace new development of infusion technology that works and incorporate it in L&T as a supplement. The infusion of technology has resulted in incomparable developments in teaching, learning, research, administration, and decision-making, influencing all other endeavours in developing HEIs. Thus, traditional teaching methods are required to imbibe infused technology in L&T as a necessity. However, the infusion will require more than the establishment of competencies. On this note, If technology effectively enhances L&T in a systematised way, then the question is, “Why hasn’t it been well embraced?” The answer to this question is inadequate training programs that emphasise learning and a lack of adequate technical support to assist academic staff in integrating technology into their teaching content. Therefore, developing HEIs must be established to train academic staff and students to utilise technology and offer real-time technical support effectively. As a part of Infusion technology, a learning styles inventory must be administered to gather more information about the academic staff and students and their ability to function effectively, especially in the 4IR and global competitiveness. The combination of technical skills and applied learning theories will catapult the paradigm shift from "teaching" to "learning." This will give higher educational institutions a competitive edge in the new millennium.

The article was harnessed through a systematic literature review and strengthened with the TPACK theory. From the preceding, developing HEIs must initiate and carry out training programs and projects in L&T, as well as provide necessary technical support for the successful integration of technology in L&T. Therefore, developing HEIs must ensure capacity-building of their academic staff and students through specialised training in technology utilisation, as this will trigger a paradigm shift from "teaching" to "learning." Furthermore, to achieve success in infused technology in L&T, individual and institutional barriers should be combatted through organisational commitment, revised allocation of resources, provision of incentives, and training/retraining initiatives. Finally, a more in-depth investigation and understanding of each of the technologies and their combinations for effective L&T must be incorporated to reduce any uncertainties that may occur while infusing technology in L&T. This will concomitantly give developing HEIs a competitive advantage in this dispensation and the future.

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