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Integration of Information and Communication Technology in Pedagogy: A Systematic Review of Literature

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Abstract

This paper examines an effective integration of information and communication technology (ICT) in pedagogy in an educational setting. Presently, teaching-learning activities in higher education are becoming more complex and challenging. Therefore, knowledge of the content alone is insufficient to teach social sciences in higher education specified by the curriculum. The knowledge and skills of modern information and communication technology have become equally essential for a skilled teacher to have effective teaching and learning. This study aims to analyze teachers' perceptions of the importance of ICT integration in pedagogy at higher levels of education. Thus, this paper focuses on integrating information and communication technology in pedagogy. It is integral to education in many developing countries, including Nepal. The connotations of information and communication technology have been used variously in teaching. All the electronic materials including computer technology used in teaching-learning activities are considered information and communication technology (ICT). A systematic review of literature on 'Importance of ICT in education and 'Teacher's perception on the integration of ICT in pedagogy' with the theoretical base of content knowledge (CK), pedagogical knowledge (PK), and pedagogical and content knowledge (PCK) with ICT are the main bases of this study. Information was collected from the review of 14 articles published from 2013-2020 in English, which covers teachers' views and perceptions on integrating ICT in pedagogy. The findings indicate that teachers can inevitably use ICT to deliver content effectively and fulfil students' 21st-century ICT needs by integrating pedagogical content knowledge with ICT.

Key Words: higher education, ICT, pedagogy, perception, systematic review

Introduction

Information, communication, and technology (ICT) are integral to education in many developing countries like Nepal (Meenakshi, 2013). ICT are those technologies which are used for the collection, storing, processing, researching, transferring and unloading of information directed to teaching and learning activities; it includes all hardware and software, computers, the Internet, and electronic delivery systems such as radios,

televisions, and projectors surrounded by others, and is widely used as pedagogy in present periods (Speidel, 1995). ICT eliminates time barriers in the teaching-learning process. It also eliminates geographical barriers, as learners can log on from any place (Anderson et al., 2002).

Technologies are those things which enhance the way of living of human beings (Selwyn, 2011). Technologies are more significant than material things and artefacts, which help in activities. It is so on in every option that differentiates human beings from other animals. Technologies are discreet mechanisms of educational settings in a global context. All the devices with connecting Internet, i.e. laptop, computers, tablets, smartphones, a global positioning system (GPS), geographic information system (GIS), remote sensing (RS), virtual classes, smartboard, etc. and institutional uses of all implements in use in virtual courses, smart electronic boards are included in educational technologies. ICT is used in educational settings to support diverse activities to produce qualified human resources.

Education is a fundamental component of modern society. For educational change and reform, there is a need for the convenience of information-skilled instructors in an academic setting (Selwyn, 2013). ICT has not been considered only as a vehicle for teaching-learning activities but also a contributory resource for advancing designed goals. Digital technology plays a significant role in both informal and formal education (Pritchard, 2007). ICT provides innovative knowledge and skills differently from the students of the 20th century.

ICT empowers teachers in teaching techniques and pedagogy and provides easiness and broad knowledge to students. It helps to improve learners' achievements by providing significant knowledge (Meenakshi, 2013). In this digital age, ICT can provide 21st century skills to students through the ICT integrating pedagogy. It also helps teachers in the teaching process by overcoming obstacles and improve in classroom teaching (Ghavifekr et al., 2016). One of ICT's crucial roles is to create a self-learning environment for students (Masango, 2014).

There is a mainly increasing responsibility of academicians to fulfil the need of the modern and complex world. In this context, ICT-integrated pedagogy is inevitable in the education field (Lendis, 2014, Farren, 2005, & Ghavifekr et al., 2016). There is a deceptive relationship between education, economic development, and competitiveness. So policymaker in predominantly developing countries needs to take ICT as a crucial key to improving the educational quality for fulfilling the global demand for abundant technology worker (Yildiz, 2016). It accelerates student engagement, promotes self-motivated and collaborative learning, and enforces challenge-driven and human-centred learning (Alcardo et al., 2019).

In Nepal, the Ministry of Education prepared Master Plan on Information and Communication Technology in Education (2013-2017) by providing necessary ICT skills to students and improving classroom teaching-learning activities. This plan's primary focus is to effectively integrate ICT into teaching and learning across all education sub-sectors so that access to education will be expanded, the quality of education will be improved, and equity will be endorsed. The plan has also focused on ICT-based education in higher education. Still, due to a lack of a strategic plan, higher education has not integrated ICT into all social sciences subjects. In this context, the Faculty of Education (FOE) has established a Department of ICT under the guidance of mathematics education at Tribhuvan University. Furthermore, with the joint efforts of the Second Higher Education Project (SHEP) and the Norwegian Programme for Capacity Building in Higher Education and Research for Development (NORHED) under the Norwegian Agency for Development Cooperation (NORAD), the Faculty of Education have involved in the development of ICT infrastructure and skills in different colleges for integrating ICT in pedagogy (Rana & Rana, 2020).

Because the integration of ICT in pedagogy is still a crucial problem in Nepal, especially in social sciences at FOE, literature on the integration of ICT in pedagogies has given a higher pace to the developed countries and the scanty for the developing countries, like Nepal. But the differential situations of ICT application in pedagogy between developed and developing countries make it difficult to conclude the same basket because of the different conditions of use. Moreover, the literature has not explored ICT applications in education in developing countries (Teo et al., 2019). In this context, this study would have attempted to conduct a review to provide insight for academics of less developed countries like Nepal. Instead, this study aims to analyze teachers' perceptions of the importance of ICT integration in pedagogy at higher levels of education.

Methods

This study has been based on a systematic review of the uses of information and communication technology in teaching and learning activities. The articles have been selected purposively under this heading for review. Petticrew and Roberts (2008) have defined a systematic review as an interpretation of selected documents on a specific topic that optimally involves analysis, summarization, evaluation, and synthesis. A systematic literature review is associated with a brief performance of a range of documents on a particular topic that optimally involves summarizing, analyzing, evaluating, and synthesizing the documents. The advantage of a scientific review is that it produces a map of the bigger image (Mulrow, 1994). Therefore, it is essential to identify ICT's most widely recognized role in the classroom.

I developed the theoretical ideas about CK (content knowledge), PK (pedagogical knowledge), PCK (pedagogical content knowledge), and PCK with ICT to conceptualize

this systematic review. Due to access and quality, the search strategy mainly centered on Google Scholar and ProQuest databases. In addition to these databases, I manually searched the other journals, i.e. International Journal of Education and Information Studies, Educational technology and society, Journal of Research and Method in Education, and Educational Technology Research and Management, which are related to ICT and education. Keywords used in the literature search included "ICT", "ICT and Education", "ICT integration in the classroom", Teacher's perception regarding ICT integration in Teaching, and "Role of ICT in Education". Peer-reviewed journal articles and other empirically published documents in the English language were considered for the systematic review. Grey kinds of literature, repeated search results, opinion parts, letters, editorials, and papers that did not contain full texts were excluded. This study included research literature for review published between 2013 and 2020. Some databases did not provide any result that satisfied the review criteria. Based on these searches, the author recognized 504 possible relevant journal articles. By screening the titles and abstracts of the studies, exclusions were made if the studies did not meet the objectives of this review study. The author also scanned the whole paper in some cases due to the poor structure of the abstract. Lastly, this study included 14 studies for review. The review methodology is presented in figure 1.

Planning the Review

Step 1. Identify the objective of a systematic review.

Step 2. Developed theoretical ideas about CK, PK, PCK and PCK with ICT.

Step 3. Select keywords and databases.

Step 4. Search the databases mainly centred on Google scholar, ProQuest databases, journals i.e. International Journal of Education and Information Studies, Educational Technology and Society, Journal of Research and Method in Education, and Educational Technology Research and Management, among others, based on their relevancy to the research area. 504 search results.

Step 5. Review the title and abstract to eliminate documents for duplication, other languages besides English, and the non-education sector.

Step 6. An extensive review of documents to eliminate those that were not applied in this review criterion. Fourteen records were selected for the full review.

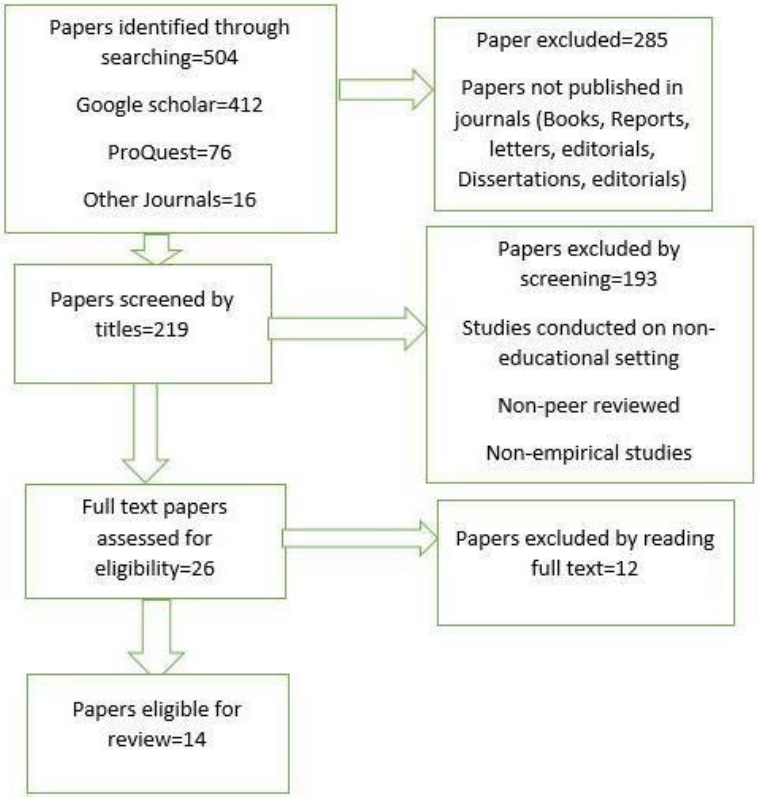
Step 7. Group the selected documents based on common themes.

Step 8. Review and report the key findings.

Figure 1

Systematic Review Methodology

An overall review process is presented below.



Results and Discussion

This review paper aims to describe ICT integration in the pedagogical field comprehensively. It provides both conceptual and theoretical bases for discussing the integration of ICT in classroom teaching-learning.

Importance of ICT in Pedagogy

The teacher needs both content knowledge (CK) and pedagogical content knowledge (PCK) to create an effective teaching-learning environment in the classroom. Social science teachers cannot fulfil the objectives of higher education just by knowing the subject matter. They also need knowledge of teaching and technology. Content knowledge (CK) provides the deepening of the subject matters that are designed in the curriculum. Pedagogical knowledge (PK) offers different techniques and methods of teaching, and the combination of CK and PK provides pedagogical content knowledge

(PCK) for creative teaching-learning. At present, knowledge of contents, pedagogy, and ICT are equally playing significant roles in achieving desired outcomes of teaching social sciences at a higher level. But developing countries like Nepal do not seem to be able to integrate content, pedagogy, and ICT. Due to this, the teaching of social sciences seems to be becoming dull and without any achievement. It is mainly due to the lack of ICT integration in the pedagogy of higher-level education. But in the 21st century, teachers failed to increase ICT skills equally necessary to curriculum design, classroom application, and measure the desired outcomes (Bhattacharjee & Deb, 2016; Kaiser, 2019; Suárez-Rodríguez et al., 2018).

In this paper, the term content knowledge (CK) includes the subject matter knowledge of any subject designed in the curriculum that a teacher delivers their teaching in the classroom. Pedagogical knowledge (PK) is instructional strategy and method essential to achieving desired outcomes. Pedagogical content knowledge (PCK) combines instructional practices with subject matter knowledge (CK and PK). Integration of ICT in pedagogy includes combining content knowledge, pedagogical content knowledge, and the application of ICT for pedagogical purposes.

The systematic review indicates that teaching history mainly followed content knowledge (CK), with increasing professional development and teachers' training programs changed into pedagogical knowledge (PK). Nowadays, the application of ICT in education seems more practical for achieving desired outcomes through classroom teaching. In the social sciences classroom, the integration of ICT with PCK plays a vital role in delivering subject matters, and it facilitates increasing students' participation in teaching-learning activities. The use of ICT in pedagogy improves education quality, and pupils now expect ICT as part of their learning in the 21 century. ICT eliminates the time and geographical barriers as learners can log on from any place. The findings show that ICT-integrated teaching strategies have increased learners' critical thinking, problem-solving, and decision-making skills.

This systematic review of the importance of ICT in pedagogy showed that the use of ICT in the pedagogical field is crucial and inevitable. It plays a vital role in teaching and learning by assessing teachers and students (Ghavifekr et al., 2016). The use of computers in school is crucial in the teaching-learning process. Using suitable software, computers could teach subjects like Maths, Science, Geography, Art, Physics, Biology, and other issues (Edward et al., 2013; Petticrew & Roberts, 2008). Many studies focused on the role of ICT tools in the teaching-learning process. The above review showed that ICT enhanced the learner's knowledge by providing essential technology skills, increasing motivation and engagement through teacher training, and improving the student centered teaching-learning pedagogy. On the other hand, it helps the teacher in presentation,

collaboration, interaction, drill and practice, and demonstration (Meenakshi, 2013; Teo et al., 2019; Wajszczyk, 2014).

All studies focused on ICT as a prominent tool for conducting adequate and relevant teaching and learning activities. ICT was essential for creating a shared knowledge domain (Lai et al., 2016; Masango, 2014). ICT in teaching provides positive changes in the teaching-learning process and the whole aspect of schools (Morris, 2012; Wajszczyk, 2014). Although some studies have also shown the challenges of ICT integration in pedagogy in schools and at higher levels, Bhattacharjee and Deb (2016) identified the thirty importance of ICT for 21st-century teacher education. They explored the importance of ICT in teaching-learning processes and teachers' professional carrier (Bhattacharjee & Deb, 2016; Hong, 2016; Willis et al., 2019).

The above extensive review provided evidence of the inevitability of ICT in the teaching and learning process for student centered and contemporary teaching strategies. ICT improves the quality of education through training for teachers, increased ICT equipment, and use in schools (Alcardo et al., 2019). ICT is relevant in the teaching-learning process in STEM. ICT integration education system improves motivation, increases learners' involvement, motivates self-regulated and collaborative learning, and enhances competitive and student-centered learning (Pritchard, 2007; Selwyn, 2011; Tinio, 2003). Technology-enabled participation of students in the broader sphere increases their learning opportunities (Magdalena et al., 2017; Wajszczyk, 2014). Teachers need to improve their teaching methodologies according to 21st century students' need for this administration to conduct training for teachers to apply innovative and technology-integrated pedagogy (Magdalena et al., 2017; Suárez-Rodríguez et al., 2018; Tokareva et al., 2019).

Teacher's Perception of the Integration of ICT in Pedagogy

This systematic review of teachers' perceptions regarding ICT integration in pedagogy provides extensive evidence in this literature. All works of literature provide teachers with positive beliefs and attitudes regarding ICT integration into teaching and learning. However, Mndzebele (2013b) disclosed a need for government support and teacher training facilities for technology integration in pedagogy (Mndzebele, 2013a; Teo et al., 2019). One study showed that other stakeholders, besides teachers were negligent in integrating ICT into education. Izmirli (2015) suggested that the government introduce Majoring in ICT as a teaching subject, increasing teachers' confidence in technology integration. This review paper indicated a need for government policy and strategy for implementing technology in the pedagogical field.

This study revealed that the teachers wanted to integrate ICT into pedagogy to fulfil the current needs to improving the student's knowledge. ICT-integrated pedagogy broadly

increases student participation and subject knowledge (Feon, 2021; Koh, 2019). A large percentage of the participant had positive perceptions of integrating technology into the school curriculum. Furthermore, most teachers were willing and capable of integrating technology with their existing curriculum (Singleton, 2017). This evidence shows teachers' keen interest in working with ICT in their classrooms. However, some participants in every study pointed to the hurdles to integrating technology due to the unavailability of infrastructures and negligence of the administration.

All the studies I reviewed revealed a positive relationship between teachers' perception and ICT integration in the teaching-learning process. Participants of all studies showed a keen interest in integrating technology into their pedagogy. So this review paper integrates the evidence which focuses on using technology in the teaching and learning process. In contrast, Ghanney and Mwinkaar (2019) found … negative perceptions of teachers integrating technology in pedagogy. Some teachers were unwilling to incorporate technology due to the inadequacy of computers and other ICT tools. Barley (2013) and (Douglass, 2020) recommended providing in-service training and the availability of infrastructures to increase the ICT integration in pedagogy. Most of the papers explored that the teachers are happy, proud, competitive, motivated, emotionally intelligent, and honorable to engage in pedagogical change. Several factors motivated teachers to adopt the new pedagogy, i.e. students, a well-organized administration, belongings, collegiality among peers, working with IT experts, novelty, the position of responsibility, and enjoying training and education (Schulleri, 2019).

By reviewing the above literature, this paper concluded that there is also emerging integration of ICT in the pedagogical field in the Nepalese higher-level education sector. By exploring the certainty of the knowledge of CK, PK, PCK, and integration of ICT in the pedagogical area as well as teacher's positive perception of it, this study suggests that there is a strong need to use ICT in the pedagogical field in Nepalese context to meet the 21st century of education. To improve the quality of teaching and to compete with the worldwide workforce, ICT integration is inevitable in the Nepalese higher-level context.

Conclusion

This paper concludes that in some subjects of social sciences, the integration of ICT in pedagogy began in 2000. FOE has also introduced this subject separately, but it still does not seem to be an integral part of the pedagogy of Faculty of Education. Although this Faculty has been emphasizing the use of ICT in all subjects, it does not seem to make a part of teaching social sciences in general. The importance of training in social science subjects is broad; ICT helps present the issue easily to the learners. Teachers use GIS< RS< GPS, social media, email, internet, zoom, teams, etc. But still, this technology is not reaching the general teachers. Teaching is effective only if teachers integrate knowledge

of the subject matters or content (CK), pedagogical knowledge (PK), and pedagogical content knowledge (PCK) with ICT. Therefore, this paper recommends that FOE and concerned departments organize professional development and refresher trainings to its faculties to enhance PCK with ICT at higher-level education in Nepal.

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