A Systematic literature Review of ICT in the Educational System of Iran

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Abstract

Although information and communication technology (ICT) is discussed in different aspects of education for a long time and numerous scholarly works have been published by Iranian researchers in Persian and English, but a study that illustrates the whole status of published works is not yet conducted. There is no reliable source to display the body of knowledge produced in this field. For this reason, it is necessary to investigate state of the art of ICT in educational system of Iran through a systematic review of scientific published papers. The present research aims in identifying, interpreting and describing the topics and approaches used by the Iranian authors to study ICT in the educational system of Iran. Achieving the identity or knowledge base of this field is performed with an descriptive-interpretive approach in order to perceive the status of technology application in the educational system of Iran. The research population includes all articles published in the journals of Education and ICT. In this regard, research articles in the field of ICT in the educational system in both Persian and English languages were searched in databases between 2001 and 2022. By using the systematic review method, a list of related keywords and concepts were searched in Persian and English databases which include related journals. After conducting the initial search and applying the inclusion criteria, 112 articles were included in the study. Finally, a detailed review and in-depth investigation was conducted by using qualitative content analysis. Based on the results of the analysis, four dimensions of ICT in the educational system were extracted: "Leadership", "Professional development", "Assessment", and "Teaching-learning process". Analyses shows that these dimensions are not considered evenly. Sub topics of these four areas as well as ignored areas are discussed. Also, future directions are proposed.

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1. Introduction and Statement of Problem

ICT, which stands for Information and Communication Technology, as an interdisciplinary subject is considered as a catalyst for change and is affecting every aspect of human life in this digital era (Shokeen et al., 2022). The impact of technology can be felt in every possible aspect of Education as well. Thanks to technology; education has gone from passive and reactive to interactive and aggressive, since it is equipped towards creating curiosity in the minds of students (Raja & Nagasubramani, 2018). In the present 'technology age', the traditional responsibility of students and educators, and the function of education itself, have drastically changed. In the field of education, teachers and students are affected by unprecedented developments that changed the world as a learning environment powered by tools. Considering that schools take the burden of educating individuals, the administration, should invest in technology, retool its teachers, and transform the physical environment into a learning environment that will develop the students' 21stcentury skills (Abd Ghofur, 2022, p. III).

The age of technology and the information society require educators to prepare students for future jobs which are highly dependent upon skills of how to function in a competitive and interactive technological workplace (Lemoine et al. 2020). In this age of technological development and digitalization in education, the accessibility of the digital tools and services is not the only requirement for students; however, the focus should be on equipping students with knowledge and skills to adequately navigate digitized reality for their benefit in life, and not to digitize education per se (European Council for Steiner Waldorf Education, 2022).

The application of ICT in education contributes to several outstanding benefits such as making students active learners, upgrading their literacy and numeracy, and increasing their learning motivation and interaction (Adi Suryani, 2010). The use of new technologies makes students learn based on their individual capabilities, collaboration with peer, and congruity between subjects. These factors can enhance students' social capabilities and their passion and motivation for learning (Azizi Nejad & Allah Karami, 2018). ICT Can also be used as a tool to improve the quality and efficiency of education by creating an active, inclusive and interactive learning environment, in which students can provide new ideas and apply them in attaining their educational objectives (Sheikhi & Haredashti, 2014).

The positive impact of technology is not merely limited to students, but also to all educational stakeholders, particularly the teaching staff. Fundamental problems in the quality of education can be solved by transferring knowledge more efficiently, typically using some form of information

technology by teachers (Ramsden, 2003, p. 108; Russell & Johnson). They can obtain the required information for setting an appropriate curriculum based on the number of courses and the days of attendance of teaching staff. Moreover, teacher can use new technologies and manage the class in an audiovisual way to increase the level of student learning, teaching more content and generally improving the quality and quantity of classes; they can also use internet to find the latest scientific achievements of research in the world and present them to students (Habib Gholam Shahzari, 2018). By covering all major teaching models plus the leadership of teaching, including planning, classroom management, assessment, motivation, and management of time and space, properly educated management helps future teachers master both the theory and application of successful teaching (Ramsden, 2003, p. 110).

Taking advantage of such benefits requires a strong congruity between education and rapid development of technology, since it is intensely changing the nature of teaching-learning process, school management process, professional development ways, and assessments alternatives. These massive changes are evident in distinguished teaching and learning methods, including "project-based learning, STEM/STEAM, blended learning, flipped classrooms, inquiry-based instruction, mobile learning (mLearning), TV-based interactive

learning (T-learning), microlearning, social learning, gamification, Tin Can and personalized learning, all feature as the latest buzzwords in the field of learning and development" (Cohen, Manion & Morrison, 2018, p. 607). All the mentioned keywords are indicative of the pervasive impact of technological advances upon the core activities of educational systems. ICT will, inevitably, influence the performance of students and other individuals involved in the process of education.

Among the most critical individuals involved in the application of technology are school leaders and teachers. It is necessary to hold different courses for preparing teachers and making them familiar with different dimensions of technology and their usage in classrooms. Hence, ICT tends to be regarded as an optional area of specialization in pre-service for teachers (Jacobsen & Friesen, 2002). Various motivational and incentive techniques can even be considered for teachers who use ICT in their teaching in order to promote this teaching method. For example, the most active and successful teachers can be identified and honored for their use of ICT. School leaders should prioritize preparing school infrastructures and equipping them with ICT, so that teachers can benefit from the facilities provided in the teaching process. Also, school principals are required to support teachers and to institutionalize the use of ICT in the teaching-learning process (AziziNejad & AllahKarami, 2018). Such

technology-based educational methods can in turn, motivate students and increase their achievement; specifically, students who are not eager to attend schools regularly.

Analyzing the dominant discourse and content of academic writings plays a central role in identifying the identity of a selected area, because "most pedagogically oriented efforts in the cultivation of academic identity are concerned with traditional genres such as academic essays, journal articles, or dissertations" (Flowerdew & Ho Wang, 2015). Scholar's academic writings provide a central framework for achieving the identity of their academic area. According to Flowerdew and Ho Wang (2015), making an appropriate relationship among different scholars in specific fields and finally providing a comprehensive identity requires an investigation of scholarly texts. Such texts can include several sources such as student papers, journal articles, dissertations and other text produced by practitioners or researchers. However, "despite the large proportion of staff dedicated to teaching-specific appointments, the perceptions of the academic identity of education-focused (or equivalent) academics appears to be under-researched (Flecknoe et al., 2017). Therefore, there is a need to shift from the evaluation of the performance of different technological and educational stakeholders, to the assessment of their textual contributions in order to find an academic identity of the particular field of ICT in education.

In this regard, a major question arises: What is the general state of ICT integration in the educational system of Iran based on the reviewed published articles? The Main objective of the present paper is to illustrate the general identity or state of ICT in the Iranian education, based on the published articles in this area. Since the knowledge base of every field of study consists of several scholarly works such as books, journal articles, papers, research reports, thesis and many other publications, research articles were solely selected for the purpose on the present work.

2. Methodology

We used a qualitative- interpretive approach for this research. According to research objective a systematic literature review was used. The research scope includes all Persian and English articles in the area of ICT in education. In order to obtain documents and scientific evidence related to the subject of the study, an electronic search was conducted in Persian and English published databases. The basic Persian databases (including Noormags, Civilica, Magiran, Elmnet, RICeST, SID and Ensani.ir) and related English database (including WoS, Scupos and google scholar) was searched.

A purposive sampling method was used to select the related research terms. Data gathering tool included a checklist of some major keyword in the selected area of research. The keywords were categorized into four categories such as, technological instruments,

technological terms and concepts, different styles of learning, and learning theories (table 1). The first category consisted some keywords like computer, internet, web, podcast, software, mobile, and audiovisual tools. The second category includes smartization and smart schools. The third category includes keywords of blended learning, web-based learning, distance learning, virtual learning, lifelong learning, and network learning. The final category consisted of connectivism and constructivism as two major contemporary learning theories.

Table 1- Categorization of search terms and keywords for systematic review

Categories	Keywords
Technological Instruments	Computer, internet, web, podcast, software, mobile, audiovisual tools
Technological Terms and Concepts	Smartization and smart schools, electronic test, electronic assessment, technology in education, electronic education and publication, Digital transformation in education, new technology in education.
Learning Styles	Blended learning, web-based learning, distance learning, virtual learning, lifelong learning, network learning, e-learning,
Learning Theories	Connectivism and constructivism

First, the studies conducted in the selected field of study were systematically examined, the period selected for document search was from 2001 to 2022. Among the total 293 articles, 112 related articles were elected.

In this study, articles were selected based on two inclusion and exclusion criteria. In the next step, the articles were chosen according to the main purpose of the research and using intuitive judgment. Hereby, the inclusion and exclusion criteria are as follows:

Inclusion Criteria

Systematic review is done transparently and explicitly. One of the features that creates this transparency is the precise inclusion and exclusion criteria, that is, the criteria that are eligible for the study and are considered for review (Holly, Salmond & Saimbert, 2012). Therefore, the inclusion criteria for selecting articles are:

- Articles that discussed the use of technology in education;

- Articles published in the period from 2001 to 2022;

- Articles published by Iranian scholars in both English and Persian languages;

- Articles with full text;

- Articles that are indexed in scientific-research journals;

- Research, case studies or reviews;

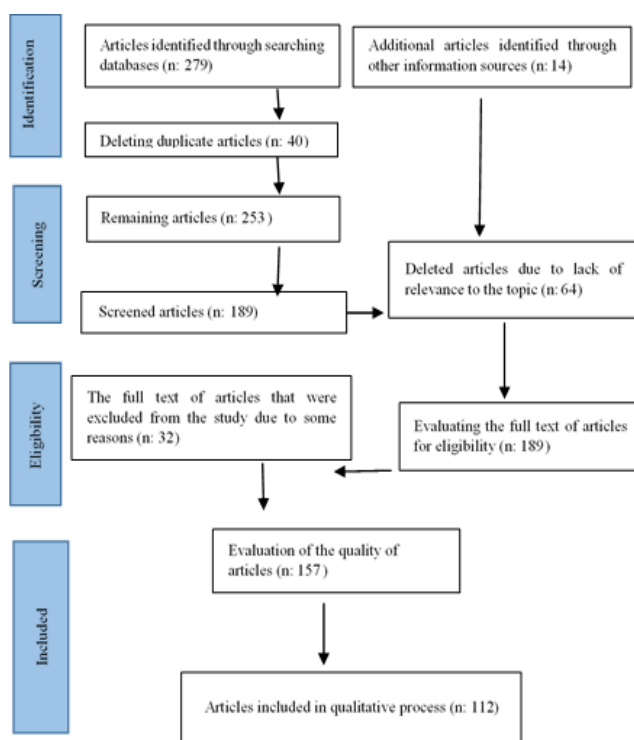- Articles that were available and downloadable in full text.

Diagram 1. Flow diagram of the Data Entry Stages for Systematic Review

Analyzing Content Method

We used three stage content method (open, axial and selected coding). Open codes are phrases which are extracted from the original articles text. Axial codes are fields of study that cover some related open codes. And selective codes act as an umbrella to cover some related axial codes. This way we can organize topics that have studies in selected papers.

3. Findings

According to Fig.1, four main areas have been identified as the dominant dimensions emphasized by researchers: Administration (9%), Assessment (11%), Professional development (17%), Teaching-learning process (63%). As fig. 2 illustrates, the volume of studies is not distributed evenly. Dimensions of administration, assessment and professional development lacks enough attention rather than teaching-learning process. The limited frequency of these dimensions is indicative of the fact that the dimensions of administration, assessment and professional

development and their sub-topics in the modern digital era has been ignored by Iranian researchers. In the case the all extracted dimensions are important in educational system, it is worth attention to investigate ICT use in those areas. For more details, ICT use in each of these four dimensions are discussed below.
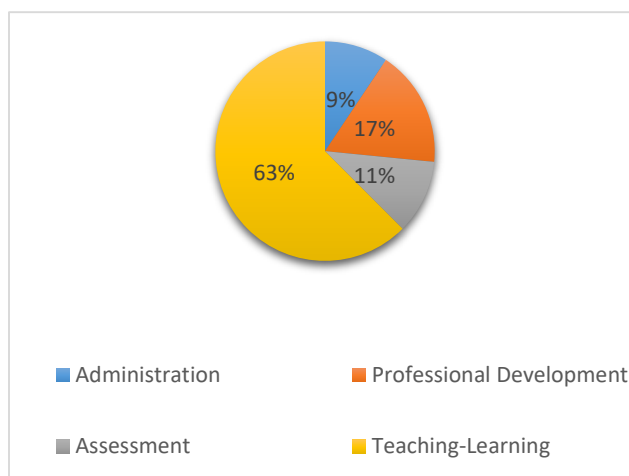

Fig. 2. Areas of ICT in the educational system of Iran according to published articles

3.1. Administration

According to table 2, Iranian researchers have studied sub topics as leadership skills, motivation, Recruiting and employing specialized human resources, and Development of technology infrastructure.

Table 2. Coding of researches of ICT in educational administration dimension

Selective Code	Axial Codes	Open Code	Article Code
Administration	Leadership skills	Effective school principal communication, establishing favorable human relations, management planning, leadership skills, developing teamwork and group work, existence of visionary managers, electronic leadership, transformational leadership style, the climate of participation and interaction, transformational management, thinking together with colleagues, organizational intelligence of school principals, individual characteristics, principal' information literacy	1- 7- 10- 19- 21- 26- 30- 31- 37- 43- 52- 69- 93- 98- 103- 110
	Motivation	Creating motivation in learning, students' motivating, creating passion for technology, interest in using technology, improving learners' interest, increasing motivation, paying attention to teachers'	1- 4- 8- 9- 14- 19- 32- 34- 37-

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		motivation in online education, making colleagues interested in online learning, creating motivation, motivation, creating and strengthening culture of using technology, persuading employees, persuading human workforce, encouraging the use of computers, encouraging the use of technology	48- 59- 62- 75- 81- 82- 92- 98- 102- 107
	Recruiting and employing specialized human resources	Employing expert human resources, human capacities, capable human resources, human resource skills, recruiting technology expert teachers, employing internet literate teachers, employing competent human resources, welcoming expert personnel in technology	7- 12- 23- 38- 61- 79- 83- 90- 93- 102- 106- 107
	Development of technology infrastructure	Investing in the expansion of technology infrastructure in schools, access to educational software, access to technology, equipping technological infrastructure, equipping schools, the existence of online libraries, smartization of schools, diverse learning resources, allocating technological facilities, improving the quality of facilities and equipment, using modern educational equipment, education and research facilities and equipment, creating a network between schools, creating a platform and providing infrastructure, suitable bandwidth, quality of Internet access, providing infrastructure, teachers' access to computers and technology, access to online resources, access to information resources, access to the content of teaching aids, access to computer and Internet	2- 7- 9- 10- 12- 14- 15- 20- 24- 25- 28- 29- 31- 35- 43- 49- 53- 56- 61- 65- 68- 70- 94- 96- 99- 109
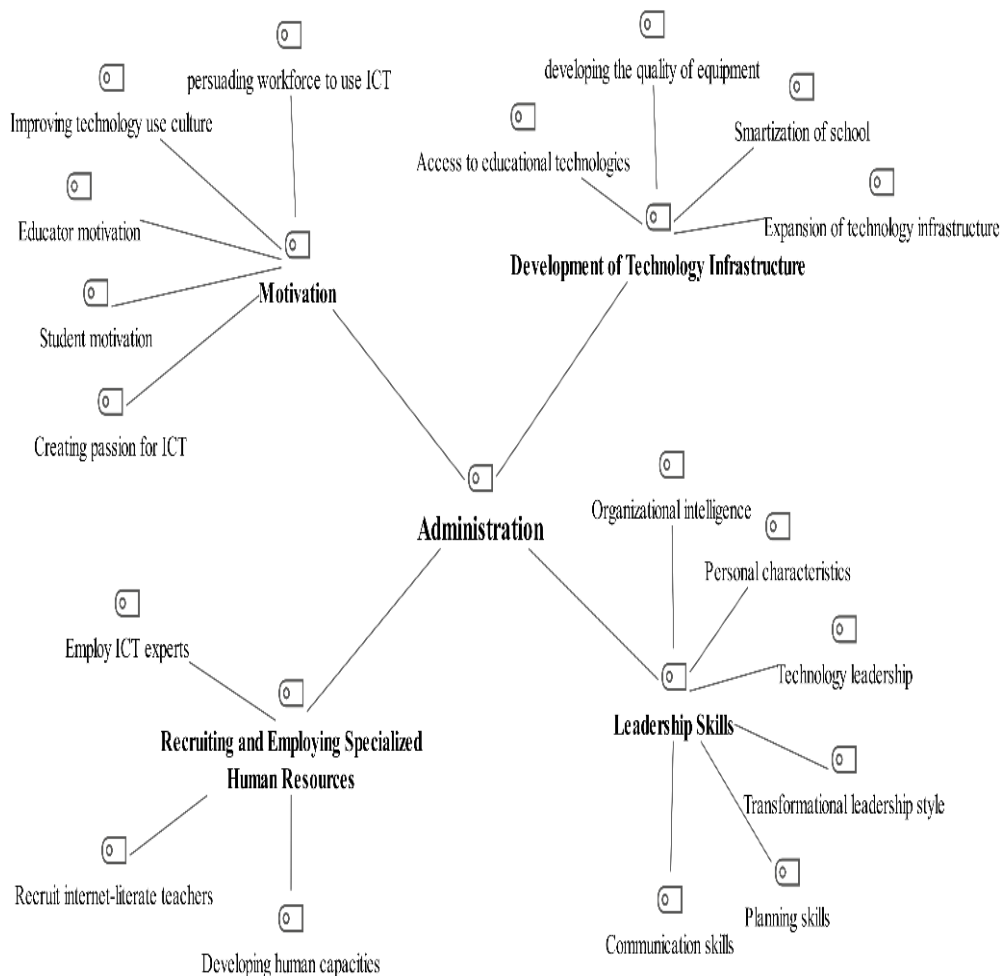
Fig.1. Concept map of ICT in educational administration

Fig. 1 shows 4 main and 18 subdomain areas about ICT in administration of education in Iran. Some Important areas are ignored, such as educational administration information systems (EAIS), ethics of using ICT in education, legal and social aspects of ICT in education, national/local policies and strategies of ICT in education, technical aspects of ICT (such as user experience, interface design and evaluation, accessibility and information content management systems).

3.2. Professional Development

Table 3 shows aspects of technological knowledge, acceptance of technology, use of technology, technology skills, and career ability.

Table 3. Coding of ICT related to professional development in education system

Selective code	Axial Code	Open Code	Article Code
Professional Development	Technological Knowledge	Improving the level of knowledge and skills in the field of technology, familiarizing teachers with educational technology, increasing teachers' skills, teaching the use of equipment and software, teaching new methods to teachers, introducing teachers to technology, teaching teachers how to use virtual education, training teachers, training teachers to increase their online skills, teaching special software, creating short-term training courses, holding technology training courses in the teaching process, continuously holding in-service classes, holding pre-service classes	11- 14- 16- 24- 25- 27- 33- 45- 49- 57- 64- 79- 83- 92- 94- 95- 102- 106- 108- 109- 112
	Use of Technology	developing the use of technology, planning technology, strengthening technological aspects in educational centers, paying attention to the importance of technology, improving ICT indicators, smartization, providing facilities for using computers, developing technology, strengthening creativity and innovation, improving knowledge sharing, sharing information, sharing technology knowledge, cultural conditions, cultural criteria for coexistence with technology	1- 9- 23- 28- 37- 42- 47- 66- 71- 79- 80- 81- 84- 90- 93- 102- 107
	Acceptance of Technology	Positive attitude in dealing with technology, promoting the culture of using ICT, welcoming ICT, trusting in the attitude towards learning with technology, planning for the creation of technology use culture, cultivating interest and desire for information technology, accepting technology, accepting the new paradigm of technology, society adaptability, strengthening a positive attitude towards technology, formulating a digital vision, changing the attitude towards transformation, drawing technology goals and expectations, developing a vision for the use of technology, planning for technology development	2- 5- 11- 13- 14- 16- 24- 30- 45- 62- 74- 91- 99- 109- 110- 111
	Technology Skills	Using technology in teaching, using technology in formulating goals, using applied software, using electronic magazines, using different software, getting to know the principles and methods of	14- 16- 19- 22- 26- 28- 33- 44-

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		online teaching, getting to know databases, developing media literacy, technological capability, developing the use of technology, the ability to use digital tools, the ability to search information, the ability to connect to the Internet, the ability to use email, the ability to implement content in a virtual way, the ability to present electronic content, the ability to organize an online learning environment, the ability to design content	55- 60- 73- 82- 94- 111	59- 67- 75- 87- 96-
	Career Ability	Self-management, development of self-control, self-discipline, self-management in the education process, self-management in performing tasks, improving self-concept, self-awareness, awareness of one's ability, development of self-confidence, feeling of competence, professional growth, meaningful responsibility in work, personal development, career development, improving the level of competence, improving ICT literacy	4- 13- 20- 28- 46- 57- 77- 86- 106- 112	12- 15- 24- 44- 49- 63- 80- 92-
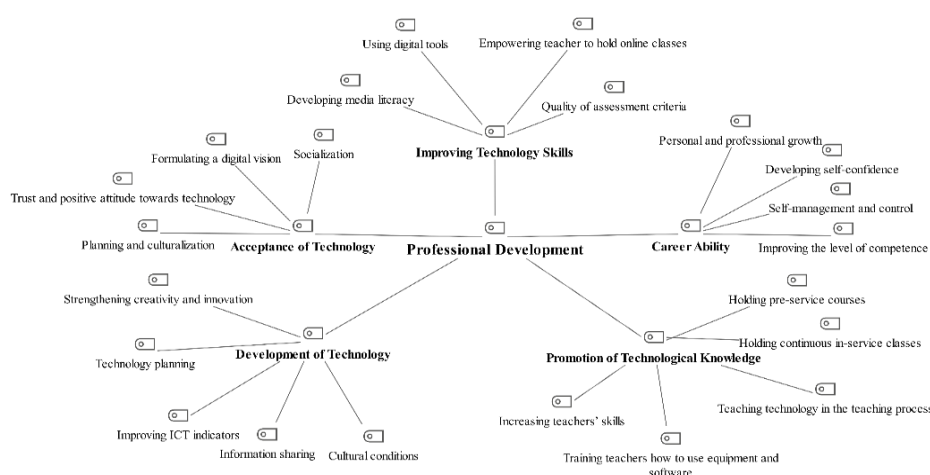
Fig. 3. Professional development concept map

According to fig. 3, Although some aspects of professional development (including technology knowledge, acceptance, skills and development) are considered in Iranian researchers, some new opportunities like community of practice, social media, scientific networking and the policies and mechanism of improving professional development for teachers via ICT are note studied theoretically nor empirically.

3.3. Assessment

According to table 4, assessment diversity, assessment ethics, assessment quality and assessment criteria clarity are axial codes that have studies by Iranian researchers. Diversity of assessment in ICT means attention to types of questions and kinds of tests as well as the diversity of tools and way of testing. Ethics of assessment points to controlling mechanisms of cheating as well as examiners commitment. Clarity of criteria means that teacher should use expertise methods to design suitable assessments. Quality of assessment discusses the comprehensive conditions which upgrade the assessment validity and credibility.

Table 4. Coding of the selected educational ICT researches (Assessment dimension)

| Selective code	Axial Code	Open Code	Article Code
Assessment	Assessment Diversity	Implementation of different assessment methods, diversity in assessment methods, assessment by peers, assessment of performance with work portfolio, designing open book questions, electronic test, self-assessment, process-oriented assessment, continuous assessment, online tests, creation of valid evaluation methods	12- 14- 26- 34- 46- 63- 68- 80- 89- 91- 97- 104
	Assessment Ethics	Probability of unethical behavior, ethics in assessment, security of the test, fair judgment, the quality of dealing with plagiarism, appropriateness of the time considered for the test, attention to individual ability, type of grading, conformity of assessment methods with educational content, timeliness of assessment, coordination of the assessment tool with the goal	34- 43- 51- 63- 72- 74- 78- 80- 88- 104
	Clarity of Assessment Criteria	Providing sufficient information about the test, providing useful information to the learners, the clarity of assessment criteria, providing information about the test, determining the assessment criteria, setting standards, quick feedback, providing feedback, timely assessment, quick feedback from the instructor, specifying the test conditions	28- 37- 62- 72- 78- 80- 84- 88- 90- 103
	Assessment Quality	Quality evaluation of training, evaluation of education quality, evaluation of practical skills, validity of response, quality of response, quality of test content, less control, comprehensiveness of evaluation of technical issues of the test, providing expert feedback, quality of assessment criteria	9- 39- 50- 63- 72- 78- 80- 88- 90- 95- 104- 111
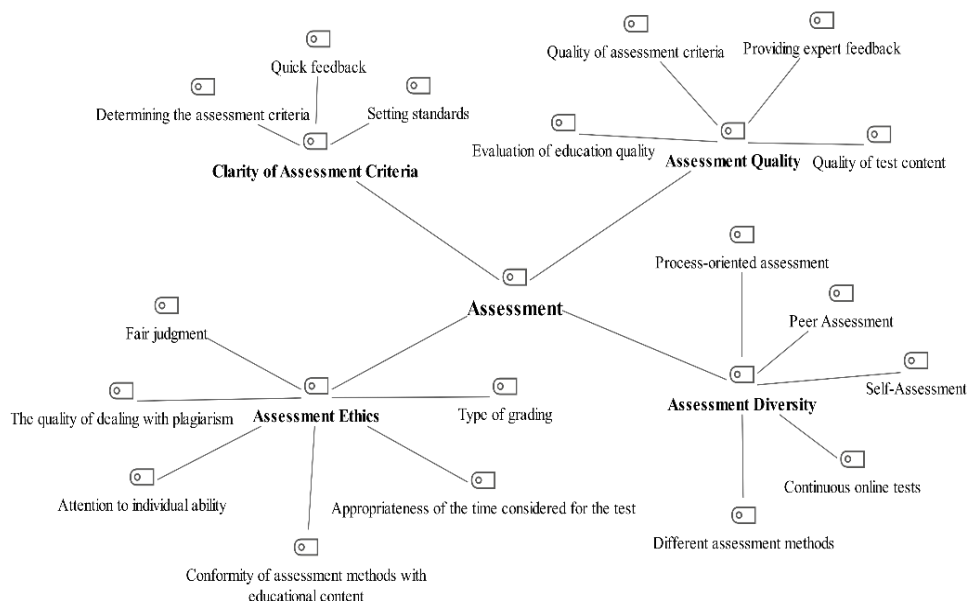
Figure 4. Assessment concept map

As fig. 4 shows, Iranian researchers investigated four sub categories of assessment through ICT including quality, ethics, diversity, and criteria. In the case that quality of assessment in the context of ICT depends to synchronicity and interactivity as well as observability, the technological infrastructure, internet speed and bandwidth as well as hardware and software are important topics that are not mentioned by Iranian researchers.

3.4. Teaching-Learning Process

Table 5 shows developing interaction, collaborative learning, improving the quality of teaching, improving the quality of learning, and improving quality of content are sub codes in this dimension. Three pillars of education are teacher, learner and content. ICT can develop all of them, teachers can overcome the limitation of time and space for reaching out students and teach them. As well as use collaboration teaching and make more reach content accessible for students. Students also, may use different strategies for learning by using synchronous and asynchronous participation in the classes. Also, they may use much more resources and benefit from more recorded teaching which are provided by sophisticated teachers.

Table 5. Application of ICT in teaching- learning codes

Selective code	Axial codes	Open codes	Article codes
Teaching-Learning	Developing Interactions	Continuous electronic communication with students, creating individual interaction in the online class, interactive nature of learning, establishing electronic communication, active presence on school e-classes, online communication with students, web-based communication, sharing teaching information, appropriateness of online interactions, cooperative and interactive education, creating interaction between learners and teachers in online group discussions, establishing online communication, improving interaction, improving communicative and social skills, suitable interactive environment, opportunity for more interaction, interactive process	3-3-8-12-14-17-27-29-35-42-44-51-60-65-69-74-75-85-87-89-111
	Collaborative Learning development	Cooperative and group learning, active learning, network learning, interactive learning, learning by doing activities, guiding the learner in the right direction, development of learning groups, development of cooperative learning, participation in learning, learning networks, development of students' participation	5-20-25-26-35-49-58-76-77-78-83
	Improving the Quality of teaching	Improving the quality of education, improving the quality and efficiency, teaching and learning, increasing the level of academic involvement, more efficient transfer of learning materials, effective transfer of educational content, flexibility of education, improving the quality of education, stimulating the sense of curiosity	9-18-26-33-37-39-43-58-61-64-85-86
	Improving Educational Content	Up-to-dated educational content, attention to content, trustworthiness of content, usefulness of content, suitable content, creative content, interactive content, quality of content material, content novelty, content relevance, content presentation in electronic way, online content presentation	2-34-35-46-52-59-68-70-73-81-84-90-93-94-102
	Improving the Quality of Learning	Enrichment of learning, growth and flourishing of talent, deep understanding of learning content, richer learning in the online environment, deeper learning process, optimal learning, improving learners' learning, increasing the depth of	6- 24- 29-33- 39-40-42-44-47-51-53-58-62-91-

|		learning, increasing the quality of learning, increasing learning and memorization, developing Learning efficiency, improving students' learning process, improving learning speed, improving students' learning, deep processing of information in learners, academic progress, development of educational system, development of creative thinking, improvement of learning quality, expansion of critical thinking	93-101-109-112
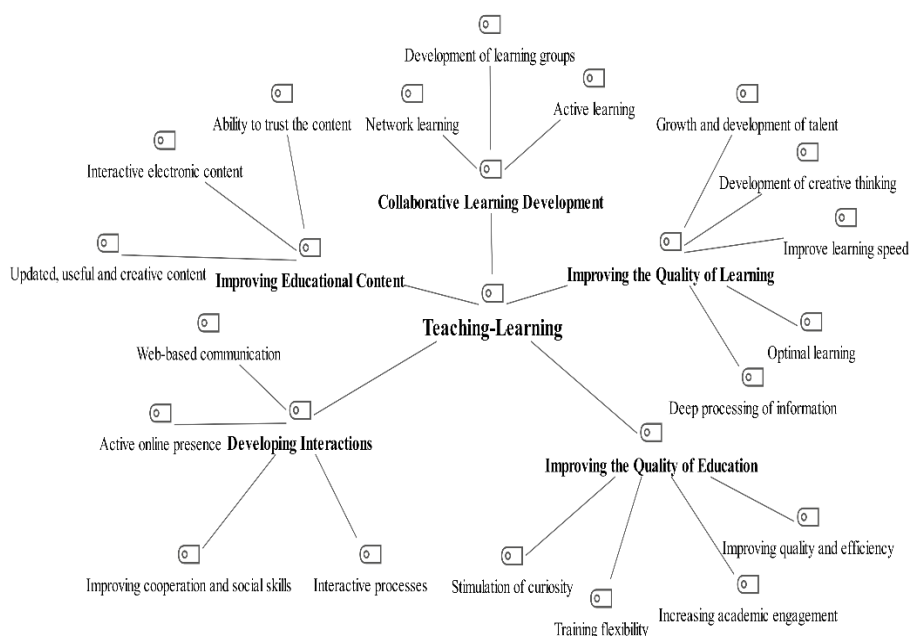
Figure 5. Teaching-Learning concept map

New Emerging fields such as artificial intelligence (AI) and its application in education, network analysis (fairness and complexity in education) are not considered in Iranian studies.

Discussion

This systematic literature review of Iranian published papers demonstrated that ICT in the educational system has been studied in four dimensions: "Administration", "Professional Development", "Assessment", and "Teaching-Learning Process". These final codes are in line with the course book written by commonwealth association of learning in the area of ICT in education (Shivalingaiah et al., 2016; p. 12). These four aspects are considered to have undergone the impact of digital innovations in the global educational systems. This is a highly comprehensive classification of education that covers all aspects of

educational system and its distinguishing stakeholders. For more details and description of abovementioned dimension the following four discussion are prepared:

First:

The function of school principals and their leadership style in the integration of technology in school curriculum and its application by students and teachers is an inevitable fact, which is mostly mentioned by different scholars. Supportive and interactive situation, planning vision, technology-based learning, promotion of scientific and professional ability and digital literacy are some strategic features that school principals should possess in order to create an appropriate organizational culture for leading the school in modern digital setting (Mardani & Molaie, 2015; Asarzadegan et al. 2003; and Moradi & Keshmiri, 2021). Although some preliminary factors such as school technology infrastructure are also important for using technology in schooling, the role of school principals is paramount. In order for principals "to provide effective leadership in their schools in the 21st century, they must possess knowledge and understanding of the issues and the capabilities of technology" (Uğur & Koç, 2019). They should apply such technological skills in order for a better implementation of school programs and fulfilment of activities.

Effective technology leadership plays a pivotal function in the 21th education. School leaders who have digital skills and capabilities, are more successful in implementing technology in classrooms and hence, contributing to better technology spending decisions and valuable use of technology in schools (Aquino Quidasol, 2020). The concept of technology leadership has also been explored by some Iranian scholars who realized the significance of leadership in relation with technology integration.

In this regard, Zeinabadi and Piralghar (2015) refer to technology leadership as an emerging area in modern school leadership and identify nine dimensions for school leaders in their active role of implementing technology. These dimensions include, knowledge, belief and action of the principal to use technology; demonstrating the expectations and goals of technology; technology planning; creating and strengthening the culture of using technology; empowering teachers to use technology; encouraging and motivating teachers to apply technology; evaluating teachers' technology performance; enhancing technology knowledge sharing, and technology support. Such dimensions help principals to develop their digital skills and make better decisions for an appropriate implementation of technology in the classrooms.

Moreover, the leadership style exhibited by school principals can help or hinder the integration of technology and its application by school agents (Afshari et al., 2012). This relation of leadership style and technology use in educational environments is also

explored by other scholars. Transformational, transactional and to a lesser extent, distributive leadership styles were found to be positively correlated and appropriate styles for leadership in the digital era of education (Khakpour et al., 2012; Tafazzoli & Sadegh Hoseini, 2017; Aghamalizadeh & Ehteshamrasi, 2019; and Heydari & Einghalaei, 2021).

Second:

Teachers are considered to be the first agents who take care of education in society. They are regarded to be capable of demonstrating and transferring new changes in the area of technology and shape students' pedagogical objectives based upon such changes (Chabra et al, 2016; p. 117). Students' educational needs, which are characterized by new innovations in technology, could be realized by some inform teachers who are continuously promoted in their professional requirements. Therefore, "to transform, grow, and remain effective, teachers need continuous and effective support through various initiatives for professional development" (Tran Ba Trinh, 2016). Professional development that focuses upon teaching strategies associated with specific curriculum content supports teacher learning within their classroom contexts that is more accelerated through technology-facilitated opportunities (Darling-Hammond et al., 2017).

Educators, as guardians of community learning should receive 'constant, complete and in-house training' and be aware of the changing needs of community. These changes are transferred in technology and require the whole association of educational stakeholders to take advantage of modern technology in order to properly fulfill their pedagogical responsibility and achieve a standard professional development. The highly 'standardized system of submissive occupational improvement' is now drastically changed by new innovations in technology (Chabra et al. 2016, p. 134). This is indicative of the overriding importance of teachers' professional development in preparing them for adapting to digital changes in education. With these changes, teachers own learning is at the forefront of the general teaching-learning process of students. Such a leaning is made possible through teachers' participation in learning communities by the help of technology.

Teachers in the new information space, are the pioneer of their learning journey and they get what they need to know, from different information resources. Being with other colleagues in online spaces leads to an original and new learning. Participation in learning communities provides a platform for continuous improvement of teachers' performance and capabilities. For this reason, the notion that formal education is the only cause for teachers to learn and acquire new knowledge is obsolete. Today, teachers are surrounded by a learning environment, consisting of formal and informal curricula. So, the basic principle that 'genuine knowledge

can be built for professional training' should be at the forefront of all activities for designing teachers' professional development programs (Gandomi & Sajjadi, 2016, p. 284).

Besides the prominence of teachers' learning of, and their familiarity with ICT skills, it is necessary to provide them with necessary training courses in this area. As Masoumi et al. (2016) claim, professional development of teachers is possible through two dominant approaches, "first, integrating the use of ICT with teacher training courses (pre-service training) and second, holding in-service training courses to promote the use of ICT in educational activities". Receiving such pre-service and in-service training programs, alongside some strategic, operational, and technological support can guarantee teachers' success and their desired professional growth.

According to the abovementioned extracts, professional development is a prerequisite for better performance of all educators in the modern educational setting; however, it is an underestimated factor among the Iranian researchers, whose works were explored in the present thesis. Among the whole sample of articles, only 22 investigated the concept of professional development and its connection to ICT. Among this limited 17.18 percent of papers, nearly all of them referred to technology as a prominent instrument for developing teachers' skills, providing their professional growth and finally,

achieving a better academic outcome for both educators and learners.

Third:

The advent of technology has paved the way for the motivation and encouragement of learners to learn better by the help of new digital instruments. With the omission of numerous limitations of time and place, the delivery and transfer of knowledge and data from educators to learners is much more facilitated; however, measuring learners' perception and understanding of educational materials is problematized. This raises the assessment dimension of education by the help of ICT and different evaluation types, by which learners' knowledge is measured. Biswajit Behera (2021) distinguishes between two types of assessment in the digital era:

Formative evaluations are measurements made throughout the instruction, a sequence to attempt the answer the question "how are we doing?" The information gained through a formative evaluation is key to informing the progress of learning process. Summative evaluation is taken at the end of instruction to answer the question "how have we done?" These measurements are intended to examine the outcomes of instruction by demonstration of competencies or mastery of objectives (P. 180).

If sufficient infrastructures are provided and skillful human resources are selected, both the process and the outcome of education will be greatly evaluated by the help of technology.

Formative assessment is more preferred in the modern educational environment, in that it can benefit both educators and learners. This kind of evaluation provides the students with just in-time feedback that improves their performance and provides teachers to assess their teaching effectiveness and, accordingly, adjust and modify their teaching activities (Elmahdi et al., 2018). Integrating ICT in school curriculum can transform outcome-based (summative) into process-bases (formative) assessment, which is more suitable in modern educational environments (Niroumand et al., 2012). E-assessment will yield some beneficiary results in educational systems. It is successful in reducing anxiety and can be used as a reliable method to decrease pre-test anxiety (Mousavi et al., 2017) and increase learners' motivation, satisfaction and academic achievement (Rezaie Rad & Akbari, 2016). Being aware of students understanding of pedagogical subjects, providing particular in-time feedback and adjusting teaching techniques with students' needs and capabilities are demonstrative of the significant of assessment dimension in educational technology. Hence, investigating the representation of this dimension in the work of Iranian scholars is of high priority.

According to the data illustrated in figure 2, only 11 percent of research sample were dealt with the concept of student assessment in the technology-based education. This limited number is indicative of the fact that the majority of Iranian researchers in the area of educational ICT have ignored the evaluative dimension of education and the influence it has upon students' perception and retention of subjects.

Besides students' perception and retention of subject matters, their satisfaction of digital appraisals is also significant in technology-based education. The more the quality of digital tests, the more the satisfaction of learners both with e-learning and e-assessment. Hence, some criterions are required to measure the quality of digital tests. Indicators of satisfaction with the test software, the physical environment of the test and the test infrastructure are some quality features, by which the essence of technology-based assessments can be judged (Ganji Arjenaki, 2017). Moreover, Learners' attitude towards electronic test; test content; fast, accurate and useful feedback; training and preparation of learners; accountability of testers; hardware and software technical issues; physical space of test execution and test security are other quality criterion that should be absolutely considered when designing e-assessment questions (Habibi et al., 2016).

In conclusion, in the Iranian evaluation system, plagiarism, pre-testing and matching test methods with the content are some shortcomings that are less considered by educational stakeholders (Azimi et al., 2016 and Dolati et al., 2015). In order to overcome such shortcomings and

increase the effectiveness of tests, some e-assessment instruments are proposed by researchers. Synchronous tools such as tests, chats, online discussion groups and shared group assignments; and asynchronous tools such as self-assessment, peer assessment, project, electronic portfolio, and article can be applied for better holding of e-tests and increasing applicants' satisfaction (Abbasikasani et al., 2019).

Forth:

According to the data analysis (fig. 1), more than half of the investigated papers completely dealt with the teaching-learning dimension of education. 80 papers (around 62.5 percent) explored the impact of educational technology upon some students and teacher features such as motivation, self-efficacy, attitude, creativity, critical thinking and academic achievement and their final contribution to student learning. Such features were found to be under the positive effect of technology; however, as the results of some limited papers indicate, technology can have devastating impact upon students' social skills and school socialization (Mousavi and Jamali, 2011).

The high number of papers related to the development of ICT in teaching-learning process is indicative of the fact that most Iranian researchers generally consider the integration of ICT in education, as technology-based teaching and learning that thoroughly related to the application of teaching and learning technologies in school

environments. Because of the pervasive influence of technology in all areas of modern life and particularly education, nearly all students are familiar with it and may learn better in a technology-based environment. Therefore, it is necessary to explore the effectiveness of digital innovations in the teaching-learning pedagogical aspect which leads to the effective leaning by the help and support of ICT elements and components.

ICT elements can be used in various ways to help both teachers and students learn their respective subject areas. A technology- based teaching and learning offers various interesting ways which includes educational videos, stimulation, databases, music, and other methods that will make the learning process more fulfilling and meaningful. On the other hand, students will benefit from ICT integration, in that they are not bounded to the limited curriculum and resources, instead technology-based course is designed to help them to stimulate their understanding about the subject. It also helps teachers to design their lesson plans in an effective, creative and interesting approach that would result in students' active learning (Ghavifekr & Wan Rosdy, 2015). Moreover, use of learning technology and e-content can lead to the "development of the quality of education, the expansion of learning opportunities and the availability of education" (Razaghi & Hashemi, 2017).

Although human resources are essential factors in the application of

ICT in teaching-learning process, some researchers consider other factors including infrastructural, managerial, organizational, and economic situation as the most important barriers affecting the use of information and communication technology in the teaching-learning process of educational institutions (Yosefpor, 2021). By overcoming the barriers in each of these areas, human resources will be fully developed in order to provide a better technology-based education. As a result, new teaching-learning methods and approaches will emerge and contribute to the depth of learning among students. Some of the teaching-learning methods mostly mentioned in papers investigation include blended learning (Zaraii Zavaraki et al., 2013; Rajabi et al., 2017; Zaraii Zavaraki & Toofani Nejhad., 2011), lifelong learning (Zahedi et al. 2016), mobile learning (Allahi et al., 2016), virtual or e-learning (Nourian et al., 2012; and Zaraii Zavaraki et al., 2009), web-based learning (Delavar & Ghorbani., 2011) and other approaches that yield fruitful results for both educators and learners. However, some psychological factors such as self-efficacy, self-learning, academic engagement, teaching-retention, self-confidence, critical thinking, and creativity are some unique contributions to teaching-learning process as a result of the utilization of such methods.

Although some related sub topics of these four dimensions are investigated,

some new and prominent areas are ignored:

For administration dimension educational administration information systems (EAIS), ethics of using ICT in education, legal and social aspects of ICT in education, national/local policies and strategies of ICT in education, technical aspects of ICT (such as user experience, interface design and evaluation, accessibility and information content management systems) are not studied yet.

At professional development dimension opportunities like community of practice (CoP), social media, scientific networking and the policies and mechanism of improving professional development for teachers via ICT are not studied theoretically nor empirically.

Iranian researchers investigated four sub categories of assessment through ICT including quality, ethics, diversity, and criteria. But synchronicity and interactivity as well as observability, the technological infrastructure, internet speed and bandwidth, hardware and software are important topics that are not mentioned by Iranian researchers.

In teaching and learning dimension new emerging fields such as artificial intelligence (AI) and its application in education, network analysis (fairness and complexity in education) are not considered in Iranian studies.

Considering that this research focused on the identity of ICT in diverse dimensions within the educational system of Iran, it is recommended that

future researchers investigate it in comparison to the educational system of other countries in order to overcome the weaknesses and shortcoming in this regard. Such comparative studies will evaluate and analyze the research data in a more efficient way and detect similarities and differences, which will in turn, contribute to better findings.

As the results of the present research indicate, technology is revealed in four educational dimensions including leadership, professional development, assessment and teaching-learning process. There is a large lack regarding the availability of a coherent model or framework to test these dimensions and their relation to the dominant technological factors. Therefore, as the final recommendation remark of this work, it is suggested that future researchers re-evaluate and expand the current research findings and provide a comprehensive model and conceptual framework to demonstrate a better picture of the general state of knowledge in the selected area.

Ethical considerations

During the implementation of this research and the preparation of the article, all national laws and principles of professional ethics related to the subject of research, including the rights of statistical community, organizations and institutions, as well as authors and writers have been observed. Adherence to the principles of research ethics in the present study was observed and consent forms were consciously completed by all statistical community.

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