


Innovation culture in education: A systematic review of the literature

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Abstract

The education system in the 21st century has focused on innovation as a tool that revamps the traditional educational system. The need for quality improvement in the curriculum and the desire to produce students with 21st-century competency skills have made innovation the core emphasis in the educational context. Hence, school cultures that support innovation should be developed and encouraged extensively. However, studies on innovation cultures within the educational context are still scarce. Researchers have also yet to concur on universally agreed features of innovation cultures within education settings. Thus, this systematic literature review has been carried out to identify the norms, beliefs, values, customs and behaviours shared in educational innovation cultures. From a total of 156 studies analysed, this article reviewed 28 most relevant studies within three categories, which were organizational cultures, sociocultural norms and national cultures. Seven studies discussed involved organizational cultures, while 20 studies focused on sociocultural norms. Only one study explored national cultures. The Competing Value Framework, six building blocks of 'Innovation Quotient', the theory of innovation culture, the innovation-oriented culture as well as employee skills and competence had been used to explain the innovation cultures within an organization. The themes that emerged in sociocultural norms were the individual personality, interaction, collaboration and teamwork, support as well as leadership of a teacher. Meanwhile, the national innovation cultures were described through Hofstede's cultural dimensions theory.

Keywords

innovation culture, national cultures, organizational innovation culture, school transformation, sociocultural

Introduction

Innovation, which is the implementation of creative ideas, is a necessary process for organizations in competing at a global platform within this 21st century (Kremer et al., 2018). An organization that utilizes innovation in related operations can improve organizational efficiency, productivity and competitiveness (Manafi and Subramaniam, 2015). Within the education industry, the conventional education system has since transitioned to incorporate a more technologically advanced system that integrates the 21st-century competency skills. This form of innovation in education is vital to improve the learning outcomes, the quality of education provision, the equity and equality and the efficiency, besides reducing educational costs and maximizing revenues from education expenses (OECD, 2016). However, according to OECD (2016), the education system is still generally known as a conservative social system,

which is observed to be challenging in being innovative due to strong oppositions for change among teachers. According to Bereiter and Scardamalia (2006), schools need to radically reform as organizations that encourage knowledge creation, cultivate innovation-oriented culture and foster creative thinking among 21st-century learners.

Studies on a culture that influences innovation have been garnering attention in recent years (Lousã and Mónico, 2018; Tian et al., 2018). Jaskyte (2004) and Tushman and O'Reilly (1997) believe that cultural perspective is essential in understanding innovation. Similarly, Danks et al. (2017) assert that innovative culture is a predictor of organizational

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Table 1. The exclusion and inclusion criteria.

Criterion	Eligibility	Exclusion
Literature type	Journal articles	Book series, books, chapter in a book, conference proceeding, thesis and dissertations
Language	English	Non-English
Timeline	Before October 2019	After October 2019
Indexes	Index	Non-indexed paper

innovativeness. Members of an organization would feel supported and encouraged to make innovative decisions and explore new approaches to solve problems within the culture of innovativeness (Amabile, 1997). Thus, organizational culture is considered to be the heart of the innovations (Tushman & O'Reilly, 1997) that requires a conducive environment that promotes motivation and creativity, as well as eliminates barriers, in ensuring innovation success (Hofstede, 1991). This increasing importance of innovation in an organization today established the need to investigate cultures that support innovation.

The definition of an innovation culture is still highly debated among scholars as the meaning of culture remains challenging (Benedict, 2005). While there have been numerous perspectives on the concept of innovation within a culture, a single definition of innovation culture has yet to be established (Jucevičius, 2007). Moreover, challenges in specifying the different cultural content (Fine, 1979), primarily through a multicultural perspective (Hung and Hong, 2017), have contributed to the absence of a universally agreed meaning of innovation culture. Many empirical studies have, however, proven the relationship between innovation culture and organization (Jan et al., 2015; Naranjo-Valencia et al., 2016), which suggested that culture is an essential determinant of organizational innovation. Culture would influence the behaviour of an individual that empowers the person to innovate and create something valuable for the organization. On the other hand, the individual would also be highly committed to the organization for the opportunities and encouragements. However, existing empirical studies are unable to describe the influence of cultural features that can either enhance or hinder innovation.

Within the education context, the extent of innovation cultures that promote school organizations, as well as the teaching and learning processes, is still limited (Ghasemzadeh et al., 2019). The existence of new ideas or innovations challenges the traditional or usual way of carrying out teaching and learning activities within a classroom or school environment (Siti et al., 2018). Nonetheless, investigations on the concept of cultural innovation have been picking up within the education industry (Mohd Roffeei et al., 2018), with relevant studies exploring the perspectives of teachers and the teaching practices, the effects of innovation in practices, the learning culture among students and the culture within the teaching team (Feixas et al.,

2018). The many layers of cultural aspects (such as values, norms, beliefs and underlying assumptions) are needed to be described and shared between all stakeholders of a school, such as the students, teachers, school staff, administrators as well as parents. By involving the related members of the school community, a conducive environment and positive relationships built would have a considerable impact on the culture that can influence, share and shape the desired behaviour within the school organization.

Review questions

This systematic literature review is conducted to answer the following questions:

- What are the theoretical, empirical, norms, values, beliefs and underlying assumptions shared in innovation cultures in an educational context? and
- What are the recommendations for future research aimed at developing a more integrated analysis of cultures that will promote innovation in the educational context?

Methodology

This section discussed the method used to retrieve the relevant articles on the culture of innovation in education. A systematic literature review had been employed to collect all the empirical evidence that fits the eligibility criteria to answer the research questions in this article. Findings from this review were reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, which ensured the reporting of the literature review was unbiased (Liberati et al., 2009). The primary sources chosen for this review were Scopus, Taylor and Francis, Emerald and Google Scholar databases. The following section discussed the eligibility, exclusion criteria, reviewing processes and data abstraction for this review.

The eligibility in this review was limited to (a) journal articles; (b) articles that were published in the English language to avoid any confusion, especially in translation; (c) articles that were published before October 2019; and (d) indexed social sciences articles. The exclusion criteria included (a) book series, chapter in books, conference or proceeding paper, thesis as well as dissertations; (b) non-English journals; and (c) non-indexed journals. All these eligibility and exclusions had been summarized in Table 1.

There were four stages involved within this systematic literature review that was carried out in October 2019. The first stage encompassed the formation of similar keywords in strings and the abstraction of articles from the databases chosen. These strings were related to innovation culture in education, as shown in Table 2. The results showed 170 articles retrieved from the databases selected. In the next stage, 14 duplicate articles were removed, with 156 articles remaining to address the context of this review, which was education. Then, 75 articles had to be removed as these articles discussed culture that was irrelevant to the context of education. The third stage was to perform eligibility and

exclusion to the remaining 81 articles. A thorough analysis was carried out by eliminating the articles that were not able to answer the research questions developed in this article. This stage resulted in a total of 28 articles for the final stage of the systematic literature review, which was

the qualitative analysis. The processes of this review are shown in Figure 1.

Results

Findings for all 28 articles used in this systematic literature review were reported and discussed in this section. Based on the qualitative analysis, 13 articles were found to have used qualitative methods, while 6 articles had employed quantitative methods. Seven articles used a mixed-method approach, with one study implemented the approach on secondary data, and another used the approach based on a reviewed paper. All the data abstractions and the major findings of these 28 papers are presented in Table 3. From these findings, the majority of the studies on innovation culture in education had used qualitative methods to collect data. However, the use of quantitative and mixed-method approaches was also shown to be applicable in studies on culture and the collection of relevant data.

Table 2. The search string used for the systematic review process.

Databases	Keywords used
Scopus	(TITLE-ABS-KEY ('innovation\$culture\$') AND ('education')) AND (LIMIT-TO (LANGUAGE, 'English')) AND (LIMIT-TO (SRCTYPE, 'j'))
Taylor and Francis Online	[Publication Title: innovation\$ culture\$] AND [All Subjects: Education]
Emerald	'innovation culture' AND 'education'
Google Scholar	allintitle: 'innovation culture' AND 'education'

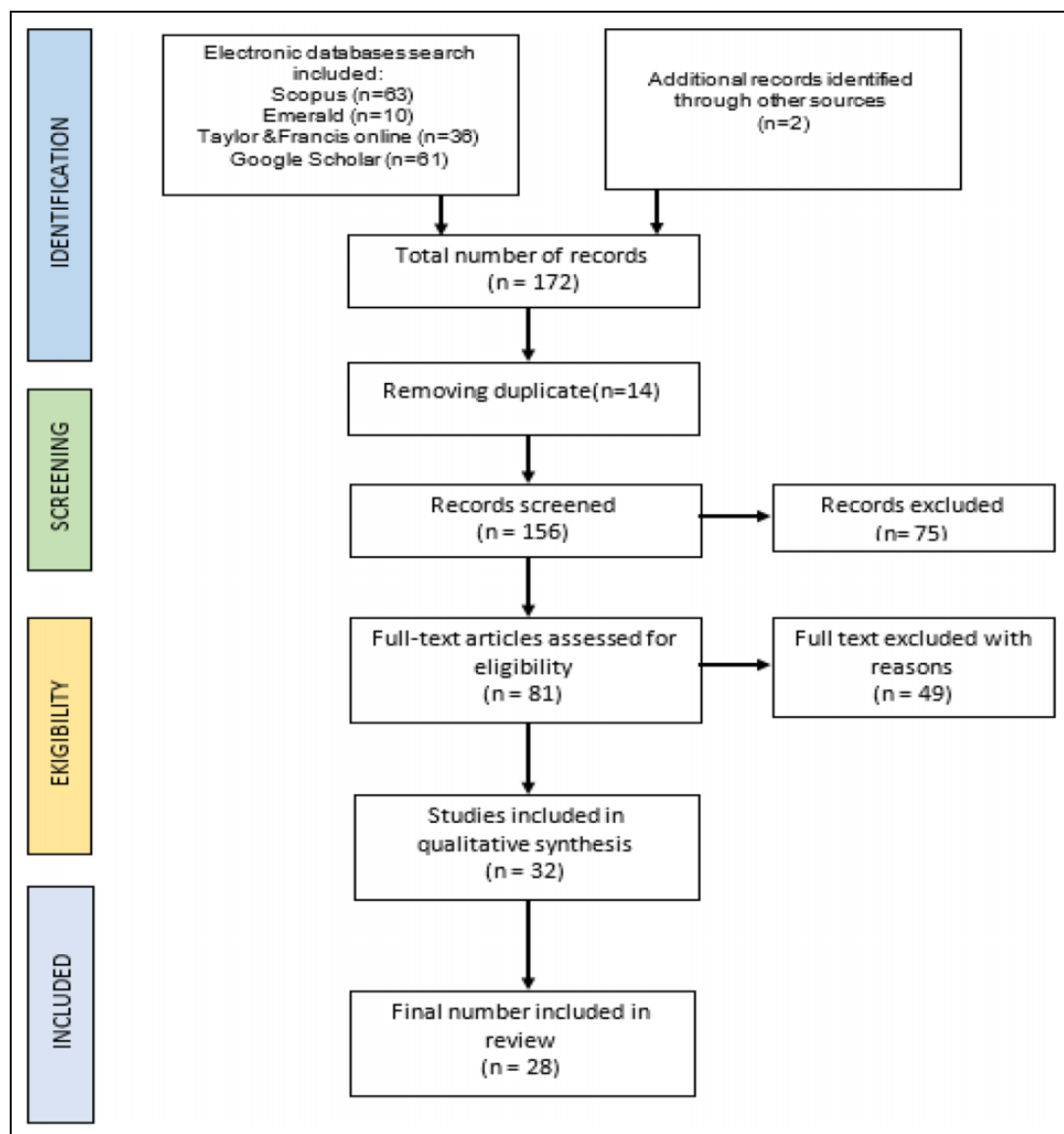


Figure 1. A detailed flow diagram on the application of PRISMA on innovation culture in education through qualitative analysis. PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

The type of culture that had an impact on the educational context was distinguished into three categories, which were organizational cultures, sociocultural norms and national cultures. The Competing Value Framework (CVF), six building blocks of 'Innovation Quotient', the theory of innovation culture by Dobni (2008), the innovation-oriented culture by Schein (1990) as well as employee skills and competence had been used to explain the innovation cultures within an organization. The themes that emerged in sociocultural norms were the individual personality, interaction, collaboration and teamwork, support as well as leadership of a teacher. Meanwhile, the national innovation cultures were described through Hofstede's cultural dimensions theory.

Discussion

Organizational culture and innovation in education

Researchers in the field of innovation have suggested that there is a link between organizational culture and organizational innovation. The culture of innovation can change the organization (Yeung et al., 1991). Schein (1985) states that organizational culture is associated with the sharing of underlying assumptions in solving a problem. Thus, culture can be understood as a process (or pattern) in solving organizational issues through innovation (Obenchain et al., 2004). From the 28 research articles reviewed, 7 studies are found to be related to organizational culture in innovation. While two of these studies have used the CVF, Schein's model, Hogan and Coote's (2014) organizational culture and Dobni's (2008) organization innovation culture have been applied in a separate study each. The remaining two studies, on the other hand, have focused on the professional and competency skills and the organizational innovation cultures that define an institute. Besides, five of these studies are found to have investigated organizational innovation as a predictor of innovation culture.

Cameron and Quinn have introduced a cultural theory known as the CVF in 1999, which defines four types of cultures, which are adhocracy, clan, market and hierarchy. According to Shepstone and Currie (2008), the culture of adhocracy involves innovation and risk-taking, whereby employees are bold to take risks, and the leaders have innovative insights. Members of the organization are committed to experimentation and innovation, which are considered to be essential for organizational success. Thus, there is a willingness for the organization to change, and the concept of new challenges is paramount by prioritizing the mastering of knowledge, services and products. On the other hand, Koutroumanis and Alexakis (2009) assert the clan culture is usually portrayed as a conducive working environment where employees can share information, and the leaders are the mentors. The organization is characterized by loyalty and tradition, with high commitment from the employees as priority is given to long-term individual development. There would also be high cohesion and morality as the organization prioritizes teamwork, engagement and consensus. The market culture is often labelled as a

rational goal model and is described as driven, goal-oriented, achieving and focused culture. The leaders in this culture will drive the organizations towards productivity, results, profits and market mastery, which unites the organization. However, the main concern in this culture is the competitive actions in achieving goals and targets as well as increasing competitiveness (Prajogo and McDermott, 2005). The hierarchy culture emphasizes formal rules and structures within the organization, whereby procedures are used to control the actions of the employees. The leader would be competent and capable in coordination to ensure that the organization runs smoothly. The main challenge for the hierarchy culture is long-term stability, inclination and efficiency (Alexakis et al., 2006).

CVF has been applied by Fathiya and Bardai (2012) as well as Obenchain et al. (2004) to investigate the link on an innovation culture. In the study by Obenchain et al. (2004), clan cultures dominate the institutes, which is then followed by market, adhocracy and hierarchy. Moreover, institutes with higher adhocracy culture have reported a higher level of innovation, which indicates that these institutions are generally more innovative, adaptable, aggressive and entrepreneurial than institutions from other types of culture. This argument is in line with the characterization of adhocracy culture as defined by Cameron and Quinn (1999), which relates more to innovation, risk-taking, innovative leaders, experimentation and willingness to face challenges. The domination of clan culture in the study prevents the innovation culture, as the focus has been more on human resources and the external operating environment. In contrast, the study by Fathiya and Bardai (2012) that was carried out in universities has shown that all four cultures are significant predictors of organizational innovation. According to Zammuto et al. (2000), the balance of these four cultures within an organization has a significant impact on the views among members on innovation, the expected outcomes and the ways that the innovation should be implemented. As revealed further in the study by Fathiya and Bardai (2012), the market culture influences technical innovation, and the hierarchy culture has more impact on administrative innovation. The effect of the hierarchy culture on administrative innovation is believed to be the biggest challenge to an innovation culture. Zhang et al. (2015) argue that although these four cultures are useful to define the characteristics of organizational cultures, the innovativeness of the culture is yet to be able to be examined empirically. Therefore, the study by Zhang et al. (2015) has used the model of innovation culture introduced by Rao and Weintraub (2013).

Rao and Weintraub have introduced the six building blocks of 'Innovation Quotient' Zhang et al. (2017) in 2013 and developed an assessment tool that captures the ideas of the previous models of an innovative culture. The assessment is known as 'innovation quotient' and measures the innovation culture through a multifactorial survey, which involves resources, processes, successes, values, behaviours and climates. According to Zhang et al. (2015), although this assessment is designed specifically for commercial firms, the tool is still competent to assess

Table 3. Table of findings from the systematic literature review.

Authors (date), country	Sample size	Research design and data collection	Theoretical framework	Findings
1 Altaf et al. (2019), Pakistan	22 directors, managers of universities and firms	A qualitative study (semi-structured interviews and focus group discussion)	Triple Helix model (government, university, firms and other organizations)	Universities in Pakistan had made a great effort to promote the innovation culture in the country. The role of the government and firms in supporting the innovation culture was still weak.
2 Burnard et al. (2007), United Kingdom	7 head teachers, teachers, teaching assistants, and university-based researchers	A qualitative study (video-stimulated recall and analysis, interviews)	'Possibility thinking' framework	Teachers had the opportunity to reflect upon their teaching, share experiences with colleagues, participate in innovative teaching and collaborate with peers.
3 Bezhanova et al. (2019), Russia	Statistical data from public authorities, legislative and statutory acts	A qualitative study (statistical data)	Innovation culture of an individual	The innovation culture of an individual consisted of world outlook, information, creativity and technology.
4 Boer and Asino (2018), Namibia	48 primary schoolteachers	Mixed-method study (surveys and engaged in information workshops, training workshops, on-site visits and research follow-up meetings)	Ubuntu (Namibian cultural practices)	Poor literacy in ICT skills, strong cultural practices and mental models in teachers result in hesitation to start the forum.
5 Daydova and Dorozhkin (2016), Russia	Review papers	A qualitative study (theoretical methods and methodological analysis, and modelling)	Network interaction	The interaction between the network was able to solve the complex pedagogical issue through the exchange of resources or other mechanisms to promote innovative educational programmes.
6 Duygulu et al. (2015), Turkey	38 R & D centres	A qualitative study (focus group discussion with semi-structured form)	–	The themes that emerged were learning and development, knowledge sharing and open communication, social networks and external cooperation, tolerance of mistakes, allocation of free time, managing differences, rewards and incentive systems as well as teamwork.
7 Fathiya and Bardai (2012), Libya	390 employees in three universities	A quantitative study (survey)	Competing Values Model (Cameron and Quinn, 1999)	All four cultures in the Competing Values Model have a significant impact on the organizational innovation culture.
8 Feixas et al. (2018), Spain	390 employees in three universities, 453 coordinators and members of innovation groups, and 8 team coordinators	Mixed-method study (survey, in-depth interviews and focus group discussion)	Innovation acceptance and diffusion models by UTAUT (Venkatesh et al., 2003)	The primary factor for transfer that contributed to innovation acceptance was the supportive environments and collaborative innovation culture among the teachers, support and leadership from management, recognition and support.
9 Halibas et al. (2017), Oman	40 published OAAA Quality Audit Reports of HEIs	A summative and causal content analysis	The Penta Helix model	The role of an HEI in fostering innovation in education was still low. The SMEs in Oman collaborated and implemented the innovation culture through financial assistance, financial advice and also mentoring on start-up programmes.
10 Hung and Hong (2017), Taiwan	126 (survey), 45 (treatment group) and 31 (experiment group)	Mixed method (survey and quasi-experiment)	Innovation-oriented cultural views	The cultural views of a student shifted from being transmission-oriented to a more innovation-oriented when they involved in idea-centred activities.
11 Jensen (2012), Western United States	Pre-service teachers	A qualitative study (ethnography – observations and discussion)	–	The artefact built in the classroom was a valuable and constructive tool for teacher education, which assisted the teachers to embed literacy training on ICT in early training and implementation as teaching and learning methods.

Table 3. (continued)

Authors (date), country	Sample size	Research design and data collection	Theoretical framework	Findings
12 Jeon and Kim (2012), Korea	11,473 team managers, staff and operation workers	A quantitative study (survey)	Innovation-oriented culture developed by KRIVET research team	Innovation culture had not significantly correlated to informal learning through interaction with peers.
13 Koponen (2019), Europe	45 master's degree programme students	Mixed-method study (survey and open-ended questions)	Flipped classroom approach	The role of teachers shifted from the facilitated collaborative learning experience, as well as maintained, encouraged and supported learning environment compared to a more traditional teacher-based input.
14 Lee and Hung (2016), Singapore	13 interviews and 3 observations	A qualitative study (single case study using interpretive phenomenological analysis)	Adaptive expertise	The principal distributed the role in leadership and built networking with stakeholders; the teachers had the opportunity to be reoriented with the pedagogy, curriculum and assessment; the community and peers supported and helped teachers to innovate.
15 Midthassel (2004), Norway	1435 elementary and junior high schoolteachers	A quantitative study (survey)	Perceived innovation culture	The involvement of principals had the strongest correlation with the perceived innovation culture based on SDA.
16 Midthassel et al. (2002), Norway	1371 teachers	A quantitative study (survey)	Innovation Culture is a subscale taken from School-Level Environment Questionnaire (Fisher and Fraser, 1991).	There was a strong correlation between the involvement of principals in SDA and innovation culture. A significant correlation was found between innovation culture and the involvement of teachers in SDA.
17 Meissner and Shmatko (2018), Russia	935 surveys and 42 interviews	Mixed-method study (surveys and interviews)	Professional skills and competencies	Personal competency skills developed leadership skills, increased mutual trust and produced great teamwork. General professional skills emerged were sharing and exchanging information and knowledge, professional management and communication skills.
18 Obenchain et al. (2004), United States	922 college students	A quantitative study (survey)	The Competing Values Framework by Cameron and Quinn (1999)	Thirty-eight institutes in this study had the adhocracy culture as the dominant culture. The clan culture also appeared to be dominant. Nine institutes reported having a higher hierarchy culture. Fifty-eight universities showed no dominant cultures in their institute for innovation. Most of the institutes had multiple and competing cultural types that fostered innovation.
19 O'Reilly and Robbins (2019), Ireland	7 universities	A quantitative study (survey)	'Innovation Quotient' by Rao and Weintraub (2013)	This study highlighted the strong correlation between innovation quotient and knowledge transfer capability (external engagement metrics) in Irish universities.
20 Sipe (2019), Florida and Ohio, United States	11 participants, faculty and college administrators	A qualitative study (case study with semi-structured interviews)	Edgar Schein (1985,1990); Hogan and Coote (2014)	Six themes emerged from this study, which were transformational leadership, convergent or divergent practice, varied multidisciplinary support, innovative institutional identity, significant impacts and descriptive communication.

(continued)

Table 3. (continued)

Authors (date), country	Sample size	Research design and data collection	Theoretical framework	Findings
21 Tsegaye et al. (2019), 80 countries representing 10 cultures	Based on United Nations Population Report (United Nations, 2015)	United Nations Data (2017) analysis	Hofstede and Minkov (2010) cultural value dimension scores	Power distance and individualism had a positive and strong correlation on the CI among the nations. The dimension of masculinity had no significant impact on the CI among the nations. The dimension of uncertainty avoidance had an impact on the CI among the nations but insignificant.
22 Vick and Nagano (2018), Brazil	40 team leaders, tenured faculty and team members	A qualitative study (interviews)	Dobni (2008), the culture of innovation	The formation of multidisciplinary teams positively showed intention to innovate as well as encouragement to co-create and collaborate between team members. The implementation of innovation had a positive predominance by the teams to execute innovative ideas. The infrastructure to innovate was a mismatch with the innovation goals of companies in encouraging cooperation among the teams.
23 Wallace and Priestley (2011), Scotland	5 secondary teachers	A qualitative study (interpretive case study)		Teacher beliefs had an impact on teacher interactions with pupils and the classroom. Five themes emerged in this study, which were responsibility, critical questioning, communication, informed decision-making and diversity.
24 Waring and Skoumpopoulou (2012), United Kingdom	22 university staffs	A qualitative study (ethnography study)	Integration (Martin, 1992, 2002; Meyerson and Martin, 1987); differentiation (Smircich, 1983); and ambiguity (Frost et al., 1991; Martin, 2002)	Ambiguity and contradictions were the bases of culture. The integration of new technology changed the cultures in the university, while power had shifted from the academics to the management offices.
25 Yang and Li (2018), Hong Kong and Shenzhen, China	2 kindergartens from each city (2 curriculum developers, 3 lead teachers and 3 random classes)	A qualitative study (case study)	Social culture	Progressivism was one of the main philosophical foundations in the ECC innovations shared by four kindergartens. Progressivism showed that the teacher was a guide in solving students' problems, and the curriculum should focus on project-based and interdisciplinary activities that result in development.
26 Zhang et al. (2017), Ireland	1461 (19 Irish HEIs)	A quantitative study (online survey)	'Six Building Blocks of an Innovative Culture' by Rao and Weintraub (2013)	Public universities had a higher innovation quotient compared to IoT institutes.
27 Zachopoulou et al. (2006), Greece	251 children aged 4–5 years	Mixed-method study (test and interviews)	Thinking creatively in action and movement test of Torrance (1981)	The most important goal for early childhood teacher was to provide adequate knowledge and skills to the children and support an environment that allowed creative thinking that emphasized knowledge and skills.
28 Zhang et al. (2018), Guangxi, China	106 schools, 636 school principals and teachers	Mixed-method study (survey and focus group discussion)	Based on Stoll and Temperley (2009), Basadur (2004), Levesque (2011) and Robinson (2011)	The role of principals was to involve every teacher in creative teaching as a way to foster students' creativity and to empower the imagination of the teacher towards teaching.

R & D: research and development; HEI: higher educational institution; KRIVET: Korea Research Institute of Vocational Education and Skill Training; SDA: school development activities; CI: creativity and innovation; ECC: early childhood curriculum; IoT: institute of technology; OAAA: Oman Academic Accreditation Authority; UTAUT: Unified theory of acceptance and use of technology; SME: Small and medium-sized enterprises.

the degree of cultural innovativeness in a higher educational institution (HEI) due to the innovation activities that have long existed in the universities, which is similar to commercial firms. The study by Zhang et al. (2015) has yielded universities in Ireland having a higher innovation quotient compared to the institutes of technology (IoTs). This result could be due to the introduction of innovative subjects in universities that address industrial demands, which also encourages innovation cultures. Besides, a majority of the academicians find innovativeness within the respective IoTs to be the lowest. However, the study also shows that the culture only supports innovation activities between academicians and external stakeholders to a moderate level, whereby these Irish universities have a weak innovative culture within the institutions that show openness or success to implement the innovative organizational approaches. However, O'Reilly and Robbins (2019) argue that this assessment might not have captured all the constructs of innovation culture in the organization through their research that could prove better industrial engagement when a university has a higher innovation culture.

Dobni's (2008) theoretical approach is more consistent with the manifestation of a balanced organizational innovation. According to Dobni (2008), the culture of innovation is a multidimensional context, which includes the intention to be innovative, the infrastructure to support innovation, the behaviour at the operational level to influence the market and value orientation, and the environment for innovation implementation. There are four dimensions within this theory, which are the intention to innovate, the infrastructure for innovation, the implementation of innovation and the influence of innovation. The intention to innovate is associated with the extent of team members involved in innovation, and their thoughts on the contributions of the innovation to other members, as well as the organization. On the other hand, the infrastructure for innovation refers to the creative ability of the team members and the amount of creativity that they are willing to express, which includes the educational opportunities aligned to the innovation goals. The implementation of innovation refers to the ability of a team to perform all the creative ideas and the way the systems and processes are co-aligned to changes. Meanwhile, the influence on innovation refers to the extent of focus and involvement for an individual in the innovation process.

Vick and Nagano (2018) used this theory to study the precondition for successful knowledge creation in the context of academic innovation projects. Results show that the intention for innovation is found in multidisciplinary teams, which encourages co-creation and collaboration among members, though in restrictive aspects of the teams. In the team with a collaborative culture, the implementing innovation had a decisive predominance through the remarkable ability of the team to execute ideas with added values. However, some team members are found to have lost determination and motivation due to bureaucratic challenges on the infrastructure within the parameters of innovation. Besides, the influence of innovation can be negative due to either the lack of company involvement during

developmental stages or confusion on the purpose of collaboration.

Hogan and Coote (2014) have tested the model created by Schein (1990) and argue that cultural norms and artefacts have led to innovative behaviours, whereby values and assumptions underlie the norms. Schein's (1985) model mainly consists of three main dimensions, namely artefacts, espoused values and underlying assumptions. A study by Jensen (2012) using an artefact developed in university classrooms has demonstrated that educators could create educational materials to interrogate and deploy multiple media forms to explore, play with, recombine and reproduce images for and with students. Hence, the development of artefacts leads to innovative behaviour among educators to be implemented in the classroom. According to a study by Sipe (2019), colleges generally exhibit numerous values to support innovation. These values include success, openness, flexibility, internal communication, competence, professionalism, inter-functional cooperation, responsibility and appreciation among employees, risk-taking, high autonomy, tolerance of failure, low bureaucracy and learning orientation. However, most educational institutions also show a high value in bureaucracy, which indicates that although there are strong leadership and innovative values in these institutes, bureaucracy can have a negative impact and hinder creativity.

Jeon and Kim (2012) have used innovation-oriented culture that has been developed by the Korea Research Institute of Vocational Education and Skill Training to measure innovation culture in an organization. Their study shows that innovation-oriented culture does not have a significant relationship with one of the organizational factors, informal learning through interaction with peers, or learning by doing. Besides, excessive innovation can lead to distrust and resistance among employees (Lundvall, 2010). These arguments can be supported by a report by Economyplus (as cited in Jeon & Kim, 2012) that 55% of employees have a negative opinion about innovation activities driven by their organization. Hence, Meissner and Shmatko (2018) have proposed using the skills and competence of the employees to explore the innovation culture among university students. Several skills that involve professional skills and competencies to general (analytical) professional skills, such as special (instrumental) professional skills, and professional management skills have been listed in the study. The universal skills and competencies, such as communication skills, personal effectiveness and leadership skills, have also been acknowledged in exploring the innovation culture.

Sociocultural norms and innovation in education

Sociocultural norms are the set of values, beliefs, customs and behavioural norms that are found in a group of people or a social group within the environment of the population. Underlying sociocultural forces have inevitably shaped institutional curriculum innovations (Dahlberg and Moss, 2005; Li and Chen, 2016). Bezhanova et al. (2019) have stated that innovation culture can be a result of social

interactions that are transmitted through training, behaviours, standards, settings, orientations of values and multiple contacts among groups of people. Other forms of social aspects such as manners of dressing, symbols, styles of management, ethics of relations, ceremonies, languages or communications can also affect innovation culture (Bezhanova et al., 2019). Meanwhile, Lee and Hung (2016) have listed four enablers of sociocultural dimension in curriculum innovation, which are (a) school leadership that creates an opportunity for socio-technological provisions among teachers to experiment and innovate; (b) learning contexts that refocus the curriculum, pedagogy and assessment in the classroom; (c) learning communities in building teacher capacity; and (d) historicity for developing adaptivity. However, this review has categorized sociocultural manner as the individual personality, interaction, collaboration and teamwork of a teacher as well as support and leadership.

Based on the context of individual personality; teacher beliefs, opportunity, competency and progressivism are the essential sociocultural norms. Teacher interaction between cultural and structural factors can change teacher beliefs in the new curriculum. A study by Wallace and Priestley (2011) has investigated the sociocultural factors that underpin curriculum changes by examining teacher beliefs in the context of professional development. Results show that the administrators of the district must allow teachers to create personal reformed methods in the school curriculum as the congruency between teacher beliefs and the philosophy of the new curriculum encourages teachers to be innovative in the classroom. Teachers with strong personal beliefs can boost their confidence through experimenting, making changes in the pedagogy, morphogenesis and enhanced potential cultural and structural practices. These results are supported in a study conducted by Feixas et al. (2018), which argue that teachers would feel capable, confident and self-assured to implement the new teaching pedagogy when they are able to overcome any problems that limit the use of the latest knowledge and abilities. Teacher beliefs have a strong correlation to the opportunity given by the principals, communities or stakeholders. Thus, the development of innovation projects in the curriculum will help educators to change their teaching practices according to the learning conditions of the students. Burnard et al. (2007) have also asserted that teachers place a high value on the opportunity given to reflect on teaching pedagogies and to share opinions with other teachers. Teachers believe that participation in innovative teaching methods can help their students think creatively. Similarly, Lee and Hung (2016) also find that teachers will refocus pedagogy, curriculum and assessment practices in the classroom when given the opportunity, which encourages them to address challenges in innovations and foster learning adaptivity.

Teacher competency is also a characteristic that is emphasized within the context of individual personality. Individuals with higher innovation cultures have been proven to have higher competency skills (Bezhanova et al., 2019). According to a study by Meissner and Shmatko (2018), the most demanded competency skills are

professionalism, continuous improvement, assertiveness and endurance. Hence, teachers with personal effectiveness competency can develop leadership skills and increase mutual trust in oneself and others to perform efficient teamwork. As a result, teachers who are involved in a continuous learning environment for improvement will also be aware of risks and failures. On the other hand, the general professional skills, which is sharing and exchanging information and knowledge, need to be developed further for an innovation culture to take place, which includes a critical competency skill required by teachers; the ICT skills. A study by Waring and Skoumpopoulou (2012) finds that the integration of new innovative systems in the university can change the skill sets required for the job. This result is supported by a study conducted by Boer and Asino (2018), which has observed staff being employed based on competency in ICT skills rather than interpersonal skills and ability to work with students. Hence, teachers who are weak in ICT skills will limit their participation in innovative pedagogy approaches. Another value in individual personality among teachers is progressivism. Yang and Li (2018) find that being progressive is a philosophical foundation in the implementation of new curriculum innovations, whereby progressivism places teachers as guidance to solve students' problems.

Social interaction has an impact on innovation culture (Bezhanova et al., 2019). The aspects involved within social interaction include behaviour, training, standards, settings, multiple contacts among groups of people, manner of dressing, symbols, system of values orientation, style of management, communication, ceremonies, language, ethics or labour relations. These aspects are found to be prominent in solving complex pedagogical issues that some organizations find challenging to solve. According to a study by Davydova and Dorozhkin (2016), interaction among colleagues can help solve a common problem, with multiple methods developed as a result of the communication. Besides solving issues through the exchange of resources, teachers can allocate new pedagogical positions to participate in network interaction, search for other mechanisms to promote innovative educational programmes or network groups as well as support activities from municipal and regional authorities within the social network. Similarly, Feixas et al. (2018) also believe that interaction between academics will provide them with the space to explore conceptual alternatives to improve their capabilities and discover new learning instruments. A study by Duygulu et al. (2015) also reveals that innovation culture is a multidimensional construct that resulted from the interaction between innovativeness and corporate culture. These constructs are learning and development, knowledge sharing and open communication, social networks and external cooperation, tolerance of mistakes, allocation of free time, managing differences, rewards and incentive systems as well as teamwork.

The interactions among government departments, universities, firms and organizations have been mentioned by two studies that used the Triple Helix and Penta Helix model as a framework to promote innovation culture in the

country. Altaf et al. (2019) have applied this framework in a study to improve interactions among university, industry and government in developing an innovation culture within Pakistan. The study has revealed that an active interaction exists between the university, the industry and the government to foster innovation culture in the country. Moreover, further results show that the functions and organizations of underlying factors are different in every developing country, which requires less responsibility from the government but a more prominent role from the universities. However, this Triple Helix model used in the study has been criticized by Halibas et al. (2017), who argue that the use of this model in social innovation will hinder the innovation in an organization. Therefore, the Penta Helix model has been proposed to examine the interaction between institutions, which consisted of public institutions, private institutions, academes, civil societies and social entrepreneurs. According to Halibas et al. (2017), this model will shift the social innovation of various sectors of society to share common goals using unique skills and resources that can overcome societal challenges. The government, on the other hand, will play a role in promoting and supporting the innovation system through public investment in research and development, knowledge infrastructures, public innovation policy and support for innovation network and public-private partnerships. The industries can then support the research funding of HEIs, product development and commercialization. Lastly, HEIs will enrich industries with new technologies and research. Besides, NGOs and civil society can also engage in social and economic development through active participation in regional development programmes.

Collaboration is one of the characteristics in innovation culture, which has been widely mentioned in all the studies for this review (Altaf et al., 2019; Burnard et al., 2007; Feixas et al., 2018; Hung and Hong, 2017; Wallace and Priestley, 2011). Feixas et al. (2018) have stated that collaboration among colleagues who believed in the usefulness of new approaches would facilitate innovation, strengthen cooperation and interaction among academicians and offer a space for exploring conceptual alternatives to improve skills and discover new learning tools. Burnard et al. (2007) have demonstrated that when teachers have the opportunity to work collaboratively, more innovative ways to solve problems in teaching will be developed. This result is further supported through a survey by Wallace and Priestley (2011), who suggest that teacher collaborative inquiry groups, or better known as professional development, can bring teachers to view themselves as theorizers, experimenters and school leaders (Zellermayer and Tabak, 2006). Teachers will also initiate changes in the pedagogical methods based on the teaching strategies suggested by their colleagues (Meirink et al., 2009). Hence, teachers would be more willing to collaborate in creating the curriculum, which fosters a sense of ownership towards shifting classroom practices (Hinden et al., 2007; Priestley et al., 2010). Multiple evidence has also shown that collaborative work among teachers leads to a lasting impact in schools (Leat et al., 2006). This form of interaction will lead to the development of a competent

team that is multidisciplinary (Vick and Nagano, 2018; Wallace and Priestley, 2011) and dynamic (Zhang et al., 2018), which facilitates the innovation culture further through effective teamwork (Duygulu et al., 2015).

Another crucial finding in the review of these articles is the support given to teachers that allows innovation. Support comes from the government, firms, community, peers, district managements, environments, ministries or even policies and programmes. Altaf et al. (2019) have stated that the role of the government and firms is crucial to support innovation in educational institutions. Although universities have made a great effort to promote innovation, the weak performance from the government and firms in supporting innovation has a significant impact on the weak innovation culture. This issue can be caused by firms struggling to find collaborative partners and the government only acting as an observer. Besides, the government has not been monitoring the policies and programmes implemented to initiate the innovation culture. Zhang et al. (2018) argue that the support given by the government and ministry to the principal creative leadership would foster the innovation culture in the institute as supportive policies and practices are essential to encourage innovation activities. Hence, teachers can innovate once they are supported by peers and district educational management (Wallace and Priestley, 2011). On the other hand, the support given by the community and peers also helps teachers to communicate and share findings and experiences of experimentation, besides being provided with peer and mentoring support (Lee and Hung, 2016). Zhang et al. (2018) argue that the low level of community engagement and the level of substance use around the school neighbourhood are the biggest obstacles to nurture innovation culture in schools. This support encourages teachers to redesign the pedagogy and develop adaptivity in innovation. Feixas et al. (2018) also assert that the combined supportive environments and collaborations will also support leadership and recognition among teachers, which can contribute to enhanced professional development among team members. As the monitoring of the innovation projects would be intensive, the effectiveness of these innovative programmes would increase. Hence, a supportive environment involves the peers, the leaders, development staffs and the community (Feixas et al., 2018; Wallace and Priestley, 2011; Zachopoulou et al., 2006; Zhang et al., 2018).

Feixas et al. (2018), Lee and Hung (2016), Sipe (2019), Midthassel (2004), Midthassel et al. (2002) and Zhang et al. (2018) have all agreed that another essential determinant to innovation cultures in education is leadership. Lee and Hung (2016) stated that school leadership could create socio-technological provisions for teachers in experimentation and innovation. According to the study, a principal who persuades teachers to innovate will tend to cultivate deep pedagogical understandings for distributed leadership and build networking with stakeholders to alleviate the pressures for teachers to innovate. Teachers will work with communities, stakeholders and researchers to implement innovations that are focused on academic developments and 21st-century competency skills among students. The

study by Zhang et al. (2018) has focused on the creative leadership skills by principals in promoting innovation culture in schools. Results from the study yielded that principals need to strengthen the creative leadership due to the relationship between quality work among individual teachers and teams with the general culture of the schools. The support and close monitoring that is given by leaders in the innovative programmes, however, will enhance the professional development of team members and increase the effectiveness of the programmes (Feixas et al., 2018). Teachers have also perceived that principals who are actively involved in school development activities have a strong correlation to innovation cultures (Midthassel, 2004; Midthassel et al., 2002).

National culture and innovation in education

National culture plays a vital role in influencing the innovation culture. The creativity and innovation at the national level refer to the ability to create, develop and implement new or improved products, services and processes that can add value to the people (Lundvall, 2010). Hofstede introduced the cultural dimensions theory in 1980 to understand the differences between cultures across countries. There are four dimensions within this theory, which are power distance, individualism, masculinity and uncertainty avoidance. According to Hofstede and Minkov (2010), power distance refers to differences at a hierarchical level between members in the society, while individualism relates to the orientation of values in an individual or group in terms of goals and rights. Masculinity is associated with the orientation of the society towards interpersonal relationships, and uncertainty avoidance is referred to as the cultural tendencies in avoiding activities that may lead to unwanted outcomes.

Tsegaye et al. (2019) have studied the impact of culture and economic growth on the creativity and innovation of 80 countries based on various fields such as economic, agriculture, financial and education through the use of the framework. The result shows that the dimension of power distance and individualism have a strong and positive correlation to creativity and innovation among the nations. In contrast, masculinity has no significant impact on creativity and innovation. Further investigation shows that when power distance is higher, the flow of information in the institutions will be limited. Nations with a higher score in the dimension of individualist have higher creativity and innovation compared to nations with a higher dimension in collectivist. Although insignificant, the dimension of uncertainty avoidance has an impact on creativity and innovation, which is discovered in Germany, with the highest uncertainty avoidance and high scores in the capacity to implement creative and innovative activities. The interaction between economic growth and individualism has a significant impact on creativity and innovation among the nations, which suggests that the impact on the level of culture innovation diversifies according to the level of economic growth among the nations.

A nation with a high power distance tends to apply intense supervision and control towards the process, which

will restrict society from creative ideas (Runco, 2014). A nation with rigid rules and regulations will be likely to have lower innovation than countries with low power distance (Grinstein, 2007; Martins and Terblanche, 2003; Shane, 1993, 1995). Moreover, the role of the principal is different in each state, whereby the authority, delegation and responsibilities granted may vary (Moos, 2000). According to OECD (1998), an essential factor in educational policy is the sharing responsibilities between schools either at the local, regional, or national level. The distribution of responsibility is seen as a step towards democratizing schools. In Norway, the abolishment of district offices and the implementation of school-based management encourage the involvement of teachers in innovation. A study by Midthassel (2004) has also found that within the flat school management structure of Norway, principals are unable to give teachers instructions. Instead, principals alert teachers to the importance of innovation in teaching and learning processes and encourage active participation in innovative activities.

The dimension of individualism in Hofstede's theory on the values and rights is found to benefit individuals more than groups of people, which is the opposite from the collectivist culture. According to Hofstede and Minkov (2010), nations with high individualist culture will have higher innovation than countries with higher collectivist culture. The dimension of masculinity in Hofstede and Minkov (2010) theory refers to the orientation of the society towards interpersonal relationships. The masculine culture emphasizes the achievement of tasks and successes by members, while feminine culture places greater emphasis on interpersonal relationships than personal success. In theory, the domination of the masculine culture would encourage innovation, but existing empirical studies have proven that this dimension does not have a significant impact on the innovation of a country (Shane, 1993). Based on the dimension of uncertainty avoidance, which refers to cultural tendencies in avoiding activities that may lead to unwanted outcomes, countries with substantial uncertainty avoidance could not support innovation activities (Efrat, 2014; Martins and Terblanche, 2003). Innovation is well-known for hard-to-predict features, and high risk of failure, which is the reason for this culture to prevent innovation from flourishing. This argument is further supported by a study conducted by Tsegaye et al. (2019) that proves this dimension of uncertainty avoidance does not encourage innovation in education.

Conclusion

There are two main objectives of this systematic literature review. The first objective is intended to evaluate the theoretical and empirical development of the influence of culture on innovation in the education system. The second objective of this review is to propose the norms, values, beliefs as well as underlying assumptions in innovation cultures at schools. The innovation cultures in organizations are observed through the clan, adhocracy, market and hierarchy cultures (Cameron and Quinn, 1999), intention to innovate, infrastructure for innovation, implementation of innovation, the influence of innovation (Dobni, 2008),

'Innovation Quotient' of Building Blocks (Rao and Weintraub, 2013), Schein's model, organizational culture (Hogan and Coote, 2014) and other combination of organizational culture. These aspects show that the influence of organizational innovation cultures is essential in an organization that strives to excel in innovation. However, to determine the aspects of organizational cultures that should be implemented by individual organizations, the background, culture, behaviours and norms of the organization should be evaluated.

The sociocultural innovation features in education, which is referred to the set of values, beliefs, customs and behaviour norms that are found in a social group within the surrounding environment where the populations exist can be summarized to five categories. These categories involve individual personality, interaction, collaboration and teamwork, support and leadership of a teacher. The influences of these cultures are mostly seen in curriculum innovation. Collaboration, cooperation and interaction between teachers, communities and stakeholders have proven to increase teacher beliefs in applying more innovative teaching methods in the classroom. As a result, students will develop a higher level of understanding and be creative. Support from peers, school principals, community, district educational management, governments, other organizations and school environment is seen as critical factors to nurture innovation cultures in education.

In a national study, Hofstede's cultural dimensions theory has been shown to have an impact on innovation in national cultures. The countries that have higher power distance have a lower innovation compared to countries with low power distance. These findings can also be applied to countries with high individualist culture that results in low innovation activities. Meanwhile, this review has also found that the dimension of masculinity and uncertainty avoidance have not impacted innovation activities in education. Overall, this systematic literature review has highlighted a few cultural norms, values, beliefs, customs and behavioural patterns in innovation cultures either in organizations, communities or nations. However, this review is only limited to the educational context. The results that are provided in this review can be a reference to identify the research gaps in innovation culture based on the educational context, such as the challenges to define innovation cultures in education and the sustainability of innovation cultures in schools.

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