

A Systematic Review of Technology Leader Research: Theory and Practice Gaps to inform Future Directions of Education, Humanities and Wellbeing

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The importance of the technology leader concept and its effect on the field and current practice of technology leader research is undeniable. However, little research has been conducted regarding the technology leader concept, particularly the identification of the research gaps. Amidst the focus on the future of education and how technology enhances teaching and learning, the need for more studies regarding proven good practice to nurture young technology leaders that can undertake the challenges of the current and future era of teaching and learning is highly needed. Due to this shortcoming, a systematic review of how to nurture future technology leaders needs to be conducted to critically evaluate relevant studies in an attempt to identify the research gaps and hence inform the direction of future research on technology leader. Miles's taxonomy of research gaps was used in conducting this review. A systematic search strategy was engaged to review published works on technology leadership and apply a set of criteria needed to nurture these individuals and further, how these finding could impact on the future directions of education, humanities and wellbeing. Results indicated that the conceptualization and development framework of technology leadership is a potential area for future research because this area, although crucial, has yet to be explored. The results further revealed that the incorporation of Community of Practice (CoP) and Cultural-historical Activity Theory (CHAT) with Activity Systems Analysis (ASA) approach may improve the analysis of data on the technology leadership concept because the combination has yet to be extensively used and may benefit novice researchers interested in



exploring the topic. Findings from the review can serve as a valuable guideline for educational designers and educators and other related stakeholders to nurture future technology leaders and to explore more potential future research directions in this area.

Key words: *Systematic Review, Technology Leader, Education, Cultural-historical activity theory, Activity system analysis.*

Introduction

The concept of technology leadership is becoming more important as individuals undertake increasing challenge navigating emerging technology in everyday life. Recent literature reveals that limited studies have been conducted to define what technology leadership means and ways to nurture these leaders within the education ecosystem before they enter the technological world of the current era and lead both industry and the community at large. In short, technology leaders will play important roles as enablers in the future.

From the literature review, it was identified that the definition pertaining to technology leadership concept is still unclear and needs further conceptualization. Previous scholars have emphasized the importance of exposing the benefits of technology and how it affects life as a means to prepare students to live in “a knowledge society” with meaningful learning to compete in global workplace. Hence, the purpose of this paper is to define what entails a technology leader and how they can be appropriately trained from primary through tertiary education. The significance of the paper is that it can serve as a valuable guideline for educational designers and educators and other related stakeholders to nurture future technology leaders and to explore potential future research directions in this area.

The following research findings begin by explaining the method of systematic review inquiry for analysis and discuss (a) what is currently known, (b) what is not known about this topic, (c) what areas need more focus, (d) what methodologies should be adopted, and (e) what theoretical perspective might be appropriate. As mentioned by Miles's (2017) taxonomy of research gaps, which consists of seven research gaps including the evidence gap, knowledge gap, practical-knowledge gap, methodology gap, empirical gap, theoretical gap, and population gap. For the purpose of this article, the subject was explored only from the three constructs of the taxonomy, namely knowledge gap, methodology gap, and theoretical gap. We then propose the future research directions pertaining to the technology leader concept.



Methods

Systematic review

A systematic review was conducted using the relevant criteria addressed by the Preferred Reporting Items for Systematic Reviews and Metanalyses (PRISMA) standard (Moher, Liberati, Tetzlaff, Altman, & Group, 2009). In the initial stage of the review, we evaluated recent studies on technology leader. Table 1 below shows the systematic review conducted to assess the topics under this subject. From the initial stage, articles were found to match the inclusion criteria. The following subsections describe the purpose of the review and search strategy, before listing the exclusion and inclusion criteria upon which the review was based. The subsequent section then reports the findings and establishes the research gaps, which in turn, enlighten areas that necessitate further study.

Purpose

A systematic review was conducted to obtain an overview of the existing literature on technology leadership. The ultimate aim of the review was to critically evaluate relevant studies as an attempt to examine the research gaps hence the directions of future research pertaining to subject. Miles's (2017) taxonomy of research gaps was based upon to identify and select issues that necessitate further investigation and identify the patterns of theory and methods adopted by previous researchers as well as the participants involved in the studies. Findings from the systematic review were then listed and categorized based on the research gaps pertaining to technology leader.

Search strategy

In order to retrieve the articles for systematic review, we engaged in a structured search strategy with the following three main resources serving as sources of information: (a) electronic databases (i.e., Emerald collection, Springer collection, ScienceDirect collection, EBSCO host, and the ERIC collection); (b) Google Scholar; and (c) cited works from the identified articles.

The search from different sources, produced somewhat similar results in terms of content and the lists of resources obtained although overlap in terms of general content, varied in results. For instance, the search from electronic databases produced similar results as those obtained from the search from Google Scholar, particularly on the area of <field>. Nevertheless, most of the identified articles were retrieved from the online databases. Resources were searched using the “AND” and “OR” operators for the combination of the following keywords: <concept>, ICT integration, elementary schools, secondary schools, ICT in education, technology. Articles were searched to the point of saturation (i.e., same articles were derived even with the use of different combinations of keywords). Year of publication was not set as a

parameter in order to allow as many published works to be included for the analysis, so as to derive the patterns of publications over the years.

After conducting the database search, the abstract of each article was read to confirm whether it could be potentially categorized under technology leadership. As mentioned, all potential articles were collected and then individually analyzed for any focus pertinent to technology leadership. The PRISMA flow diagram (Figure 1 below) shows articles that were derived from the initial search. A screening process was then carried out to identify duplicates and irrelevant articles, deriving further the articles as relevant to technology leader. Further screening confirmed that only 12 articles matched the exclusion and inclusion criteria pertaining to technology leadership in education. These articles concern various levels of education settings and studies that were conducted between 2003 and 2017 as presented in Table 1 below.

Diagrammatic representation of the literature search and review process

Figure 1. PRISMA flow diagram for the search articles

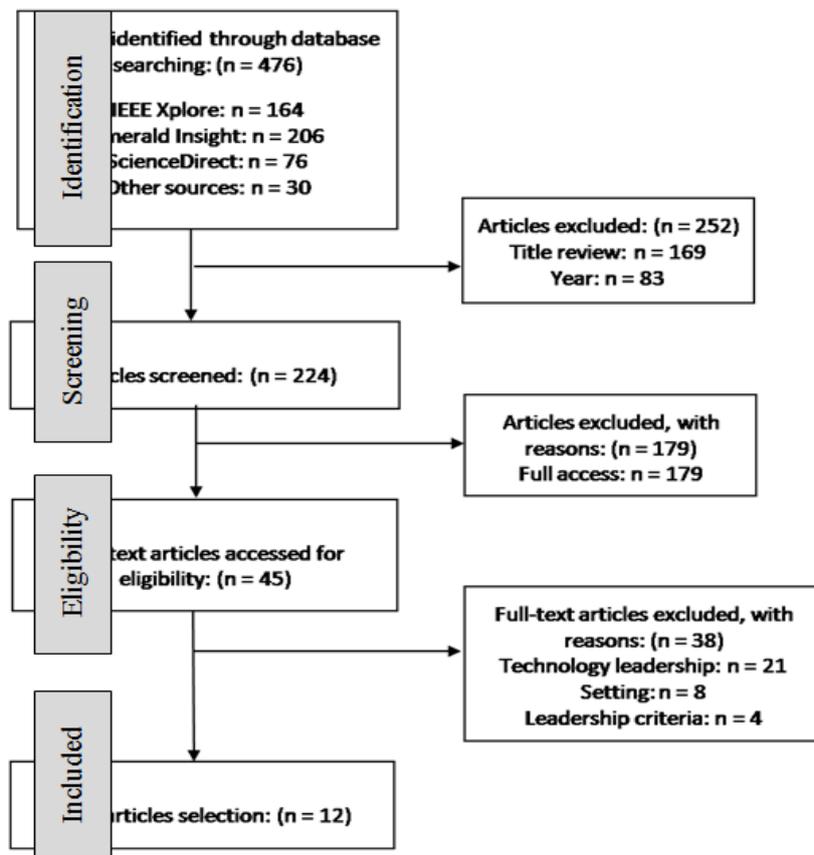


Table 1: Systematic Review Results for ICT integration in teaching in Elementary and Secondary Educations Final articles (abstract) selection n=12

No	Title/Reference	Objective	Abstract
1	<p>A Content Analysis of Scientific Research Studies on Technology Leadership in Turkey</p> <p>Uysal, S., & Madenoğlu, C. (2015). A content analysis of scientific research studies on technology leadership in Turkey. <i>Procedia-Social and Behavioral Sciences</i>, 191, 37-43.</p>	<p>The purpose of this research study is to evaluate the scientific researches on technology leadership completed between the year of 2007-2012 using the method of content analysis.</p>	<p>It is important for the reason that this study provides information about the content of previous studies in research topic and research method. Content analysis research design was used in this study. The coding book was formed by the researcher after scanning the literature and determination of the research purposes. Then the changes in the coding book were made by examining the theses, in accordance with expert opinions. The research population consists of 23 researches of technology leadership made in Turkey in the last 6years. No sampling method was applied. It was analysed using frequency and percentage.</p>
2	<p>Distributed Leadership: Structural Equation Model</p> <p>Prasertratana, S., Sanratana, W., & Somprach, K. O. (2014). <i>Distributed Leadership: Structural Equation Model</i>. <i>Procedia-Social and Behavioral Sciences</i>, 116, 1610-1614.</p>	<p>The aim of this study was to test the distributed leadership of basic school principals in a structural equation model.</p>	<p>The developments of the management quality focused on the distribution of administrative power and manage educational system for primary educational office area Research samples were 728 principals of educational institutions the Office of the Basic Education Commission. Sample selection was made using the multi-stage sampling. Research tool was rating scale. LISREL statistics software used to analyze the data. The result indicated that the structural equation model of distributed leadership, developed</p>

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			<p>by the researcher, fit well with empirical data with the following figures; chi-square value = 36.06, df=47, GFI=0.99, AGFI= 0.98, CFI=0.98, SRMR=0.00, RMSEA=0.00, CN=1451.98, LSR/SSR=1.71/-1.91. Moreover, the finding suggested that factor on trust had the highest total influence of 0.85 on distributed leadership. The factor on collaboration had the second highest total influence of 0.47 on distributed leadership. And the factor on creativity had the total influence and direct influencing weight of 0.01 on distributed leadership no significantly. In conclusion, the results showed that all 3 causal factors were 74% explained the distributed leadership of school basic education principals. From the result of this study, it is suggested that this structural equation model should be the guidance for the development of the school staffs.</p>
3	<p>Leadership Styles and Technology: Leadership Competency Level of Educational Leaders</p> <p>Gençer, M. S., & Samur, Y. (2016). Leadership styles and technology: Leadership competency</p>	<p>This study aims to reveal if the leadership style can be a predictor of competent technology leaders.</p>	<p>Researchers have studied the leadership styles of educational leaders in connection with their level of computer use and success in integration of ICT. The importance of this study is to investigate the leaders' competency as technology leaders rather than level of perceived use of technology, using Technology</p>

No	Title/Reference	Objective	Abstract
	level of educational leaders. <i>Procedia-Social and Behavioral Sciences</i> , 229, 226-233.		Leadership Competency Scale for School Administrators (TELÖY) (Hacıfazlıoğlu, Karadeniz, & Dalgıç, 2011) which is adapted from International Society for Technology and Education (ISTE) standards for school administrators. Fifty educators, who take leadership or administrative roles in educational institutions from the Eastern part of Turkey, completed Multi factor leadership questionnaire (MLQ) developed by Bass (1985) and translated and modified for the Turkish leaders by Demir and Okan (2008) and TELÖY. The results indicate moderate correlation between both transactional and transformational leadership styles. It is concluded that leadership style is not a predictor of competency level of technology leadership. The study contributes into literature discussing the effects of cultural differences in different countries on desired leadership styles, which in result may affect the level of technology leadership competency. In addition it also argues that leadership style characteristics cannot be used as a method to transform education and schools.
4	Correlation between Cultural Perceptions, Leadership Style and	This paper investigated the extent to which	School leaders are key factors in implementation of information and communication technology

No	Title/Reference	Objective	Abstract
	<p>ICT Usage by School Principals in Malaysia</p> <p>Arokiasamy, A. R. A., Abdullah, A. G. K., & Ismail, A. (2015). Correlation between cultural perceptions, leadership style and ICT usage by school principals in Malaysia. <i>Procedia-Social and Behavioral Sciences</i>, 176, 319-332.</p>	<p>secondary school principals use computers in Malaysia and determined factors related to level of computer use by principals (cultural perceptions and leadership style of principals).</p>	<p>(ICT) in schools. They need to understand the capacities of the new technologies, to have a personal proficiency in their use, and be able to promote a school culture which encourages exploration of new techniques in teaching, learning and management. However, there is less information about the current status of ICT use by Malaysian school principals. This paper investigated the extent to which secondary school principals use computers in Malaysia and determined factors related to level of computer use by principals (cultural perceptions and leadership style of principals). Initial report also highlighted analysis of a baseline data gathered from 520 secondary school principals in the state of Selangor and Wilayah Persekutuan, Malaysia. Findings indicate that school principals are using computers for instructional and administrative purposes and they have moderate competency in computer applications and spent a few times a week working on their computers. Also, cultural perceptions and transformational leadership contributed significantly to the level of computer use by principals. It is anticipated that the data obtained from the study will open new lines of inquiry about the crucial roles</p>

No	Title/Reference	Objective	Abstract
			<p>of school leaders in the adoption of ICTs and will contribute to decisions about future developmental needs because more will be known about their preparedness for change. Hence, policy makers must design professional development programs, such as leadership studies, in order to teach the components of transformational leadership; idealized influence, inspirational motivation, intellectual stimulation and individual consideration to future administrators.</p>
5	<p>The relationship between technology leadership strategies and effectiveness of school administration: An empirical study Weng, C. H., & Tang, Y. (2014). The relationship between technology leadership strategies and effectiveness of school administration: An empirical study. <i>Computers & Education</i>, 76, 91-107.</p>	<p>This research has four main themes: (1) the level of school technology leadership used by administrators in elementary schools; (2) the degree to which administrators are aware of the effectiveness of school administration; (3) the relationship between administrators' technology leadership strategies and the effectiveness of elementary school</p>	<p>The participants were 323 administrators (comprising principals and directors of academic-affairs, student-affairs, general affairs, and counselling divisions) from 82 elementary schools located all over Taiwan and its three offshore islands. Semi-structured interviews, expert validity surveys and a pilot-study were implemented to develop a "Technology Leadership Strategies and School Administrative Effectiveness Scale". The quantitative data gathered from the instrument was analyzed through the use of descriptive statistics, Pearson's product-moment correlation coefficient, and simple linear regression. The findings indicated that elementary school</p>

No	Title/Reference	Objective	Abstract
		<p>administration; and (4) whether administrators' technology leadership strategies can predict the effectiveness of elementary school administration.</p>	<p>administrators were highly conscious of using technology leadership strategies, and that these administrators generally possessed a high level of effectiveness regarding school administration. The results also indicated that technology leadership strategies had a significantly positive impact on the effectiveness of school administration, and thus the former could significantly predict the latter. The findings revealed that technology leadership strategies should be seen as an essential part of school administrators' training programs, in order to improve the effectiveness of such administration.</p>
6	<p>Making the right decisions: leadership in 1- to -1 computing in education</p> <p>Phillip A. T & Vallance, M. (2013) Making the right decisions: leadership in 1-to-1 computing in education, <i>International Journal of Educational Management</i>, 27(3), 260-272,</p>	<p>The purpose of this paper is to detail the necessity for more informed decision making and leadership in the implementation of 1-to-1 computing in education.</p>	<p>Design/methodology/approach - The contexts of high-tech countries of Singapore and Japan are used as case studies to contextualize and support four evidence-based recommendations for "true", "principled" and "right" leadership in technology integration in educational institutes.</p> <p>Findings - The cases of Singapore and Japan reveal different stages of technology implementation in education. Singapore has a broad, government-backed vision for technology integration and has invested heavily in infrastructure</p>



No	Title/Reference	Objective	Abstract
			<p>and human capital. However, the paper highlights how the benefits of 1-to-1 computing are not easily recognizable in practice and its implementation does not fit well into schools' strategic plans. Japanese education, on the other hand, has low technology utilization in its schools and subsequently produces graduates who lack basic digital and technological literacy skills.</p> <p>Practical implications - For success in 1-to-1 computing, education managers must provide sustained and informed leadership whilst facilitating an environment where all involved continually communicate and appraise their progress.</p> <p>Originality/value - The paper offers four evidence-based recommendations for education leaders. Making right decisions requires education leaders to acknowledge the shift of epistemic and technological expertise that exists in and beyond the classroom, actively encourage teachers to communicate their curriculum, assessment and pedagogical intentions with management and administrators, support the partnering of students with staff in task design, provide space and time for staff to openly discuss progress, and provide a</p>

No	Title/Reference	Objective	Abstract
			range of potential pedagogical and technological benchmarks.
7	<p>Leadership for a new vision of public school classrooms: Technology-smart and learner-centered</p> <p>Sheppard, B., & Brown, J. (2014) Leadership for a new vision of public school classrooms: Technology-smart and learner-centered, <i>Journal of Educational Administration</i>, 52(1), 84-96,</p>	<p>The purpose of this paper is to extend the understanding of distributed leadership to the school district level as the authors examine how leadership for twenty-first century learning is distributed within public schools and school districts as they strive to transform their school classrooms from primarily teacher-directed toward more student-centered and technology-enhanced. It contributes to a growing understanding of the inherent distribution of school and school district leadership and helps elucidate how existing leadership machinations can be adapted to facilitate the transformation of public school</p>	<p>Design/methodology/approach - This is a qualitative study conducted in all school districts in one Canadian province. Data were gathered through interviews of all district technology leaders and principals of two schools (per district) deemed exemplary in their use of technology for classroom learning; focus group sessions with stratified samples of teachers and all district-level program professionals in each district, and semi-structured observations of district-selected technology-savvy classrooms in two schools per district.</p> <p>Findings - The paper provides insights into the challenges of leading classroom innovation, including costs associated with technology acquisition and the provision of quality professional development. It reaffirms the continued relevance of the school principal while concomitantly confirming the inherent existence of distributed leadership within and across organizational boundaries that can facilitate or impede complex change. Finally, findings from this study serve as yet another reminder that the accumulated, rich evidence base regarding the process of leading</p>

No	Title/Reference	Objective	Abstract
		<p>classrooms from being primarily teacher-directed, to predominately student-centered, technology-enhanced learning environments.</p>	<p>and implementing complex innovation appears to be largely ignored by practitioners.</p> <p>Research limitations/implications - Because the research approach is qualitative and restricted to one defined population, the generalizability of this study may be limited.</p> <p>Practical implications - This paper draws attention to practical importance of fostering leadership from multiple sources and the need for reflection on how research evidence in education can better directed toward improved practice.</p> <p>Originality/value - Given the major public expenditures in the acquisition of new and emerging technology for public school classrooms, this paper may foster reflection for improved leadership and implementation practices. The paper anticipates that this work will contribute to a growing understanding of the distributed nature of school and school district leadership. Also, the paper believes it will help elucidate how current machinations of leadership might be adapted to facilitate the transformation of public school classrooms from primarily teacher-directed to predominately</p>

No	Title/Reference	Objective	Abstract
			student-centered, technology-enhanced learning environments.
8	<p>Technology leadership for the twenty-first century principal</p> <p>Flanagan, L. & Jacobsen, M. (2003) Technology leadership for the twenty-first century principal, <i>Journal of Educational Administration</i>, 41(2). 24-142,</p>	<p>This paper examines current issues related to technology integration and provides a contextual framework with which school principals can undertake new leadership responsibilities in this area.</p>	<p>Selected examples of successful technology integration are provided to inform current technology leadership practices. The leadership goals, competencies and responsibilities needed in order to achieve this preferred future are described. In the final section, the authors draw on professional experiences as researcher and teacher/leader to build and expand on a five-part leadership model currently in use by a large urban school district to interpret multiple dimensions of technology leadership for principals. Ways in which this framework can serve as a guide for school leaders as they develop technology competencies, implement professional growth plans, work with their community, and provide daily technology leadership, mentorship and advocacy for teachers in an elementary school are discussed.</p>
9	<p>How leadership for an ICT reform is distributed within a school</p> <p>Ng Foo Seong, D., & Ho, J. M. (2012). How</p>	<p>The purpose of this paper is to examine the process of information communication technology (ICT) reform in a government school in Singapore. The</p>	<p>Design/methodology/approach - A naturalistic inquiry approach was adopted, involving the case study of a school in the process of implementing an instructional reform involving the use of ICT.</p> <p>Findings - It was found that distributed leadership for ICT</p>

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	<p>leadership for an ICT reform is distributed within a school. <i>International Journal of Educational Management</i>, 26(6), 529-549,</p>	<p>focus is on the distributed leadership actions performed by various individuals, and how the multiple leaders and their leadership practices interacted with one another.</p>	<p>implementation requires a combination of transformational leadership and instructional leadership to develop teachers' capacity to enhance their instruction with ICT, emotional leadership to support teachers' effort to change, and strategic management of resources to sustain teachers' change efforts. Transformational leadership is performed mainly by senior management (SM). Instructional leadership is performed mainly by middle management (MM). Both senior and middle management provided emotional leadership and strategic resource management. In addition, SM provided second-order changes leadership, while MM provided first-order changes leadership.</p> <p>Originality/value - The paper rectifies the current disproportionate focus on the role of the Principal by uncovering the leadership actions performed by other school members, and how these leadership actions are interrelated. In particular, the paper provides insight into how leadership was distributed in a school reform involving the use of ICT for instruction.</p>
10	Accommodating the newfound strategic importance of	Educational technologists make significant	Design/methodology/approach - The arguments are evidence-driven by the small body of

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	<p>educational technologists within higher education: A critical literature review</p> <p>Shurville, S., Browne, T., & Whitaker, M. (2009). Accommodating the newfound strategic importance of educational technologists within higher education: A critical literature review, <i>Campus-Wide Information Systems</i>, 26(3), 201-231,</p>	<p>contributions to the development, organizational embedding and service provision of technology-enhanced learning (TEL) environments, which are key enablers for mass access to flexible higher education (HE). Given the increasing centrality of this role, it is advocated that institutions investigate sustainable career structures for educational technologists. This paper aims to address these issues.</p>	<p>research literature describing the role of educational technologists and contextualized by the experiences as academics and leaders of TEL projects in HE, including managing educational technologists.</p> <p>Findings - The roles of educational technologists are very diverse, requiring competencies in educational leadership, both management and technical. Their career paths, backgrounds, legitimate powers and organizational locations exhibit considerable variation.</p> <p>Research limitations/implications - University leaders require evidence to formulate appropriate human resource strategies and performance management strategies for educational technologists.</p> <p>Further empirical research to analyze current issues and future trajectories relating to their aspirations, career structures, legitimate power, management and organizational contexts is proposed.</p> <p>Originality/value - Given the strategic importance of educational technologists to information and communications technology-driven transformation, university leaders will require</p>

No	Title/Reference	Objective	Abstract
			evidence to formulate appropriate human resource and performance management strategies for these key academic-related/professional staff. This paper brings together relevant literature for the first time, generates recommendations for further research and policy discussion.
11	<p>A model of leadership in integrating educational technology in higher education</p> <p>Markova, M. (2014). A model of leadership in integrating educational technology in higher education. <i>Online Journal of Distance Learning Administration</i>, 17(4), 1-12.</p>	<p>The purpose of this paper is to identify the reasons why faculty members are not fully embracing technology and what leadership exists in those institutions to help instructors adapt to technology in the teaching and learning process. The authors examine instructor's perceptions and attitudes related to educational technology as it applies to the learning process and investigated the organization-wide view of leadership in the education institutions.</p>	<p>The potential impacts and implications of technology on the professional lives of instructors in higher education, and the role of leadership in integrating educational technology, present a variety of complexities and challenges. The authors also developed a theoretical model for how leadership can be applied in the use of educational technology in higher education. The model contains five major blocks. In addition to the concerns of higher education faculty, this paper also considers the impact educational technologies have on instruction itself and why many faculty members view the technology as being too difficult to apply to existing technology infrastructure.</p>
12	<p>An examination of open and technology</p>	<p>This study aims to investigate the</p>	<p>In order for a smooth and problem-free transformation to</p>

No	Title/Reference	Objective	Abstract
	<p>leadership in managerial practices of education system</p> <p>Akcil, U., Aksal, F. A., Mukhametzyanova, F. S., & Gazi, Z. A. (2017). An examination of open and technology leadership in managerial practices of education system. <i>EURASIA Journal of Mathematics Science and Technology Education</i>, 13(1), 119-131.</p>	<p>relationship between open leadership, digital citizenship, technology acceptance and self-efficacy in technological leadership.</p>	<p>take place in a digitalizing education system, efficient management is needed. Thus, educational managers need to improve their skills and develop behaviors suitable for taking education systems into the digital age. Social networks enable leaders to become digital citizens by embracing and implementing “Open Leadership”. Acceptance of technology and self-efficacy in technological leadership are both seen as factors that can have positive or negative influences on the new leadership styles. Working with a group of 153 education managers, the research was conducted using a relational screening model. Following multiple regression analyses, it was found that technology acceptance and self-efficacy in technological leadership positively influences digital citizenship at medium level and that self-efficacy in technological leadership and digital citizenship positively influences open leadership</p>

Inclusion criteria

The following three inclusions criteria were applied for the systematic review:

- (i) All articles must report on studies that were conducted in an educational setting and must focus on technology leader in education.
- (ii) Samples of the study must include those in the education context.



- (iii) Only research papers or original papers published in Q1–Q4 journals as ranked by The Scimago Journal and Country Rank at <http://www.scimagojr.com/index.php> would be included either Quartile 1(Q1) or Quartile 2(Q2) or Quartile 3(Q3) or Quartile 4(Q4).
- (iv) Articles regarding studies on technology leader that were conducted in Malaysia were included regardless of their publication the articles do not categorized as high impact articles. The purpose of this inclusion was the lack of quality articles in the Malaysian context and the need to highlight the research gaps pertaining to the Malaysian context.

Exclusion criteria

The following two exclusion criteria were based upon in selecting articles for the review:

- (i) All articles published in conference proceedings were rejected from this analysis, the purpose being to include only peer-reviewed articles that are published in high-impact journals. Certainly, applying this criterion would exclude a vast number of articles that have reported initial findings related to the topic; however, it was decided that the aim was to ensure the quality of the selected publications so as to produce valid and reliable findings.
- (ii) All articles that offer only recommendations and do not report on an explicit method of data collection were discarded.

These inclusions criteria in this systematic review were significant because they can predict future research. Since the focus of this systematic review was on technology leader in education, articles concerning similar field and focus were highlighted. The countries in which the related studies were conducted were also included because these criteria would have some implications on the cultural and pedagogical backgrounds of teachers. Research and theoretical frameworks, methods, and participants of the previous studies were analyzed in the systematic review. Identifying a relevant framework for framing an investigation is important so as to ensure rigor and trustworthiness of the findings. The number of participants in the studies it was recorded because the information can guide the designing of subsequent studies. Table 1 above illustrates the methods of systematic review that explained in inclusion criteria section. This table presents the type of data that were collected, thus revealing the orientation of each study that was reviewed.

Discussion

The systematic review led to several notable findings in terms of the research gaps hence the future directions of research of technology leader in education. Based on the analysis on Miles's (2017) taxonomy of research gaps, three constructs were derived, i.e., knowledge gap, methodology gap, and theoretical gap. These three constructs, which are inter-related, have been widely discussed in the literature hence were explored further for the present study. CHAT

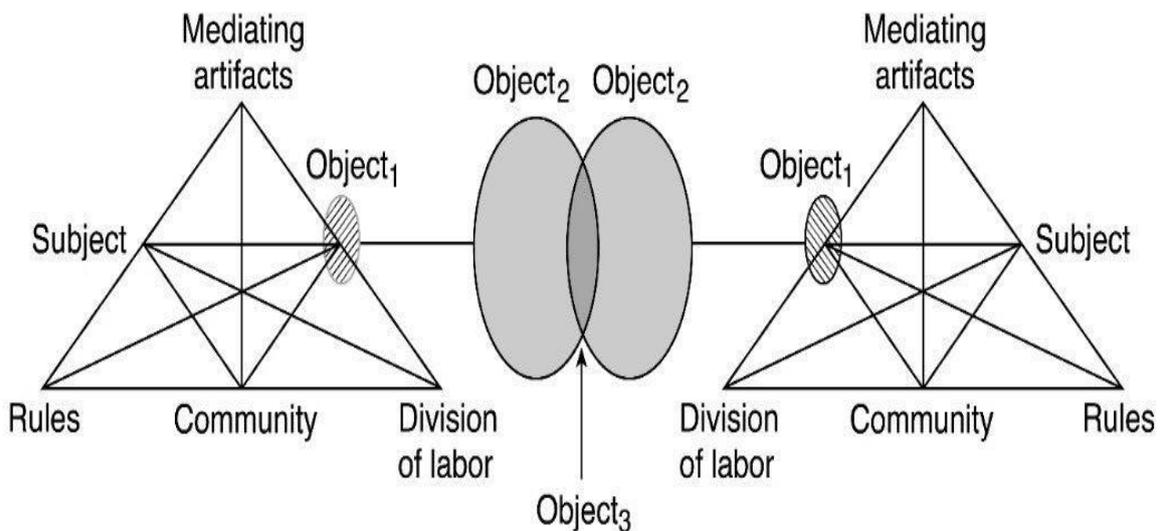
and ASA were used to explain the theoretical gaps and facilitate the researchers' production of holistic activities conducted by an individual or a group (Yamagata-Lynch, 2010).

Cultural-historical activity theory: Yrjo Engestrom (1987, 2001)

CHAT can be used as a descriptive tool for describing the components and the interrelationships of human activity which are inter-related in the activity systems. However, as emphasized by Engestrom, in order to explain cultural diversity issues, CHAT to be an application of ASA in developmental research. Engestrom then developed conceptual tools “to understand dialogue, multiple perspectives, and networks of interacting activity systems” (Engestrom, 2001, pp. 135-136: see also 2015). Engestrom also expanded the unit of analysis (

Figure 2 below) from a single activity system to two or more interconnected activity systems (Engeström & Kerosuo, 2007; Harry Daniels, 2007). CHAT has assisted researchers to analyze the “historical relationships among multiple activities by identifying how the results from a past activity affect new activities” (Yamagata-Lynch, 2010, p. 2). The CHAT also can be used with the ASA as a research methodology for explaining a school’s cultural diversity. For example, Razak, Jalil, Krauss, and Ahmad (2018) who studied school culture revealed that school stakeholders had worked together to resolve the tensions introduced by “contradictions” in different activity systems, which in turn, had shaped the school’s ICT culture hence the success of ICT integration in schools. Research on technology leader in education also can be explored using a similar perspective.

Figure 2. Two interacting activity systems as minimal model (Engestrom, 2001, p. 136).



Activity systems analysis

CHAT emphasizes that ASA is a methodology that can be valuable for qualitative researchers to understand human activity situated in a collective context. ASA is also well-suited with a case-study research because ASA involves the investigation of self-sustained systems that are problematic to be removed from the context (Yamagata-Lynch, 2010). According to Yamagata-Lynch (2010), this methodology can guide researchers to design, implement, analyse, and develop conclusions for research studies including program evaluations. The ASA can also be used to map human interactions in natural settings. Over the past two decades, several studies have referred to ASA as a descriptive tool to (i) capture the processes involved in organizational change (see Barab et al., 2004; Harness & Yamagata-Lynch, 2016), (ii) identify guidelines for designing constructivist learning environments (see Jonassen & Rohrer-Murphy, 1999), (iii) identify systemic contradictions and tensions that shape developments in educational settings (see Barab et al., 2002), (iv) demonstrate historical developments in professional development (see Yamagata-Lynch, 2003), and (v) determine the factors and interaction between factors that support teachers' integration of ICT (see Divaharan & Lim, 2010). Yamagata-Lynch (2010) emphasized the need for further application of ASA as a research methodology.

Yamagata-Lynch (2010) pointed out three advantages of the ASA. First, the ASA provides new methods for researchers to extract the essence of complex data in a graphics model that they can communicate with others. Second, using ASA allows researchers to compare one human activity with another based-on data, while drawing systemic implications. Third, the ASA can also facilitate researchers' organizing their analysis with a framework while building a reliable interpretation of data and minimize the overwhelming task of analysing and making sense of complex data from real-world settings. The fourth advantage was identified from our reflection and observation of the methodology; we found that the ASA was able to guide us in presenting how human confronted tensions as evidence of "contradictions" in collective human activities.

CHAT as an analytic lens to conduct ICT integration and technology leader research

Prominent scholars of ICT in education claim that CHAT can be used as an analytic lens "to analyse successes, failures, and contradictions in complex situations, as in most ICT-mediated learning environments, without reductionist simplifications" (Bannayan et al., 2014, p. 9). In the past decade, researchers used CHAT to explain ICT integration (Demiraslan & Usluel, 2008; Divaharan & Lim, 2010; Laferrire, Hamel, & Searson, 2013; Lim, 2007; Razak et al., 2018). For example, Laferrire et al. (2013) evaluated barriers to the successful implementation of technology in rural schools in Canada. Laferrire et al. (2013) defined the barriers as "tensions



that pulled constituents of an activity system or activity systems in opposite directions” (p. 463). They argued that the process of overcoming barriers by emphasizing the contradiction notion of CHAT, which would lead to successful ICT integration. Other studies have revealed the contradictions that occurred in activity systems in order to understand the “breakdown” in relationships (Demiraslan & Usluel, 2008; Murphy & Rodriguez-manzanares, 2008; David, 2017).

Limitations

This systematic review incorporated the data obtained from the quantitative and qualitative studies. The difference between the quantitative and qualitative studies is that the participants involved in the qualitative study was small and therefore the findings cannot be generalized. A qualitative study was needed in this systematic review because the review involved all studies under the inclusion criteria, which served to ensure the identification of valid and reliable of research gaps that can inform the directions of future research.

Implications for future directions

This systematic review can serve as a guideline for future research directions to novice researchers specifically through the provision of more specific guidelines in regard to choices of issues, theories and methodologies for researchers interested in examining teachers’ ICT integration. Future research might focus on in-house technology leader talent development. The study can also be referred by researchers intending to incorporate CHAT with the ASA approach in analysing data.

Conclusion

The study was prompted following the lack of identification of research gaps pertaining to the development of technology leadership in education. To identify this gap, the study was carried out by means of a systematic review. The purpose of the current systematic review is to critically evaluate relevant studies on nurturing technology leader in education, the purpose being to examine the directions of future research. Results from this systematic review was based on Miles's (2017) taxonomy of research gaps that has been widely discussed in the literature.

The systematic review adopted in the present study was holistically designed to include a search strategy of selecting journals, searching for articles using careful selected keywords, and categorizing the articles obtained based on inclusion criteria that were considered relevant to identifying the research gaps. Findings from the current review, in turn, could prompt several areas for investigation in future studies on technology leader in education.



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