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Successful implementation of information and communication technology integration in Malaysian public schools: An activity systems analysis approach

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ABSTRACT

This multiple-case study drew upon Engeström's (1987) activity theory (AT) to understand the conditions and explain the systematic contradictions that facilitate successful Information and Communication Technology (ICT) integration in schools. The data were collected through in-depth interviews and document analysis from one primary and one secondary public school in Malaysia. In-depth interviews were carried out with nine participants, including principals, ICT coordinators, and teachers. Findings revealed three conditions that led to successful ICT integration: 1) types of ICT tools in the school, 2) rules and regulations in the school that shape the ICT culture, and 3) division of labour within the school community. The findings indicate that school stakeholders must work together to resolve tensions introduced by systemic contradictions in different activity systems, which shape school ICT culture. The study aims to enrich the discourse on ICT integration by assisting school stakeholders to reflect on their own ICT integration strategies.

1. Introduction

ICT integration involves the utilization of technological tools that can support teachers to be innovative and effective in teaching while allowing students to learn at their own pace. Various studies have documented the impact of global ICT integration on every level of the school community, including students, teachers, peers, and experts, in the process of acquiring and sharing knowledge (Donnelly, McGarr, & O'Reilly, 2011; Gunjan, 2016; Sultan, Woods, & Koo, 2011). New learning environments support knowledge sharing and learning collaboration with the use of computers (Anderson, 2008). ICT integration in schools does not just occur within the school building, but beyond the classroom as well due to the availability of technologies that connect students with teachers, peers, and experts across vast distances and at any time. Students can access educational resources, such as interactive subject contents with multimedia, communicate through social media platforms like Facebook and Twitter, and participate in active and collaborative learning through applications like ZohoWriter, and Google Hangout messenger (Gunjan, 2016; Parycek, Sachs, & Schossböck, 2011; Tay, Lim, Lim, & Koh, 2012).

Organizational change is key to ensuring successful ICT integration in schools (Laferrire, Hamel, & Searson, 2013; Tearle, 2004). High ICT investment in schools does not guarantee that the technology will be used effectively for teaching and learning purposes. Previous studies conducted mainly in advanced economies portray how roles, rules and activities within a school's sociocultural context reflect how the organization must change for successful technology integration (Laferrire et al., 2013). A lack of understanding about the conditions pertaining to organizational change affects successful ICT integration in schools (Laferrire et al., 2013). Scholars have revealed the links between lack of organizational change and technological investment (Divaharan & Lim, 2010; Lim, Zhao, Tondeur, Chai, & Tsai, 2013). Lim et al. (2013) found that after comparing the outcomes achieved through investment in technology with sectors outside education, the gains in terms of reduced costs and increased productivity achieved by schools were significantly smaller. They urge organizational change for schools by focusing on an over-arching ICT strategy to provide clear direction to the key players especially subject teachers, ICT teachers and ICT coordinators.

As a nation, Malaysia is one of the highest in terms of ICT expenditures in schools (Ministry of Education Malaysia [MOE], 2013). The Malaysian government has allocated more than RM6 billion for ICT initiatives in education. However, recent studies indicate a low level of ICT usage in Malaysian schools (Alazzam, Bakar, Hamzah, & Asimiran, 2012; Umar & Hassan, 2015). In November 2016, Malaysia's Educational Technology Division (ETD) endorsed a list of schools with

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different levels, or star rankings, to evaluate the implementation of ICT integration in each school. The star ranking system for level of ICT integration is based on the Smart School Qualification Standards (SSQS), ranging from 1 Star (lowest) to 5 Star (highest). The SSQS is an appraisal indicator for each school in terms of technology utilization (40%), human capital (40%), applications (10%) and technology infrastructure (10%). These indicators are intended to show not only the school's ability in performing general ICT operations, but also in developing creativity, interactivity, collaborative learning, critical thinking, and problem-solving skills through such tools (Frost & Sullivan, 2010; Malaysia National ICT Initiative [MSC], 2009). Missing from Malaysia's system of ICT integration success is an understanding of the conditions or factors that contribute to success ICT integration in schools. Thus, to date, little is known as to why certain schools are more successful than others at integrating ICT into teaching.

Drawing on Engeström's Activity Theory (AT) (1987), the first aim of this study was to understand how the conditions within different activity systems have led to the successful integration of ICT into teaching. Second, the study set out to explain how systematic contradictions within and between activity systems affect the success of ICT integration in schools. The study research questions were: 1) how is the integration of ICT into teaching successfully implemented; and 2) how do systemic contradictions that introduce and resolve tensions lead to successful ICT integration?

This multiple-case study investigated successful ICT integration in two types of Malaysian schools, based on the schools' achievement of being given a five-star ranking (i.e., highest level of success) as reported by the Malaysian Smart School Qualification Standards (SSQS). ICT integration is defined as the use of technology to facilitate the connection between modern technologies and teachers, students, peers, educational resources and also experts inside or outside classrooms. Within Malaysian education policy circles, it is believed that a failure to embrace educational technological advancements could cause Malaysia to lag behind other nations by not preparing its workforce with the skills suitable for a high-income economy. Without a well-executed implementation by schools to produce the necessary ICT skill sets, it will be more challenging for Malaysian students to compete later on. Successful ICT integration in schools thus requires properly planned and optimized technology investment decisions. In line with this need, this paper sought to explain the importance of understanding successful implementation of ICT integration in schools.

1.1. Study context

The Malaysian Ministry of Education (MOE) began investing in technological integration in the 1980's. The first ICT program was the formation of the MOE-MIMOS Joint Committee in 1986, which marked the initiation of broad-based computer usage in Malaysian schools. In 1997, the MOE proposed Smart Schools, a program that utilized high capital-intensive investments to provide schools with ICT infrastructure. In 2006, 88 Smart Schools were selected as 'model schools' to act as a reference for Smart School concepts, materials, skills, and technologies developed by MOE (Frost & Sullivan, 2010). In 2013, the Ministry aimed for all schools to officially qualify as "Smart Schools" by achieving minimum standards of ICT utilisation, capability, availability of infrastructure, and applications integrating ICT into the teaching and learning process (Ministry of Education Malaysia [MOE], 2013). Since then, various additional ICT programs have been introduced into the education system, including 1BestariNet and VLEFrog.

Despite these efforts, issues regarding ICT infrastructure in schools, particularly Internet connectivity and accessibility, still need to be addressed to ensure the successful implementation of ICT integration. To address this need, the Ministry has introduced 1BestariNet under Wave 1 of the Malaysian Education Blueprint 2013-2025. The 1BestariNet aims to equip all public schools, approximately 10,000 primary and secondary schools across Malaysia, with high-speed 4G Internet access and a virtual learning environment (VLE). The VLE benefits 5.5 million students, 500,000 teachers, and 4.5 million parents. VLE enables teachers to share educational materials, online assignments, learning sites, and digital textbooks with their students (Xchanging, 2014). By the end of Wave 1 in 2015, a total of 8940 schools nationwide were connected to 1BestariNet (Ministry of Education Malaysia [MOE], 2015).

Despite these ICT initiatives, few studies have looked at the ICT integration process in Malaysia. Therefore, it is timely to examine how ICT integration can act as a mediating tool to enhance students' access to knowledge. The activity system of ICT-integrated teaching involves the entire school ecosystem including ICT coordinators, principals, Ministry officials, Parent-Teacher Associations, and alumni. This systemic way of looking at the activity systems can assist in understanding how ICT becomes part of a school's teaching process. Furthermore, researchers have noted that the most appropriate time to study the implementation of an initiative is approximately three years following its implementation (Fullan & Stiegelbauer, 2001). Hence, ICT integration in Malaysia needs to be studied holistically with a clear theoretical underpinning in order to provide an in-depth understanding of the ICT integration implementation in schools.

2. Theoretical framework: activity theory

Engeström's Activity Theory (1987), is a descriptive tool to describe the components — and their interrelationships in different forms — of human activity as a developmental process (Daniels, 2004; Kuutti, 1996). AT is also referred to as cultural-historical activity theory (CHAT). Engeström (1987, 2001, 2015) differentiated the evolution of the theory into three phases referred to as first, second and third generations. In the first generation, Vygotsky proposed the idea of mediation, expressed as the triad of subject, object, and mediating artefact (see Vygotsky, 1978, p. 40). According to Engeström (1987, 2001, 2015), the limitation of this idea was its focus on the individual as the unit of analysis. He stated that "the individual could no longer be understood without his or her cultural means; and the society could no longer be understood without the agency of individuals who use and produce artefacts" (p. 5).

This limitation was overcome when the second generation came into place, inspired by Leont'ev's work, which introduced the idea that a historically evolving division of labour has brought about a crucial differentiation between an individual action and a collective activity. Leont'ev also brought the notion of mediation as not only a mediating artefact, but also other humans and social relations in human activity (Engeström & Miettinen, 1999). Leont'ev's conceptualization was transformed into a graphical model by Engestrom (Engeström, 1987, p. 78). Engeström (1987, 2001, 2015) called the graphical model an activity system, as shown in Fig. 1. Engestrom also conceptualized the role of society and how collaboration influences the way people act.

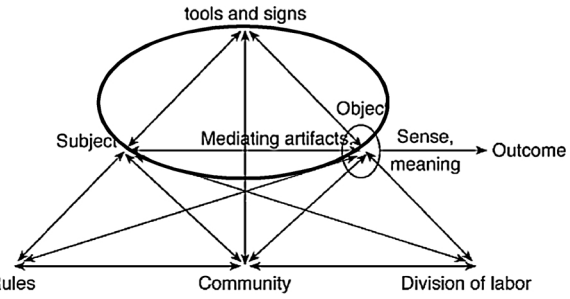

Fig. 1. The structure of a human activity system in Activity Theory (Engeström, 1987, p. 78).
Note: The large oval refers to the first generation of activity theory (Vygotsky, 1978, p. 40). The small oval indicates that "object-oriented actions are always, explicitly or implicitly, characterized by ambiguity, surprise, interpretation, sense making, and potential for change (Engestrom, 2001, p. 134).