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The Implementation of Bring Your Own Device (BYOD) at School through Actor-Network Theory (ANT)

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Abstract

This conceptual paper explores the implementation of Bring Your Own Device (BYOD) initiatives in schools from the perspective of Actor-Network Theory (ANT). The article commences by examining the significance of technological innovation in the educational realm, specifically highlighting the transformative nature of BYOD initiatives. Subsequently, it delves into the theoretical underpinnings of ANT and its suitability for comprehending the implementation of BYOD in schools. The paper introduces the concept of innovation translation, which underscores the process of bridging the gap between technological innovations and educational practices. By employing ANT, the paper conceptualizes the implementation of BYOD initiatives as a complex network comprising intricate relationships and interactions among human and non-human actors. This conceptualization takes into account the involvement of devices, infrastructure, teachers, students, and other stakeholders in shaping the implementation process. Ultimately, the article concludes by underscoring the significance of ANT in providing a comprehensive understanding of the intricate dynamics and complexities associated with BYOD implementation. Consequently, this understanding can inform the development of effective strategies and interventions to foster successful BYOD implementation within educational settings.

Keywords: Actor Network Theory, BYOD, Bring Your Own Device

Background

Technological Innovation in Education

Education plays a crucial role in shaping and preparing future society to survive and thrive in future world. Education not only to be comprehensive, sustainable, and well prepared to remain relevance but fast changing, and continuously evolve due to uncertainty globalized world. Therefore, education need innovation to remain significant. Innovation is commonly defined as introducing of a new thing or method (Dixon & Tierney, 2012). While some scholars also define innovation as finding new ways of doing things to address specific problems (Jewitt et al., 2017; Smith, 2006). In a simple word, innovation is move from

conventional practices and doing things with new perspective to solve the problem and achieving success.

In the context of education, innovation means as doing what is best to all students for productivity and efficiency of learning (Rahmat, 2020). It is involve introduction of new or an improved practices, approaches or tools in one, several, or all aspects in education and see as a process (OECD, 2019). For instance, make a change or improvement in teacher teaching technique, student learning process, instructional tool, or institutional practices (Serdyukov, 2017). Innovation in education always relate to technology. This is widely reported and extensively explored in the literature that technology help students and teacher in term of accessibility needs, reduce the repetitive and time-consuming work in teaching and learning (Haleem et al., 2022).

In recent years, there has been a significant increase in the adoption of technology innovation in education. A study by (Howard & Mozejko, 2015) record that technology innovation in education since late 1890s. There are several types of technology that was introduced. For instance, film, radio, television, computer, laptop. Now, there are trending to use mobile device like smartphone, tablet, or iPad in the classroom. Therefore, many countries started to fund a device for each of student. This idea undergirded a one-to-one computing initiative, an initiative where all students are each provided with a laptop or computer (Fleischer, 2012; Islam & Grönlund, 2016). The initiative boosted exponentially when laptop was discovered to be more affordable and lightweight, with growing availability of wireless connectivity (Harper & Milman, 2016). There are several projects that have been identified related with funding laptops to students (e.g., One Laptop Per Child – America; Emerge Project – Alberta, Canada; Digital Revolution Program – Australia; DigiOps Project – New Zealand). These projects have provided thousands of laptops to students. Somehow, the significant number of these projects is bringing the initiative to a halt due to the constraint on education budgets (Maher & Twining, 2017) as well as the difficulty for school to maintain the implementation (Hopkins et al., 2016).

Bring Your Own Device (BYOD) Initiative in Education

The rapid development of digital devices such as smartphones, iPads, and tablets, which are now affordable and accessible to users, indirectly positions digital devices as one of the important tools for personal use (Doargajudhur & Dell, 2019). Furthermore, it has become a recent practice for companies and industries to allow the use of personal devices for work purposes (Palanisamy et al., 2020). The utilization of commonly used tools in daily life greatly aids in facilitating tasks and work. Therefore, personal digital devices have started to be permitted for use in organizations and companies.

The initiative of using personal devices has been adopted in other fields such as medicine, business, and education (Brinker et al., 2012; Larner, 2012; Moyer, 2013; Selwyn et al., 2017; Song, 2014). The primary focus of implementing these initiatives to enhance work efficiency (Larner, 2012; Moyer, 2013). However, there exists a difference in focus when it comes to the field of education. Bring Your Own Device (BYOD) initiative in education is defined as the practice of allowing students to bring their personal laptops, tablets, smartphones, or other mobile devices to class (Johnson et al., 2013). Meanwhile, Song (2014) defined BYOD more comprehensively by including functionality and purpose of devices. He

refers to definition of BYOD as “a model where students bring a personally owned mobile device with various apps and embedded features to use everywhere, anytime for the purpose of learning” (p.52).

BYOD initiatives have gained significant attention in recent years. (L. Johnson et al., 2015) in New media Consortium reported that BYOD is gaining acceptance in schools all over the world due to their potential benefits of BYOD in terms of personalized learning, increased student engagement, and cost savings for educational institutions. By utilizing their personal devices, students have access to a familiar learning tool that can be customized to their preferences and needs. Therefore, BYOD is seen as a solution to increase student access to education, but at the same time lowering the cost (Kiger & Herro, 2015). The BYOD initiative is seen as a technological innovation and a new alternative for implementing technology integration in schools. The implementation that shifts the provision of technology from the government and schools to parents goes through a process of technology adoption until it becomes a practice.

The implementation of BYOD into schools has elevated them as the primary technology for active engagement in teachers' pedagogy and students' learning. The involvement of personal devices in teachers' pedagogy and students' learning can transform the traditional practices that were commonly followed prior to implementation. Consequently, personal devices can bring benefits to both teachers' pedagogy and students' learning.Students' personal devices contain various software and applications such as Edmodo, Evernote, Skitch, Google Docs, Skype, iMessage, and editing applications. The emergence of diverse software and applications with various advantages has encouraged teachers to use them in their teaching practices. Previous research reports have revealed that teachers incorporate personal devices in their teaching, facilitating collaborative learning and inquiry-based learning (Falloon, 2015; Maher & Twining, 2017; Song, 2014, 2016; Song & Wen, 2018).

Literature highlights on personal devices in schools have found that collaborative learning and of inquiry-based learning are widely used strategy. Pedagogical changes can be observed when there is interaction among students and between students and teachers involving personal devices (Parsons & Adhikari, 2016). Students work together to understand concepts, take notes, record videos, and complete assigned tasks in groups (Maher & Twining, 2017; Song, 2016). Personal devices serve as tools that facilitate students in recording information, taking pictures, and recording videos during the inquiry activities. Moreover, the advantages of personal devices such as compact size, durability, and portability allow learning to take place outside the classroom. Thus, the presence of personal devices proves highly advantageous for both teachers and students in fostering pedagogical advancements and facilitating enhanced learning experiences.

In addition to their numerous benefits, personal devices contribute significantly to student learning. One notable advantage is that personal devices enable learning to extend beyond the traditional boundaries of the classroom, allowing students to access educational materials that are not limited to the physical learning environment (Ott et al., 2018). Furthermore, personal devices facilitate access to learning resources from home, offering students the opportunity to engage in learning activities outside of school hours (Johnson, 2019). Consequently, the utilization of personal devices indirectly allows learning to occur

anywhere, transcending the confines of the classroom (Adhikari et al., 2017). Moreover, the incorporation of personal devices in the educational setting has capture students' interest and encourage their active participation in the learning process. As a result, their engagement levels increase, leading to positive changes in their motivation to learn (Adhikari et al., 2017). Ultimately, the integration of personal devices fosters a positive attitude towards classroom learning and contributes to a rewarding and enjoyable learning experience for students (Song, 2016).

Furthermore, there is evidence that the use of personal devices can transform the classroom learning environment. Teachers report that the classroom atmosphere becomes more productive and enjoyable (Parsons & Adhikari, 2016). Students also acknowledge that the integration of personal devices in learning makes the classroom learning environment more enjoyable (Chou et al., 2017; Wong, 2014). Moreover, the integration of personal devices in learning also enhances students' knowledge and understanding. In the classroom, students are often required to search for, process, and explain information acquired using personal devices (Adhikari et al., 2016). As a result, students gain more in-depth knowledge and understanding (Song, 2014, 2016; Song & Wen, 2018).

However, the literature has also identified a range of challenges associated with BYOD implementation. One key challenge is the issue of infrastructure as part of technical factor that needs consideration. Infrastructures consist of resources and arrangements of school to support learning environment. Mostly, infrastructure mentioned are internet or Wi-Fi connection; and device and software compatibility (Bulfin et al., 2016; Ferdiana & Hoseanto, 2018; Joyce-Gibbons et al., 2018; Maher & Twining, 2017). Yeop et al (2018) listed more details about infrastructure that schools need to consider such as power sockets for charging devices, lockers for device storage and classroom arrangement of table and chairs. All of these infrastructures need thorough attention to minimize the emergence of technical issue.

The literature has also identified a range of social factors that can impact the success of BYOD implementation. Schools are facing problem with different type of devices used in classrooms (Adhikari et al., 2017; Parsons & Adhikari, 2016). Precisely, not all devices have the same specification and system. Malfunction devices such as missing keys, lagging and cracked screens exacerbated the situations (Selwyn et al., 2017). While teachers have a huge challenge to actively participate and shift their teaching practices (Kiger & Herro, 2015). Majority of parents mention about financial inability to provide devices and lack of digital skills (Adhikari et al., 2017; Parsons & Adhikari, 2016; Yeop et al., 2018). Parents also having problem to provide devices recommended by school because of financial inability. This problem may spark the issue of digital divide (Song, 2016). Some parents can only provide the device but have problem in device maintenance (Parsons & Adhikari, 2016).

Consequently, implementation of BYOD needs consideration on stakeholder support such as from parents, teachers, and community. Administrators need to support and encourage teachers to use technology by giving them training and time to adapt and learn (Cho, 2017; Rae et al., 2017). Similarly, administrators need support from parents (Kiger & Herro, 2015). Parents are an important entity in supporting BYOD implementation (Joyce-Gibbons et al., 2018) as provider of devices to their children. Whereas administrators also need support from community in term of funding. Community members like businesspeople

and philanthropists can help to subsidize device to students (Hopkins et al., 2016). Supports from all stakeholders will ensure smooth BYOD operation.

Overall, the existing body of literature suggests that BYOD initiative implementation in education is a complex and multifaceted process that involves a range of technical and social factors. There is a crucial need a theoretical framework that can effectively analyze the relationships between human and non-human actors in the implementation process. This theoretical framework is essential to make sense of the interplay between the various actors and factors involved and illuminate the complexity of BYOD implementation. Therefore, a more nuanced understanding of BYOD implementation in the school setting is vital for maximizing the benefit of technology innovation in educational environments.

Discussion

Theorising BYOD Initiative Implementation in School

When technological innovations like BYOD initiative are introduced, a new technology or method will not be automatically accepted or adopted by potential users. Therefore, it can be understood that innovation also involves the process of acceptance and utilization of new technology or methods in the existing practices of individuals or organizations. Consequently, studies related to technological innovation do not solely focus on the creators and their new creations; instead, they emphasize how individuals or organizations accept and use these new creations (Gupta et al., 2007; Tatnall, 2020).

In addition, education involves individuals such as school administrators, parents, teachers, and students. Therefore, research on technological innovation in education is concerned on how individuals within the education system receive and use a technology to transform and improve educational practices (Liu et al., 2020; Tatnall, 2019). Furthermore, studies on technological innovation in education have also extended to the exploration of issues that arise between individuals involved and the technology being used, in order to avoid or at least minimize resistance to the adoption of technology (Tatnall, 2019; Teo, 2011).

Therefore, previous studies have highlighted that there are various theories that can be used to describes the process of adopting and adapting technology into practice (Imtiaz & Maarop, 2014; Lai, 2017; Tatnall, 2020). For a better understanding, Tatnall (2020) have describe well the related theories of technological innovation that can be used (The Linear Model of Innovation, The Diffusion of Innovations, The Theory of Reasoned Action (TRA), Social Cognitive Theory (SCT), The Theory of Planned Behavior (TPB), The Decomposed Theory of Planned Behavior (DTPB), The Technology Acceptance Model (TAM), Augmented TAM (or Combined TAM and TPB), TAM2, The Unified Theory of Acceptance and Use of Technology (UTAUT), Actor-Network Theory). The most appropriate model to use depends on the scale, complexity, and nature of the phenomenon.

As BYOD initiative are related between human and non-human actors in the implementation process, there is need a theory that can examine the relationships and interplay between the various actors to reveal the complexity of BYOD implementation. Actor-Network Theory (ANT) is a theory that places equal importance on both humans and non-humans during examination. In fact, ANT not only focuses on humans as important actors but also recognizes and emphasizes the role played by non-human. Moreover, ANT, through

its 'sensitivity,' is capable of highlighting "the complexity, disruptions, and ambivalence that occur within phenomena" (Fenwick & Edwards, 2010, p. 1).

Therefore, this study employs Actor-Network Theory (ANT) as a theoretical lens to explore the implementation of BYOD initiative in schools. The study focuses on the interactions that occur among humans (e.g., teachers, students, administrator, ICT coordinators, computer technicians) and non-human actors (personal devices, technological tools).

Actor-Network Theory (ANT)

Actor-Network Theory (ANT) is a theory used in the field of Science and Technology to define the relationship between material (objects and technology) and the social through networks (Callon, 1984; Latour, 1987). ANT was developed in the 1980s by two renowned French scholars in the field of Science and Technology, Michel Callon and Bruno Latour, along with a British sociologist, John Law. ANT functions by mapping the simultaneous relationships between material (objects and technology) and the social (Fenwick & Edwards, 2010). In other words, ANT helps to gain a deeper understanding of how material and social elements emerge, come together, and attempt to stay connected, forming relationships and networks that produce effects (Fenwick & Edwards, 2010). Therefore, in the context of this study, ANT will assist in understanding the interactions involved in the integration of humans and technology (such as teachers, students, and personal devices) during the implementation of students bringing personal devices to school.

ANT does not deny any distinction between technology and the social. Callon (1984) explains that the observation conducted through an ANT approach does not favor scientific, technological, or social arguments. In other words, "there is no privileged standpoint and no filtered interpretation" (Callon, 1986, p. 200). Therefore, Law (2004) emphasizes that researchers should pay attention to all aspects of the phenomenon, especially issues, complexities, and controversies within the studied phenomenon. The emphasis is not merely on reporting the observed phenomenon from an external observer's perspective, but rather actively engaging and participating in the 'world' to produce specific accounts of the investigated phenomenon (Law, 2004). Hence, this study aims to explore the issues, complexities, and controversies that arise during the implementation of BYOD in school.

ANT employs its own terminology to explain its concepts, such as entities, actors, networks, and intermediaries. Entities refer to various entities, whether human or non-human, including material and non-material differences (such as concepts and morals), objects, and actions that were initially not given, not prioritized, and not interpreted (Chen, 2019). Thus, all entities involved in this reality are known as actors. Actors can consist of both humans and non-humans, such as students, teachers, animals, computers, writing tools, texts, graphics, classrooms, furniture, and artifacts. Actors attempt to connect with one another. The relationships among actors form networks. Actors and networks are mutually constitutive. Actors cannot act without networks, and a network must consist of actors. In other words, researchers will interpret the actors involved in forming relationships and interconnectedness, resulting in complex and heterogeneous networks.

Within a heterogeneous network consisting of various actors (both human and non-human), negotiations and adjustments occur to overcome barriers and establish connections.

Understanding of actors and networks is shaped by the researcher's thoughts, suitability, and interests, thereby making the researcher the determinant of actor involvement within the studied network. Within the heterogeneous network, there are also elements known as intermediaries. Callon (1990) defines intermediaries as elements that connect actors and actor actions. There are four types of intermediaries circulating within a network, namely texts, technical artifacts, skills, and money. Table 1 presents examples of each type of intermediary.

Table 1
Examples of each type of intermediary

Type of Intermediaries	Examples
Text	Annual reports, memos, meeting minutes
Technical Artifacts	Computer, device, software
Skill	Abilities, competencies, capabilities
Money	Allocation, financial, resources

Innovation Translation

One important concept in ANT that will be used in this study is translation. The concept of translation was introduced by Callon (1986) as a method to understand what happens when technology are situated within a social system. Latour (1987) also used the term translation to elaborate on anything that occurs when entities (human or non-human) come together, establish connections, and make adjustments to form relationships. The concept of translation is also known as the sociology of translation or innovation translation (Callon, 1986; Latour, 1996). The concept of innovation translation posits that innovations are frequently not embraced in their entirety but rather after a process of "translation" that renders them more suitable for utilization by potential adopters. Thus, there are four phases in the process of translation: 1) problematization, 2) interessement, 3) enrolment, and 4) mobilization.

The first phase is problematization, where each actor attempts to specify the problem and define the roles of other actors in relation to the proposed problem (Callon, 1984). During this phase, the main focus is on the problem that needs to be addressed. Questions such as 'which actors are involved?' and 'what are their roles?' serve as initial steps in identifying the actors and their roles. Subsequently, all actors adjust themselves to other actors to demonstrate their indispensability in the collective. Proposed solutions are put forward so that all involved actors become bound and oriented towards a goal known as an obligatory passage point (OPP). Therefore, the involved actors need to adapt and move towards the OPP. Failure to do so will result in the actors not achieving the targeted goal. In other words, Callon (1984)describes the problematization phase as a coalition among actors that defines their identities and desires.

Next is the phase of interessement, a French neologism meaning 'interest is placed in between or interposition.' During this phase, a series of actions occur by actors who seek to stabilize the identities of other selected actors through the defined problem (Callon, 1984). The aim of this process is to establish roles for each actor. To garner the interest of actors and

involve them in the network, intermediaries in the form of tools and strategies are employed. This process involves competing interests among actors, which includes negotiations, appeals, or invitations to convince other actors to form relationships within the network (Fenwick & Edwards, 2010). This process continues until the goal of interessement is achieved, involving all relevant actors and their roles within the actor network.

The phase of enrollment, on the other hand, describes a series of multidirectional negotiations, attempts of power, or tactics that accompany interessement (Callon, 1984). Therefore, the enrollment phase often occurs concurrently with the achievement of interessement goals. The enrollment phase is considered successful when all actors have reached agreements on their roles, formed alliances, and joined the network. The final phase is mobilization, during which representatives or spokespersons emerge to represent the network (Callon, 1984). Additionally, the alliance among actors has formed a large, stable, and robust network. Actors within the network are depicted as mobilized when they work together to achieve the same goal.

Overall, the translation phase is an iterative process. Callon (1984) emphasizes that the translation process does not necessarily achieve successful outcomes; failures can occur. This is because the stability of the alliance among actors can be disrupted at any time if an actor withdraws from fulfilling their designated roles within the network. This situation refers to the concept of opposition. Opposition arises when an actor rejects or betrays the established identity during the formation of the network. Callon (1984) uses the concept of opposition to demonstrate that alliances composed of actors and networks can be challenged at any stage of translation, be it problematization, interessement, enrollment, or even after mobilization.

Previous studies have shown that by using ANT and innovation translation have provided detailed insights into the implementation and use of technology (Paledi, 2019; Tatnall & Davey, 2001, 2018). For example, Tatnall and Davey (2001) examined through the lens of ANT and innovation translation revealed a detailed process of how a new programming language was introduced and established as part of the curriculum at the university. Furthermore, the study findings also shed light on the fate of the previously marginalized programming languages.

Furthermore, Paledi (2019) utilized innovation translation to investigate the process of implementing m-learning focused only on the mobilization phase, found that various alignments and adjustments were necessary to ensure the sustainability and stability of the m-learning network. The study highlighted the importance of maintaining a stable network through the involvement of both human and non-human actors, such as top management support, external expert assistance, continuous system improvement, and technological accessibility.

Additionally, ANT has also been employed to elucidate failed technology innovations. Tatnall and Davey (2018) revealed the failure of a technology innovation implementation in the Australian education system in 2010. The study was explained in great detail through the lens of innovation translation. During the interessement phase, there was a lack of engagement from key actors in the network, and the introduced Ultranet System suffered from malfunctions, causing difficulties and challenges for teachers in its usage. As a result,

during the involvement and mobilization stages, only a few schools accepted and utilized the Ultranet System. Eventually, the use of the Ultranet System was discontinued in June 2013 (Tatnall, 2019).

In summary, ANT and innovation translation serve as lenses that can help explore the process of implementing technological innovations and the interactions that occur among teachers, students, parents, and technology (Matthews, 2021; Paledi, 2019; Ryu, 2019; Tatnall, 2019; Toro & Tatnall, 2016). Therefore, in this study, the researcher will utilize ANT and innovation translation to investigate the process of BYOD initiative implementing in school. The implementation process and interactions that occur will be analyzed based on the four phases of translation: problematization, interessement, involvement, and mobilization.

Conceptualizing BYOD Initiative Implementation in School using ANT and Innovation Translation

In the context of this study, ANT and innovation translation will be comprehensively used as a lens for the researcher to explore and understand the implementation of BYOD initiative in schools through the four phases of translation: problematization, interessement, enrolment, and mobilization. In the problematization phase, the researcher will begin by identifying the actors involved and their roles in the implementation. Actors in ANT encompass both human and non-human entities, so the researcher will identify the key actors in this implementation.

Next, in the interessement phase, the researcher will investigate the interactions among the actors. The focus will be on the efforts made by the key actors to attract other stakeholders to participate in the implementation, including the students' personal devices. The strategies employed and the intermediaries used to engage the stakeholders will determine the level of actor involvement in the implementation. Then, the enrolment phase requires the researcher to examine the engagement of the actors in the implementation. Actor engagement necessitates continuous negotiation to ensure each actor fulfills their designated roles. Furthermore, during the enrolment phase, the researcher will also address issues such as conflicts, rejection, or resistance that may arise during the implementation.

Finally, when all actors accept their assigned roles and move towards a common goal, the implementation enters the mobilization phase. A network of actors is formed for the implementation of BYOD initiative. Therefore, in the mobilization phase, the researcher will explore the efforts made to maintain the stability of the formed actor network to ensure the continuous implementation of the initiative. In summary, ANT provides a general framework for each phase of translation to help the researcher understand actor interactions, relationships and the processes involved (Callon, 1984; Latour, 2005). The summary of general questions for each phase of sociological translation is presented in Table 2.

Table 2
Questions for each of translation phase

Translation Phase	Question
Problematization	Who are the actors that should be involved? What roles have been assigned to the actors? What motivates the actors to get involved? What challenges are faced? What are the proposed solutions?
Interessement	What efforts have been made to attract actor engagement? What facilities are provided to attract actor involvement?
Enrollment	Is there actor engagement? Are the actors fulfilling their designated roles? Has there been a change in the actors' practices prior to engagement? Is there any resistance or rejection among the actors? Why? What negotiations and adjustments have been implemented?
Mobilization	Has a network of actors been formed? Is the formed network of actors stable? What efforts are being made to maintain the stability of the actor network? Has the innovation achieved success?

The researcher will analyze the actors involved (e.g., school leaders, teachers, ICT coordinators, computer technicians, parents, and students) through four phases of translation to gain a deep understanding of BYOD initiatives implementation in schools. Additionally, the researcher aims to explore detailed information about the efforts made, facilities provided, and issues encountered throughout the implementation process until BYOD initiative is successfully implemented. By integrating ANT and innovation translation as lens, a more comprehensive and nuance analysis can be achieved. The conceptual framework is visually represented in Figure 1.

Conclusion and Summary

There is a large body of literature explained that Bring Your Own Device (BYOD) initiative implementation in education is a complex and multifaceted process that involves a range of technical and social factors. There is a crucial need of a theoretical framework that can effectively analyze the connections between human and non-human actors in the implementation process. Therefore, the most important finding in this study is employing Actor-Network Theory (ANT) and Innovation Translation to analyze the BYOD initiative implementation in education. This study posits that the application of ANT offers a valuable perspective for comprehending the implementation of BYOD in school. By examining the interplay between human and non-human actors, ANT enables researchers to identify the pivotal elements that could impact the successful or unsuccessful implementation of BYOD. This study has highlighted the possibility of employing ANT and Innovation Translation to understand complex process of BYOD initiative in education. As in final point, we proposed future research to employ ANT and Innovation Translation to acquire a more nuanced

understanding of the intricate social and technological factors that shape BYOD implementation in diverse educational settings.

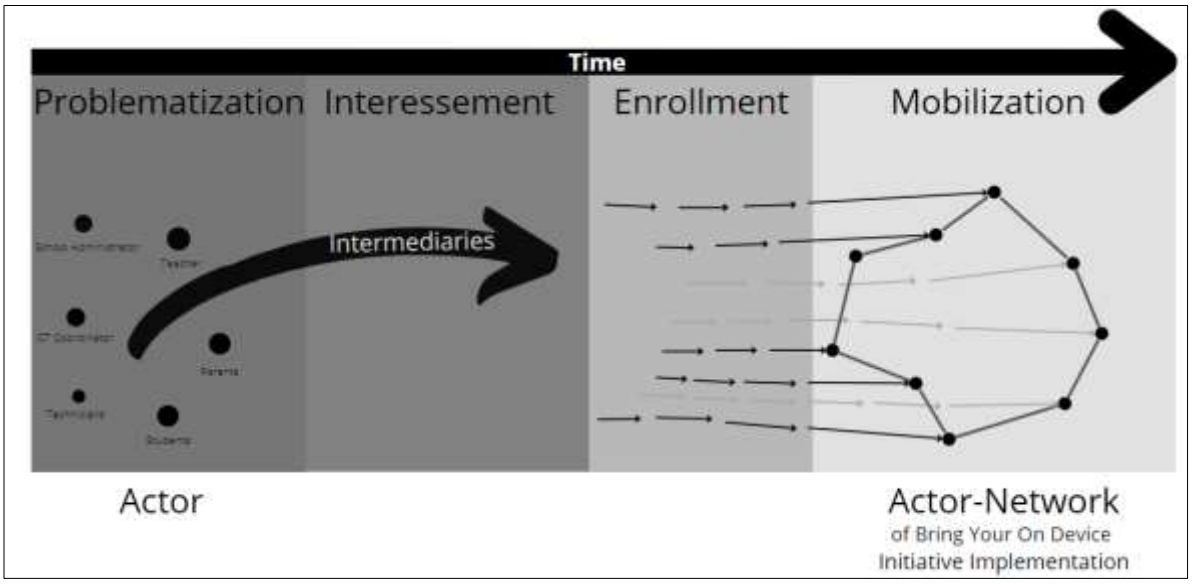

Figure 1. Conceptual framework BYOD initiative implementation integrating ANT and Innovation Translation.

References

Adhikari, J., Mathrani, A., & Scogings, C. (2016). Bring Your Own Devices classroom: Exploring the issue of digital divide in the teaching and learning contexts. *Interactive Technology and Smart Education*. https://doi.org/10.1108/ITSE-04-2016-0007

Adhikari, J., Mathrani, A., & Scogings, C. (2017). A longitudinal journey with byod classrooms: Issues of access, capability and outcome divides. *Australasian Journal of Information Systems*. https://doi.org/10.3127/ajis.v21i0.1693

Adhikari, J., Scogings, C., Mathrani, A., & Sofat, I. (2017). Evolving digital divides in information literacy and learning outcomes: A BYOD journey in a secondary school. *International Journal of Information and Learning Technology*. https://doi.org/10.1108/IJILT-04-2017-0022

Brinker, Mike, Lobaugh, K., & Paul, A. (2012). The dawn of mobile influence. *Deloitte Digital*.

Bulfin, S., Johnson, N. F., Nemorin, S., & Selwyn, N. (2016). Nagging, noobs and new tricks – students' perceptions of school as a context for digital technology use. *Educational Studies*. https://doi.org/10.1080/03055698.2016.1160824

Callon, M. (1984). Some elements of a sociology of translation: Domestication of the scallops and the fishermen of St Brieuc Bay. *Sociological Review*, *32*, 196–233. https://doi.org/10.1111/j.1467-954X.1984.tb00113.x

Callon, M. (1986). Some elements of a sociology of translation. *Power, Action and Belief. A New Sociology of Knowledge?* https://doi.org/10.1111/j.1467-954X.1984.tb00113.x

Callon, M. (1990). Techno-economic Networks and Irreversibility. *The Sociological Review*. https://doi.org/10.1111/j.1467-954x.1990.tb03351.x

Chen, F. C. (2019). Teachers' Reluctance in a BYOD Elementary Classroom. *Proceedings - 2019 8th International Congress on Advanced Applied Informatics, IIAI-AAI 2019*. https://doi.org/10.1109/IIAI-AAI.2019.00060

Cho, V. (2017). Vision, Mission, and Technology Implementation: Going One-to-One in a Catholic School. *Journal of Catholic Education*.

https://doi.org/10.15365/joce.2002082017

Chou, P. N., Chang, C. C., & Lin, C. H. (2017). BYOD or not: A comparison of two assessment strategies for student learning. *Computers in Human Behavior*. https://doi.org/10.1016/j.chb.2017.04.024

Dixon, B., & Tierney, S. (2012). Bring Your Own Device To School. *Microsoft*, *Report by Microsoft Corporation*, 1–16. https://technet.microsoft.com/en-us/library/dn645493.aspx

Doargajudhur, M. S., & Dell, P. (2019). Impact of BYOD on organizational commitment: an empirical investigation. *Information Technology and People*. https://doi.org/10.1108/ITP-11-2017-0378

Falloon, G. (2015). What's the difference? Learning collaboratively using iPads in conventional classrooms. *Computers and Education*. https://doi.org/10.1016/j.compedu.2015.01.010

Fenwick, T., & Edwards, R. (2010). Actor-network theory in education. In *Actor-Network Theory in Education*. https://doi.org/10.4324/9780203849088

Ferdiana, R., & Hoseanto, O. (2018). The implementation of computer based test on BYOD and cloud computing environment. *International Journal of Advanced Computer Science and Applications*. https://doi.org/10.14569/ijacsa.2018.090816

Fleischer, H. (2012). What is our current understanding of one-to-one computer projects: A systematic narrative research review. In *Educational Research Review*. https://doi.org/10.1016/j.edurev.2011.11.004

Gupta, A. K., Tesluk, P. E., & Taylor, M. S. (2007). Innovation at and Across Multiple Levels of Analysis. *Organization Science*. https://doi.org/10.1287/orsc.1070.0337

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*. https://doi.org/10.1016/j.susoc.2022.05.004

Harper, B., & Milman, N. B. (2016). One-to-one technology in K-12 classrooms: A review of the literature from 2004 through 2014. In *Journal of Research on Technology in Education*. https://doi.org/10.1080/15391523.2016.1146564

Hopkins, N., Tate, M., Sylvester, A., & Johnstone, D. (2016). Motivations for 21st century school children to bring their own device to school. *Information Systems Frontiers*. https://doi.org/10.1007/s10796-016-9644-z

Howard, S. K., & Mozejko, A. (2015). Considering the history of digital technologies in education. In *Teaching and Digital Technologies: Big Issues and Critical Questions*.

Imtiaz, M. A., & Maarop, N. (2014). A review of technology acceptance studies in the field of education. *Jurnal Teknologi (Sciences and Engineering)*. https://doi.org/10.11113/jt.v69.3101

Islam, M. S., & Grönlund, Å. (2016). An international literature review of 1:1 computing in schools. *Journal of Educational Change*. https://doi.org/10.1007/s10833-016-9271-y

Jewitt, C., Xambo, A., & Price, S. (2017). Exploring methodological innovation in the social sciences: the body in digital environments and the arts. *International Journal of Social Research Methodology*. https://doi.org/10.1080/13645579.2015.1129143

Johnson, L., Adams Becker, S., Cummins, M., Estrada, V., Freeman, A., & Ludgate, H. (2013). The NMC Horizon Report: 2013 K-12 Edition. In *New Media Consortium*. https://library.educause.edu/~/media/files/library/2017/11/2013hrk12.pdf

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). The NMC Horizon Report: 2015 K-12 Edition. In *New Media Consortium*. https://library.educause.edu/~/media/files/library/2017/11/2015hrk12EN.pdf

Johnson, N. F. (2019). Dysfunctional devices in the classroom meet the habitus of the new. *E-Learning and Digital Media*. https://doi.org/10.1177/2042753019831385

Joyce-Gibbons, A., Galloway, D., Mollel, A., Mgoma, S., Pima, M., & Deogratias, E. (2018). Mobile phone use in two secondary schools in Tanzania. *Education and Information Technologies*. https://doi.org/10.1007/s10639-017-9586-1

Kiger, D., & Herro, D. (2015). Bring Your Own Device: Parental Guidance (PG) Suggested. *TechTrends*, *59*(5), 51–61. https://doi.org/10.1007/s11528-015-0891-5

Lai, P. (2017). The Literature Review of Technology Adoption Models and Theories for the Novelty Technology. *Journal of Information Systems and Technology Management*, *14*(1), 21–38. https://doi.org/10.4301/s1807-17752017000100002

Larner, S. (2012). Smartphones and tablets in the hospital environment. In *British Journal of Health Care Management*. https://doi.org/10.12968/bjhc.2012.18.8.404

Latour, B. (1987). How to follow scientists and engineers through society. In *Science in Action*.

Latour, B. (1996). Aramis and The Love of Technology. In *Harvard University Press*.

Latour, B. (2005). Reassembling the Social: An Introduction to Actor-Network-Theory. In *Oxford University Press*. https://doi.org/10.1017/CBO9781107415324.004

Law, J. (2004). After method: Mess in social science research. In *After Method: Mess in Social Science Research*. https://doi.org/10.4324/9780203481141

Liu, Q., Geertshuis, S., & Grainger, R. (2020). Understanding academics' adoption of learning technologies: A systematic review. *Computers and Education*. https://doi.org/10.1016/j.compedu.2020.103857

Maher, D., & Twining, P. (2017). Bring your own device – a snapshot of two Australian primary schools. *Educational Research*, *59*(1), 73–88. https://doi.org/10.1080/00131881.2016.1239509

Matthews, A. (2021). Blurring boundaries between humans and technology: postdigital, postphenomenology and actor-network theory in qualitative research. In *Qualitative Research in Sport, Exercise and Health*. https://doi.org/10.1080/2159676X.2020.1836508

Moyer, J. E. (2013). Managing Mobile Devices in Hospitals: A Literature Review of BYOD Policies and Usage. In *Journal of Hospital Librarianship*. https://doi.org/10.1080/15323269.2013.798768

Noor Hanim Rahmat. (2020). Innovation in Education: Barriers and Facilitating Factors. *European Journal of Education Studies*.

OECD. (2019). PISA 2018 : Insights and Interpretations. In *OECD*.

Ott, T., Magnusson, A. G., Weilenmann, A., & Hård af Segerstad, Y. (2018). "It must not disturb, it's as simple as that": Students' voices on mobile phones in the infrastructure for learning in Swedish upper secondary school. *Education and Information Technologies*. https://doi.org/10.1007/s10639-017-9615-0

Palanisamy, R., Norman, A. A., & Mat Kiah, M. L. (2020). BYOD Policy Compliance: Risks and Strategies in Organizations. In *Journal of Computer Information Systems*. https://doi.org/10.1080/08874417.2019.1703225

Paledi, V. N. (2019). Perceived Actors and Factors for Sustaining M-learning in Higher Education: A South African Students Perspective. *2019 Open Innovations Conference, OI 2019*. https://doi.org/10.1109/OI.2019.8908200

Parsons, D., & Adhikari, J. (2016). Bring your own device to secondary school: The perceptions of teachers, students and parents. *Electronic Journal of E-Learning*.

Rae, G., Dabner, N., & Mackey, J. (2017). Bring Your Own Device (BYOD) and Teacher

pedagogy in a New Zealand primary school. *Teachers and Curriculum*, *17*(2).

Ryu, S. (2019). Using actor network theory for data analysis. *16th International Conference on Cognition and Exploratory Learning in Digital Age, CELDA 2019*. https://doi.org/10.33965/celda2019_201911l017

Selwyn, N., Nemorin, S., Bulfin, S., & Johnson, N. F. (2017). Left to their own devices: the everyday realities of one-to-one classrooms. *Oxford Review of Education*. https://doi.org/10.1080/03054985.2017.1305047

Serdyukov, P. (2017). Innovation in education: what works, what doesn't, and what to do about it? *Journal of Research in Innovative Teaching & Learning*. https://doi.org/10.1108/jrit-10-2016-0007

Smith, C. (2006). The Future of a Concept: The Case for Sustaining 'Innovation' in Education. *Australian Association for Research in Education*.

Song, Y. (2014). "Bring Your Own Device (BYOD)" for seamless science inquiry in a primary school. *Computers and Education*. https://doi.org/10.1016/j.compedu.2014.01.005

Song, Y. (2016). "We found the 'black spots' on campus on our own": development of inquiry skills in primary science learning with BYOD (Bring Your Own Device). *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2015.1113707

Song, Y., & Wen, Y. (2018). Integrating Various Apps on BYOD (Bring Your Own Device) into Seamless Inquiry-Based Learning to Enhance Primary Students' Science Learning. *Journal of Science Education and Technology*. https://doi.org/10.1007/s10956-017-9715-z

Tatnall, A. (2019). Researching computers and education through actor-network theory. *IFIP Advances in Information and Communication Technology*. https://doi.org/10.1007/978-3-030-28764-1_10

Tatnall, A. (2020). Modeling the Process of Information Technology Innovation in Education. In *Encyclopedia of Education and Information Technologies*. https://doi.org/10.1007/978-3-030-10576-1_176

Tatnall, A., & Davey, B. (2001). How Visual Basic Entered the Curriculum at an Australian University: an Account Informed by Innovation Translation. *Proceedings of the 2001 InSITE Conference*. https://doi.org/10.28945/2374

Tatnall, A., & Davey, B. (2018). Birth, life and death of the Victorian Education Ultranet. *Education and Information Technologies*. https://doi.org/10.1007/s10639-017-9679-x

Teo, T. (2011). *Technology acceptance in education*. Springer Science & Business Media.

Toro, F., & Tatnall, A. (2016). Developing a Project to Investigate the Introduction of ICT to Mapuche Students in Chile. *International Journal of Actor-Network Theory and Technological Innovation*. https://doi.org/10.4018/ijantti.2016010103

Wong, G. K. W. (2014). Engaging students using their own mobile devices for learning mathematics in classroom discourse: A case study in Hong Kong. *International Journal of Mobile Learning and Organisation*. https://doi.org/10.1504/IJMLO.2014.062352

Yeop, Y. H., Othman, Z. A., Abdullah, S. N. H. S., Mokhtar, U. A., & Fauzi, W. F. P. (2018). BYOD implementation factors in schools: A case study in Malaysia. *International Journal of Advanced Computer Science and Applications*. https://doi.org/10.14569/IJACSA.2018.091245