A CRITICAL EXAMINATION OF THE PRE-CONDITIONS OF LEARNING ANALYTICS ADOPTION IN DEVELOPING COUNTRIES IN SOUTHEAST ASIA

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1. Introduction

Big data analytics is a field of research that uses data analysis to make informed decisions (Daniel, 2015). It is characterized by large amounts of possibly ambiguous or noisy data collected at a high rate of speed from a variety of sources. The data is then analyzed to generate valuable insights about a specific domain.

When applied to educational contexts, big data analytics has at least three variants – academic analytics (AA), learning analytics, and educational data mining (EDM). AA usually has the coarsest grain size of the three, referring to data collected and processed at institutional levels for better administration, resource allocation, and management (Daniel, 2015). Both learning analytics and EDM, on the other hand, begin with finer-grained, transaction-level data and use them in subtly different ways. Baker and Siemens (2014) cite several differences that distinguish EDM from learning analytics:

- EDM focuses on automated methods for discovery within data while learning analytics makes use of more human-led methods;
- EDM emphasizes modeling of specific educational phenomena and their interactions while learning analytics emphasizes a more integrated, systems-based understanding of these same phenomena; and
- EDM seeks to build applications that will support personalized learning experiences while learning analytics seeks to inform and empower administrators, teachers, and learners.

For simplicity's sake and to remain consistent with the terminology of Gašević (2018), to which this paper responds, this paper will use "learning analytics" to refer to all these different forms of big data analysis in educational contexts.

In "Include us all! Directions for adoption of learning analytics in the global south," Gašević (2018) discusses learning analytics' potential to increase education quality, equity, and efficiency in the Global South. He and other researchers (e.g., Daniel, 2015; Romero & Ventura, 2010) argue that learning analytics can help improve educational management processes, upgrade learning and learning environments, support early identification and

remediation of students-at-risk, provide personalized feedback and learning experiences, optimize resource use, evaluate courseware quality, and so on.

Before educational systems can use and benefit from learning analytics, however, an ecosystem capable of four key activities – data collection and pre-processing, modeling, presentation and visualization, and intervention – needs to be in place (Gašević, 2018; see Figure 1).

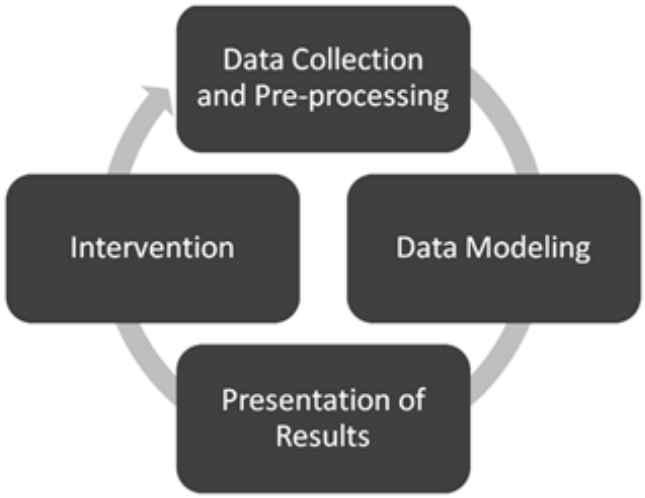

Figure 1. Key activities in the learning analytics process (Gašević, 2018).

1.1 Research questions

The questions arise: To what extent does Gašević's (2018) enabling ecosystem exist in the Global South? How ready is the Global South to embrace learning analytics and reap its benefits? Does the Global South collect enough data from enough sources at a fast enough rate to warrant the kinds of deep analyses for which learning analytics is known? Do these countries have the expertise to process the data, even if they had it? How data-driven are decision-makers when formulating policy?

1.2 Scope and limitations

This paper is an attempt to answer these questions in the context of developing countries in Southeast Asia (SEA), namely, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Thailand, Timor-Leste, and Vietnam ("ASEAN member states," n.d.; UNDP, 2016). It contrasts findings from these countries from the experiences of Singapore, a SEA country that is one of the most advanced in the world.

As learning analytics must be built on top of an ecosystem of educational policy, curriculum, pedagogy, infrastructure, and professional capabilities, this paper assesses the state of readiness of these environmental components. The organizing framework for this paper is drawn largely from a report by the Southeast Asian Ministers of Education Organization (SEAMEO, 2010) on the extent of information and communications technology (ICT) adoption in SEA educational systems. The report makes use of UNESCO's (2005 in SEAMEO, 2010) four stages of ICT Development: *emerging*, *applying*, *infusing*, and *transforming*. The SEAMEO (2010) report maps these stages along several dimensions of ICTs in education and describes how each stage would manifest. It then plots where each SEA country is within this matrix.

This paper's main discussion points, adapted from the SEAMEO (2010) matrix, are national-level education policies; ICT infrastructure and resources in schools; professional development for teachers and school leaders; ICT in education curriculum and pedagogy; assessment; and evaluation and research. These dimensions are the pre-conditions that determine the extent to which learning analytics can be applied to an educational system. The national-level policy is an articulation of a high level commitment to the use of ICTs in education. Commitment translates to the scale of ICT investments in schools. The ways in which these ICTs are used are determined by the curriculum, pedagogy, assessment styles, and teacher training. Teacher and administrator training also influence how data is analyzed. Coming full circle, plans for high-level evaluation and research determine what data is collected, how it is analyzed to assess policy

effects, and how these results are used to influence subsequent decision-making.

This paper makes use of academic publications for theoretical grounding. Most of the inputs for this paper, however, were collected from reports from institutions such as the Asian Development Bank [ADB]; SEAMEO; UNESCO; and government sources. Findings from SEAMEO (2010) are used to start each discussion point, together with information from other, more recent reports and publications. This paper focuses primarily on basic education because source materials tended to limit their scope to primary and secondary school.

2. National-Level Education Policies

A national-level ICT in education vision and related education plans and policies articulate the government's recognition of the benefits of using ICTs in education and its commitment to supporting efforts to realize these benefits. These commitments have a direct bearing on ICT investments in schools, what educational data is collected, how it can be accessed and processed, by whom, and for what purposes. It also determines the extent to which interventions can be created and deployed.

SEAMEO (2010) categorizes Laos and Timor-Leste in the *emerging* stage of having formulated ICT in education policies, in that these countries have limited ICT-driven educational plans or policies. One possible reason for this limitation is that these countries may be prioritizing the establishment of basic ICT infrastructure at this time. For example, while Laos's *National ICT Policies Education Sector Development Framework 2009-2015* promotes the development of infrastructure and access as well as human resource development in general (UNESCO, 2013a), a recent government report does not cite education as a priority sector for the deployment of broadband services (Phissamay, 2016).

On its part, Timor-Leste is in the process of rebuilding after recent internal conflicts. Its national development plans cite ICT capability as a cornerstone of economic development (International Bank for Reconstruction and Development [IBRD]/The World Bank, 2013). Primary education is a key focus area, with projects dedicated to the rehabilitation of facilities and the provision of textbooks and other instructional materials. These plans, however, are silent on ICT education. Indeed, ICT education has not yet been identified as a learning goal at any educational level.

Cambodia and Myanmar are considered to be at the *applying* stage in which ICT is used to support or automate existing culture, policies, and practices (SEAMEO, 2010). Their national governments provide funding for hardware and software but ICT developments are led by specialists. Like countries in the *emerging* stage, countries in the *applying* stage seem to be focusing most efforts on deploying a critical mass of infrastructure as well as supporting current educational approaches. Cambodia's *Education Strategy Plan 2009-2013* and *ICT-in-Education Master Plan* prioritize equitable access to education services, improvement of education quality, and educational staff development, while Myanmar's *ICT Infrastructure Development Plan* and *ICT Master Plan 2011-2015* commit to upgrading their telephone networks and Internet backbone (UNESCO, 2013a). Some broad priority programs hint at the possible use of learning analytics. Cambodia's *Education Strategy Plan 2014-2018* includes a results-based management system that is supposed to develop the capacity for evidence- and outcomes-based planning (Cambodia Ministry of Education, Youth, and Sport, 2014) but it does not mention learning analytics explicitly.

Indonesia and the Philippines are squarely categorized as *infusing* (SEAMEO, 2010). ICT is envisioned as mediating changes in culture, policies, and practice. National-level funding is provided for hardware, software, and teacher professional development.

Indonesia's *Five-year Action Plan for the Development and Implementation of ICT in Indonesia* supports the development of ICT networks and the integration of ICTs in learning (UNESCO, 2013a). The Philippines's *Education for All Plan of Action* calls for ICT integration as well as the use of ICTs to enhance educational management at all levels (Philippines National Education for All Committee, 2014).

Thailand and Vietnam straddle the line between *infusing* and *transforming* (SEAMEO, 2010). Aside from envisioning ICT as a driver of change and providing support for infrastructure and human capacity building, they also show evidence of integrating ICTs in overall school development. Teachers and students are included in ICT-related plans, and funding is broadly available. In Vietnam, these commitments to education took root as far back as 2001 when they planned the improvement of student ICT training and teacher ICT usage (UNESCO, 2013a). In its *Master Plan on ICTs in Education 2007-2011*, Thailand continues its efforts to improve access to technology and indeed strives to become a creator of technology, not just a user (UNESCO, 2013a). A more recent OECD/UNESCO (2016) report confirms that ICT has been and continues to be one of Thailand's strategies for economic growth. It notes that Thai schools began offering computer courses as far back as 1984 and, by the 2000s, Thailand was already committed to integrating ICTs in subject areas as pedagogical tools.

Malaysia was the only developing SEA country categorized in the *transforming* stage (SEAMEO, 2010), i.e., possessing exemplary national-level vision and policies that other countries study and emulate. In keeping with this status, Malaysia's *Education Blueprint 2013-2025* commits to providing students with Internet access and virtual learning environments, augmenting online content, and creating more opportunities for distance and self-paced learning (UNESCO, 2013a).

While not directly related to education, SEA countries are in the process of developing legislation regarding data privacy and protection, which have implications on analytics in general. As far back as 2005, the Asia-Pacific Economic Cooperation (APEC) network—which includes Indonesia, Malaysia, the Philippines, Thailand, and Vietnam (APEC, 2017)—crafted a framework for the protection of personal information. Among the guiding principles of this framework were the prevention of harm, informed consent, the need for security and accountability, and the right to access and correction. Several SEA countries have since begun codifying these principles (Zicolaw, 2014). Thailand and Indonesia already have laws under consideration regarding the protection of individual data, while the Philippines and Malaysia have enacted data privacy laws that protect the right to privacy while ensuring the free flow of information. Cambodia, Laos, Myanmar, and Vietnam are still in the process of developing similar legislation.

What do these findings say about the readiness of developing countries in SEA to engage in learning analytics? The national-level policy seems compatible with the use of learning analytics. All countries have mandated investment in ICT-related infrastructure, curriculum, and skills, and they are formulating laws to protect personal data. Policies state the desire for evidence-based decision-making, which hints at learning analytics without explicitly mentioning it.

In contrast, Singapore began basic ICT skills and literacy training in the 1960s and, in 1997, began introducing a series of *ICT in Education Masterplans*. As described in Tan, Cheah, Chen and Choy (2017), the first masterplan established a strong ICT infrastructure and began intensive teacher training. The second empowered schools to make their own autonomous judgments about the use of ICTs while the third focused on strengthening and scaling in order to reach a transformational stage of ICT usage. Although the plans do not explicitly mention learning analytics, they "built-up a healthy IT-oriented mindset,

familiarity with technologies, and a general belief in the value of ICT for Singapore's development" (p. 35). They also enable the next wave of development, which includes the use of analytics to track students and respond to individual needs.

In the succeeding sections, we shall examine other component parts that help triangulate the readiness of SEA educational systems in the use of learning analytics.

3. ICT Infrastructure and Resources in Schools

ICT infrastructure and resources in schools refer to the computers, the Internet, related peripherals, and courseware that are available in schools for the use of the students, teachers, and administrators. The availability of these resources and the ways in which they are used determine the volume and variety of the data captured and the speed at which it is captured, if at all. It also estimates how possible or probable it is to deploy educational interventions that are borne out of learning analytics' outputs.

SEAMEO (2010) characterizes Timor-Leste's ICT infrastructure as *emerging*. ICT resources are typically non-existent to very limited. If schools have ICTs at all, they are standalone computers with productivity tools for administrators, teachers, and students to use. Timor-Leste is taking steps to correct this situation. In 2010, the National University of Timor-Leste was linked to the *School on Internet Project* of UNESCO, which utilized satellite-based Internet to connect higher education and research institutions in SEA (UNESCO Bangkok, 2010).

Cambodia, Indonesia, and the Philippines are transitioning from the *emerging* to *applying* stages (SEAMEO, 2010). Aside from standalone computers and productivity tools, schools in these countries also have computer laboratories with a limited number of printers and other peripherals as well as Internet access. The presence of ICTs in schools, however, does not guarantee access. In Cambodian schools, there are over 400 to 500 secondary school students per computer (UNESCO, 2014). Seven percent of primary schools and less than 1% of secondary schools have Internet access. In the Philippines, over 400 primary school students share a single computer. Like Cambodia, only 7% of primary schools have Internet access. At the secondary school level, the situation is less dire with about 50 students per machine while about 40% of schools have Internet access. It is therefore unlikely that students in these countries are able to use school ICT resources in substantial ways.

Myanmar's ICT infrastructure is categorized as being in the *applying* stage (SEAMEO, 2010). In 2014, Myanmar reformed its telecommunications industry resulting in more affordable Internet access. UNESCO launched an ICT for education project in Myanmar in which teachers were trained to use mobile broadband services and ICT-based teaching in rural schools (Stenbock-Fermor, 2017).

Malaysia, Thailand, and Vietnam are moving from the *infusing* to *transforming* stage (SEAMEO, 2010). Schools are equipped with networked computers in both laboratories and classrooms. Students and teachers have access to a wide variety of peripherals and a rich variety of learning resources. In some cases, schools have access to web-based learning spaces, conferencing and collaboration tools, and self-management software. The availability of computers and the Internet in Malaysian and Thai schools bear this classification out. Malaysia and Thailand provide one computer for every 7 to 17 students (UNESCO, 2014). Over 90% of schools in these countries have Internet access.

Even if institutionally provided ICT access is limited, personal access is on the rise with young people leading the way. In developing countries, 67% of people aged 15–24 have access to the Internet, thanks in large part to the affordability of mobile broadband (ITU, 2017).

Following through on their policy commitments to provide schools with more ICT resources, countries have invested heavily in computers, the Internet, and peripheral devices. Like national-level policies, this development is friendly towards the use of learning analytics. However, the reality on the ground is much more constrained. Access to computers and the Internet is uneven both within and among countries. For every four broadband subscribers per 100 people in developed countries, there are two subscribers in developing countries and one in the least developed countries (ITU, 2017). Global mobile access is estimated at 84%, but only 67% of users are in rural areas (ITU, 2016). The youngest and oldest segments of the population, people living in rural areas, and women and girls are less likely to own mobile phones (ITU, 2016). Even Thailand, one of the more advanced SEA nations in terms of infrastructure, reports an internal digital divide in which learner-to-computer ratios are lower in urban schools than in rural schools (OECD/UNESCO, 2016). A study of the use of tablet computers in Thai schools (Office of the Basic Education Commission, 2012-13 in OECD/UNESCO, 2016) showed that hardware distributions needed to be accompanied by contextualized content and teacher support. At this stage, ICTs do not seem diffused enough in SEA schools to enable the collection of high-volume, fine-grained data for learning analytics.

As mentioned in the prior section, the Singapore experience is notably different (Tan et al, 2017). Many schools have already achieved a 1:1 student-to-computer ratio. Learning management systems and digital resources are common and broadband Internet access is widely available. Many of these environments collect fine-grained, student interaction-level data that is used to reach educational goals. This will be discussed in greater detail in Section 7.

4. Professional Development for Teachers and School Leaders

A skilled workforce is essential to the use of analytics, but it is also one of the most difficult resources to develop. It is estimated that the global public and private sector is only able to capture 30% of the value that big data offers (McKinsey Global Institute, 2016). Organizational inability to train, attract, and retain qualified analytics personnel is one of the major impediments to the success of analytics within organizations of all kinds – government, the private sector, and education.

Laos and Timor-Leste are at the *emerging* stages of professional development for teachers and school leaders (SEAMEO, 2010). They are aware of the need for professional development but have not yet formulated concrete plans to address this need. One impediment is a lack of internal capacity to support ICTs in education. In Timor-Leste, few tertiary institutions offer ICT-related courses, and they themselves lack qualified teachers and proper teaching and learning facilities (IBRD/The World Bank, 2013). Timor-Leste teachers often depend on private or religious organizations for ICT training. The situation in Laos is slightly more progressive. Teachers do receive ICT training, but it is generally limited to productivity tools and Internet searching, browsing, and communications (Utakrit, 2016).

Cambodia, Indonesia, and Myanmar are in the *applying* stage in which ICT training tends to be unplanned (SEAMEO, 2010). The training that teachers and school leaders do receive tends to be limited to ICT applications. The dearth of ICT-related training for teachers could be caused in part by the focus on other aspects of teacher training. For example, Indonesia shifted to a new basic education curriculum in 2013. It emphasized more interactive and team-based teaching to develop higher-order

thinking skills (OECD/ADB, 2015). Hence, professional development efforts focus on developing these specific areas.

At the *infusing* stage are Malaysia, the Philippines, Thailand, and Vietnam (SEAMEO, 2010). Teachers and school leaders receive training in the use of ICTs to teach specific subject areas. Pre-service teachers in Malaysia and the Philippines take at least one course on educational assessment, measurement, and evaluation (SEAMEO, 2015). In-service teachers are offered classroom assessment training once a year in Malaysia and twice a year in the Philippines.

Of interest regarding this dimension is the absence of any mention of training for learning analytics. Based on the source documents surveyed, the current focus of teacher and administrator training in SEA is, at best, at the level of using ICTs for teaching specific subjects or for tracking inputs to schools. In the Philippines, training supposedly includes item analysis and test score analysis (SEAMEO, 2015), but learning analytics is not explicitly mentioned in pre-service or in-service training programs.

The same can be said of Singapore's teacher education and training programs (Tan et al, 2017). Singapore invests extensive resources in the development of teachers' ICT skills, their capacity for innovative ICT use, and the creation of ICT resources. Capacity building for learning analytics is not explicitly included among training goals. However, Singapore's National Institute for Education regularly engages teachers in their ICT development and deployment projects and shares the results of data analysis. This implies that teachers are kept informed of the effects and consequences of these various strategies, and they are literate enough to internalize and appreciate these findings.

Several authors identify the development of learning analytics expertise as a priority (e.g., Siemens, 2012) and warn that simplistic data processing may lead to its misinterpretation and misuse, leading to negative consequences on stakeholders (Karnad, 2014). If learning analytics is to be used correctly and effectively in SEA, teachers and administrators need training. The reports reviewed suggest, however, that this specific type of training is not widely available at the pre-service and in-service levels. Hence, the education workforce in developing countries in SEA is not well-poised to use learning analytics, even if the data were available.

Not all software captures for fine-grained, user-level data. Software has to be designed to collect user interactions. Computer-based learning environments must be built to log student data and to include other educationally relevant attributes such as learning contexts, correctness, and timing. Curriculum and pedagogy determine whether such environments exist in schools and the extent to which students use them.

5. ICT in Education Curriculum and Pedagogy

Curriculum can be described at three levels: the *intended* curriculum which refers to high-level articulations of educational goals; the *implemented* curriculum, referring to mid-level plans for content, time allocations, and instructional strategies; and the *achieved* curriculum, which refers to the competencies that students actually develop as a result of the educational interventions (Pelgrum, 1999). This and the succeeding section examine what developing countries in SEA state as their educational goals, how they implement these goals, and how they assess whether they have reached these goals.

Within the nationally-prescribed ICT in education curricula, *emerging* category countries Cambodia, Laos, and Timor-Leste mandate the development of ICT literacy skills (SEAMEO, 2010). The pedagogical strategies used by *emerging* category countries Laos and Timor-Leste are usually highly teacher-centered and didactic (SEAMEO, 2010). Several factors

account for a reluctance to shift to student-centered methodologies. Teachers confront "… isolation, lack of collaboration, and limited support from administrators; the constraints of the official syllabus or curriculum and examinations that test memory instead of understanding; lack of time and resources, among others" (MacKinnon & Thepphasoulithone, 2014). These circumstances make innovation difficult and traditional teaching methods convenient.

Cambodia and Myanmar span the *emerging* to *applying* categories. They are still teacher-centered, didactic, and teach ICTs as a separate subject (SEAMEO, 2010). This is consistent with reports on limited student access to computers and the Internet: About 1% of primary school students and 15% of secondary school students in Myanmar are enrolled in classes with access to these resources and only 2% of teachers were trained to teach with ICTs (UNESCO, 2014).

Indonesia, Myanmar, the Philippines, and Thailand are categorized as *applying* (SEAMEO, 2010). Their national curricula stipulate the use of ICTs in specific subject areas but these uses are generally isolated from one another. At their best, Indonesian and Thai pedagogical practices are characterized as *infusing*, where they introduce more learner-centered and collaborative methods (SEAMEO, 2010). The categorization of Thailand, however, might be overly modest as all Thai students are reportedly enrolled in classes that make use of computers and the Internet, and 79% of trained Thai teachers teach using ICTs (UNESCO, 2014).

In contrast, the categorization of the Philippines as being in the *infusing* category (SEAMEO, 2010) might have been overstated. UNESCO's (2014) report showed that only 41% of primary school students and 87% of secondary school students were enrolled in classes that made use of computers, while 4% of primary school students and 28% of secondary school students had classes that made use of the Internet. Indeed, the same report showed that only 2% of teachers in the Philippines were trained to teach with ICTs.

In the *infusing* category, Malaysia and Vietnam have integrated learning systems that encourage students to solve problems in authentic contexts (SEAMEO, 2010). None of the intended curricula of developing countries in SEA have reached the *transforming* stage. Teaching and learning strategies in the schools in Malaysia and Vietnam are varied; hence, these countries span the *applying* to *transforming* categories (SEAMEO, 2010). There is evidence of both teacher-centered and student-centered pedagogies. ICTs are taught as separate subjects and they are used for experimentation and multi-sensory learning. Other data sources imply that Malaysia provides its schools with the resources to achieve transformation. All Malaysian primary and secondary students are reported to be enrolled in classes that use computers and the Internet, and 100% of teachers teach with ICTs (UNESCO, 2014).

In the search for information about ICT-based curricula and pedagogical practices, it was evident that there is a dearth of academic literature regarding innovative ways in which ICTs are being applied in SEA schools. The International Conference on Computers in Education is an annual meta-conference hosted by the Asia-Pacific Society for Computers in Education. Under this conference are tracks on artificial intelligence in education, advanced learning technologies, game-based learning, and others. A cursory inspection of the proceedings from 2014 (Liu, Ogata, Kong, & Kashihara, 2014), 2015 (Ogata, Chen, Kong, & Qiu, 2015), and 2016 (Chen, Yang, Murthy, Wong, & Iyer, 2016) showed few contributions from developing countries in SEA.

Learning analytics typically leverages on the use of highly interactive learning environments such as tutorials, games, simulations, and the like. These environments produce rich data streams that can be

mined for interesting patterns. In Singapore, teachers are trained to make use of ICT-based pedagogies and are able to implement lessons with ICT components (Tan et al, 2017). Indeed, Singaporean teachers are so comfortable with ICTs that they are able to contribute to the development of ICT-based applications to help teach subjects such as Math and Physics. The same cannot be said of their counterparts in developing SEA countries. The data suggests that teachers in these countries are either unable or reluctant to make use of these formats; hence, students in SEA do not have much exposure to them. The ways in which ICTs are used in most SEA classrooms – primarily teacher-centric, with a focus on ICTs as subject matter in themselves – do not lend themselves to substantial data collection and, hence, use of learning analytics.

6. Assessment

Assessments are used to determine how much of the intended and the implemented curriculum is actually achieved. They are an indicator of the effectiveness of teaching and the readiness of learners to progress. They are also indicators of the quality of an educational system (SEAMEO, 2015). In SEA, assessments usually take place at three levels: the classroom level, where teachers give periodic tests to gauge student achievement; the national level, where high-stakes exams determine promotion from primary to secondary school or from secondary school to college; and the international level, where sample schools take standardized tests as a means of diagnosing the entire educational system to help formulate or adjust policy (Cambodia Ministry of Education, Youth, and Sport, n.d.).

At the classroom level, teachers in SEA have access to a variety of assessment tools: textbooks, workbooks, assessment toolkits, scoring rubrics, test item banks, and test item data (SEAMEO, 2015). Students in *emerging* countries Cambodia, Indonesia, Laos, Myanmar, Philippines, and Timor-Leste tend to be assessed for discrete subjects, using paper-and-pencil tests (SEAMEO, 2010). ICT use in assessment tends to be limited to the development, encoding, and recording of assessments, especially at the primary school level (SEAMEO, 2015).

Thailand and Vietnam fall into the *applying* stage where students are assessed for their skills but the overall format is still teacher-centered and subject-focused (SEAMEO, 2010). As with the *emerging*-stage countries, the use of ICTs for assessment is limited because teachers themselves lack confidence, and because ICTs are taught as subjects in themselves (OCED/UNESCO, 2016).

Malaysia is the sole entry in the *infusing* category (SEAMEO, 2010). The Malaysian school system designs what it views as holistic, authentic assessment that measures students' cognitive, affective, and psychomotor skills (SEAMEO, 2015). These assessments are designed to be taken in authentic situations as well as during coursework.

At the national level, all SEA countries give summative, high-stakes examinations. The main use of the test data is to determine student achievement levels against the prescribed curriculum (SEAMEO, 2015). There is, however, a certain level of mistrust of national-level tests. Test validity, sampling methods, and quality of test administration are all the subject of doubt (SEAMEO, 2013). In Indonesia, for example, the national-level examinations are supposed to assess learning, serve as criteria for graduation, rank students for competitive entry, evaluate the success of educational programs, provide information to improve teaching and learning, and so on (OECD/ADB, 2015). However, there is little confidence that the exam is able to satisfy any of these purposes.

At the classroom and national levels, it is clear that all developing SEA countries have massive stores of student-level assessment data. Much of it though

is not digital and therefore not in a form that can be easily mined. ICT-based assessments are not commonly used. Furthermore, questions are raised about the validity of national-level tests. This is a challenging environment for learning analytics.

Finally, developing countries in SEA make use of large-scale international tests as tools to evaluate their educational systems. The Programme for International Student Assessment, Progress in International Reading Literacy Study, and Trends in International Mathematics and Science Study are examples of tests in which whole countries participate (Assessment, Curriculum, and Technology Research Center, 2015).

Countries generally claim to use test results for policymaking (Assessment, Curriculum, and Technology Research Center, 2015; UNESCO, 2017a). The Philippines, for example, uses results to rationalize capacity building and skills development among teachers. Thailand uses the results to review the curriculum and design student intervention programs. Like the Philippines, Myanmar uses results to design professional development programs. There is a sense, however, that large-scale assessment data is underutilized (UNESCO, 2017b). As mentioned in the section on professional development, teachers and administrators are not trained to process large data sets; hence, educational systems lack the human resources capable of performing the rigorous research needed to convert data into information.

7. Evaluation and Research

At first blush, evaluation and assessment appear synonymous. The two areas do overlap, but evaluation in this context differs from assessment in terms of focus. Evaluation examines the effects of broader ICT in education policies on the identified areas for improvement, while assessment, as discussed in Section 6, investigates the extent to which the goals of a curriculum were achieved. Research, on the other hand, refers to scholarly inquiry into an educational problem. Evaluating the effects of policy is a research endeavor that can result in a cost-benefit analysis of ICT investments, refinement of educational theory, and identification of best practices (SEAMEO, 2010). It is here that learning analytics should be put to work.

At this point, many developing countries in SEA still lack the capacity for evaluation and research. *Emerging*-stage countries Cambodia, Laos, the Philippines, and Timor-Leste generally do not include evaluation and research in their national-level ICT plans (SEAMEO, 2010). There are, however, efforts that support the evaluation process. The Philippines, for example, has mounted substantial initiatives to collect a variety of data on the basic educational system in a comprehensive and timely manner (Read, 2017). These include enrollment, staffing, ICT resources such as computers and the Internet, health and nutrition, exit assessment results, and others. Data tends to be coarse-grained though. It includes all resource inputs – not just ICT – and has a limited indication of resource usage.

Indonesia, Thailand, and Myanmar are in the *applying* stage in which evaluations tend to be summative in nature and the capability to make evidence-based decisions is limited (SEAMEO, 2010). One of the issues surrounding Thailand's ICT in education plans is that the country lacks the capacity to monitor and assess ICT usage in schools (OECD/UNESCO, 2016). Despite the substantial investments that Thailand has made in this regard, it does not systematically collect data on inputs and outcomes; hence, it has limited data upon which to build policy.

In the *infusing* stage are Malaysia and Vietnam (SEAMEO, 2010). They make use of both summative and formative assessments and invest in research to provide the basis for data-driven policies. These claims are not undisputed though. A UNESCO (2013b)

study pointed out that Malaysia has fallen behind its benchmarking countries because of a lack of policy formulation, monitoring, and feedback. In Vietnam, a survey of 32 key representatives from 20 public and private sector organizations involved in ICT in education ranked evaluation and research as a 7th priority among 10 ICT in education dimensions (VVOB Vietnam, n.d.). Highest among these dimensions are the deployment of infrastructure, teacher training, and curriculum. Key representatives agreed that research was essential for proper policy formulation but only for as long as it did not impede change and innovation.

Learning analytics is one of the tools of evaluation and research. At this point, however, developing countries in SEA lack a culture of evaluation and research, which leads to an underutilization of these tools.

In contrast, Singapore's Learning Sciences Lab within the National Institute for Education focuses on the use of learning analytics to develop "evidence-based claims about how people learn to derive practical, pedagogical, and theoretical implications" (Tan et al., 2017). To illustrate: The *Rapid Collaborative Knowledge Improvement (RCKI)* using *GroupScribbles (GS)* project refers to both a product and a practice that supports group participation and face-to-face collaboration. GS is a shared digital space in which students can share ideas in textual or graphical forms. Students scribble on a personal window and post their work to a shared window when they are ready. The analysis of RCKI using GS showed that GS classes performed better than non-GS classes because GS facilitated students' understanding of and attitude towards the subject matter. Since its introduction, over 300 RCKI lessons have been designed with the help of 15 teachers and 17 classes.

8. Conclusion

Within developing countries in SEA, there are massive opportunities to improve education with the use of learning analytics. As Gašević (2018) argues, learning analytics can be used to improve education quality, equity, and efficiency in many ways and at many levels. Rich sources of data such as social networking behaviors and discourse can augment formal assessments to come to better understandings of learners and their needs, and can help learning systems direct students to appropriate learning activities. Learning analytics can help overcome biases in education access by factoring in the effects of geography, gender, minority status, and so on to lead to more equitable learning environments. Finally, learning analytics can help policy makers and practitioners better manage educational programs and resource allocation.

The Singaporean experience provides a success story. Singapore proves that ICTs in general, and learning analytics in particular, have the potential to contribute positively to educational change (Tan et al, 2017). Examples of Singaporean projects such as the RCKI using GS and EduLab, point to increased quality, equity, and efficiency, with even greater promise ahead. Singaporean researchers anticipate that learning analytics will lead to more personalized learning environments capable of complex interactions and challenge educators to design, develop, and study such innovations.

However, the Singaporean experience is not universal. The goal of this paper was to determine the extent to which the enabling ecosystem of learning analytics existed in developing countries in SEA. The findings are somewhat grim. There is a national-level commitment to the use of ICTs in education, but the priority is on addressing internal digital divides through the improvement of telecommunications, increased technology deployment, and teacher training for ICT literacy and integration.
The computer-based learning environments in schools tend to consist of personal computers with productivity tools, with the possible exception of schools in *infusing* and *transforming* countries such as Malaysia. Even in these advanced countries, however, there is little evidence that learning systems

automatically collect the kind of fine-grained data that drives learning analytics. Rather, most testing still uses pen and paper. Even when digitized data is available, the teachers and administrative staff lack the culture of evaluation and research and the specialized training to convert the data into meaningful information.

At this time, none of the pre-conditions to making full use of learning analytics seem to be present in developing countries within SEA. Countries are still in the process of amassing policy, technology, and human resources, as well as developing the culture to leverage learning analytics for wide-scale educational improvements. Fortunately, efforts continue to bolster ICT in education and develop related expertise within these countries. It is therefore reasonable to expect that SEA will become an active participant in the learning analytics community in the years to come.

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