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Technology-Supported Distance Learning for Basic Education in the Philippines

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What is Technology-Supported Distance Learning?

Distance learning (DL) is a teaching-learning modality in which teaching occurs at a different place from learning (Moore & Diehl, 2018). Technology-supported distance learning (TDL) is DL in which learning contents—whether documents, videos, or games—are disseminated via the Internet, broadcast signals, or storage devices like USB drives and can be accessed by a learner any time after they have been received. These three kinds of TDL are called online DL (ODL), DL via datacasting (DLD), and electronic DL (EDL), respectively. Reproduction of learning materials is much faster and cheaper using TDL than traditional, paper-based DL.

Of the three kinds of TDL mentioned above, ODL provides the highest degree of teacher-learner interactivity because teachers can receive and send feedback from and to their students on the same technology (i.e., the Internet) used to disseminate the learning materials. In contrast, broadcasting technology is essentially unidirectional. Therefore, interactivity in DLD is lower than in ODL, though it is possible to use a different type of network, such as SMS (Alencar, 2009, p. 11; International Telecommunications Union, 2021), as a return channel for learners to send data back to their teachers. SMS can also be used as a return channel in EDL; however, dissemination of learning materials in USB drives is much slower and more expensive than disseminating them over the Internet or broadcast signals. Therefore, EDL provides the lowest degree of interactivity among the three kinds of TDL mentioned above.

Why Might DLD be Important for Basic Education in the Philippines?

Although ODL might be the preferred form of DL due to its interactivity, only 17.7% of Philippine households have Internet access; in contrast, 82.7% of Philippine households have television sets (Department of Information and Communication Technologies, 2019). To be sure, the Department of Information and Communication Technologies (DICT) has plans to increase Internet access throughout the archipelago (e.g., it plans to install 9,000 free Wi-Fi sites this year; Santhika, 2023). However, it is not clear at what point in time will enough Philippine households be able to connect to the Internet reliably and inexpensively for effective ODL to take place on a large scale. Until

then, DLD promises to be the best way for technology to support DL in households with TV sets but no Internet. Even when these eventually gain reliable and inexpensive access to the Internet, the remaining 17.3% will probably find it more affordable to make a one-time purchase of a TV set and a set-top box than purchase an Internet device and pay monthly fees for Internet access.

When school campuses have to close, whether for a long period, such as what happened in the country during the COVID-19 pandemic, or for a short while, such as during a recent heat wave (Reyes, 2023; Mukherjee, 2023), students in households with no internet but with TV sets and datacasting set-top boxes will be able to continue learning with zero days of disruption. This is important because learning loss, which tends to be higher for younger and poorer students, compounds over time (Sabarwal et al., 2023). The staggering problem of learning loss due to long school closures has prompted major multilateral agencies to sound the alarm (World Bank, Bill & Melinda Gates Foundation et al., 2022).

Blended learning, which combines in-person and DL modalities, has been identified by the Department of Education (DepEd) as one of the two major components of its "two-tracked approach to solve the issue of classroom shortage" (Bautista, 2023). For example, students could go to their campus to learn in person three days a week and stay at home to engage in DL on the other days. Though students without Internet connection may use paper-based DL (which DepEd calls "modular" DL) on their DL days, DLD provides a better alternative, as discussed above.

Might DLD be Effective for Basic Education? What Factors Might Affect Its Success?

Our recently concluded design research project (Sison et al., 2023) indicated that learning materials developed following a carefully designed framework might enable student learning, even at elementary school, even when the learning materials target higher-order thinking skills (HOTS) in a low-interactivity DL context such as DLD, and in spite of the country's very high learning poverty rate (World Bank, UNESCO et al., 2022), in which only 1 in 10 Filipino 10-year-olds could read texts with comprehension, a crisis made even direr by the learning loss resulting from two years of school campus closure.

Our project began with the design of an overall framework and set of guidelines for DLD, followed by the design of specific frameworks and guidelines for science learning, mathematics learning, English learning, self-regulated learning, multimedia in learning, and parental engagement, all in the context of upper elementary TDL, particularly DLD. Salient features of the frameworks include a focus on HOTS, that is, on supporting the learning of competencies at the higher levels—analyze, evaluate, and create—of the revised Bloom's taxonomy (RBT; Anderson et al., 2001) and the research-based use of visual and other multimedia elements to support low-interactivity TDL. For the latter, new pedagogical techniques even had to be developed (e.g., Sison, 2022).

Following the abovementioned frameworks and guidelines, a total of 62 lessons, including 322 learning worksheets, were developed. These covered all of the "most essential learning competencies" (MELCs) identified by DepEd for Grade-6 science, mathematics, and English in its 2020 streamlined curriculum (DepEd, 2020b), which was used during the pandemic, in which paper-based DL was the predominant learning modality throughout the country due to the low

Internet penetration in households. The learning materials were piloted at a resource-challenged DepEd school in Silang, Cavite, for SY 2021–2022.

Due to the difficulty of getting a permit to set up a broadcasting tower at the pilot school and of developing datacasting set-top boxes for all the pilot's initial participants, the project simulated datacasting by uploading learning materials to the Internet at the beginning of the week, which the student participants would then download onto phablets. At the end of each week, the student participants (and their parents/guardians) were reminded, mainly through SMS, to submit their worksheet answers via Gmail or Gdrive. Phablets and Internet load were provided to 56 Grade-6 volunteer student participants at the start of the said school year. However, due to the students' difficulties in familiarizing themselves with the technologies (mainly phablet, Gdrive, and Gmail) and in managing their Internet load and their study time, which were aggravated by the pandemic, we could only fully pilot the learning materials for Quarters 3 and 4. Moreover, by the start of Quarter 3 (but until the end of Quarter 4), only 13 student participants remained voluntarily responsive to the project team's communications.

Qualitative as well as quantitative results of the pilot suggest that it is possible for competencies at higher RBT levels to be learned by upper elementary schoolchildren, even in a low-interactivity DL context such as DLD. Qualitatively, this was indicated by improvements in the quality of the students' explanations (claim-evidence-reasoning) in science, in the kinds of errors (conceptual and procedural errors as opposed to language errors) the students committed in mathematics, and in the students' development of their ideas (organization, cohesion, and fluency) when writing in English. Quantitatively, learning was indicated by the improvements in the students' pretest and posttest scores across all the aforementioned subjects and quarters, though the improvements were statistically significant (at $\alpha = 0.1$) only for science Quarter 3 ($p = .058$) and English Quarter 4 ($p = 0.098$), and only marginally significant for English Quarter 3 ($p = 0.181$). The lack of statistical significance of the test score improvements in mathematics (both quarters) and science Quarter 4 might be due to (a) curricular issues and (b) low sample sizes.

With regard to curricular issues, the 2020 Grade-6 curriculum for mathematics was much more congested than those for science and English, as indicated by the average number of competencies per quarter (cpq). Specifically, the number of mathematics MELCs per quarter (15.5 cpq) was almost four times that of science (4 cpq) and more than six times that of English (2.5 cpq). The MELCs of the 2020 curriculum could be viewed as DepEd's initial response to the problem of congestion (see, e.g., DepEd, 2020a, p. 35). The new MATATAG curriculum, which will be implemented in 2024, also tries to address the congestion problem (Hernando-Malipot, 2023). However, in the draft 2024 curriculum (DepEd, 2023c, 2023d, 2023e), the competencies per quarter for mathematics (14 cpq) are only slightly fewer than in the 2020 curriculum, although there are many more competencies for science (10.5 cpq) and English (12 cpq). Considering the above results as well as the grim realities of Philippine education (several aspects of which were described in the DepEd Secretary's Basic Education Report (Duterte, 2023)), it might, therefore, be wise to refine the MATATAG curriculum for further decongestion before it is implemented in 2024.

Still, with regard to curricular issues, we found the topics for science Quarter 4 and for math Quarters 3 and 4 to be less cohesive compared to the other subjects or quarters. For example, whereas the topics for science Quarter 3 were all related to energy, those for Quarter 4 were about earthquakes, seasons, and planets. As another example, whereas the topics for mathematics Quarter 1 were all about fractions and decimals, the topics for Quarter 4 were about solid figures, meter reading, pie graphs, and probability. Reading of water and electric meters appears to no longer be in the 2024 curriculum for mathematics, but solid figures, pie graphs, and probability still remain bundled into Quarter 4. Therefore, a further review of the degree of cohesion of topics within a quarter might need to be performed by DepEd while refining its 2024 curriculum for further decongestion.

With regard to low sample sizes, there were, as mentioned earlier, only 13 participants who remained voluntarily responsive to the project team's communications throughout Quarters 3 and 4. The attrition rate might be affected by myriad factors, such as those already mentioned earlier (e.g., the high rates of learning poverty and learning loss, and low digital literacy; and physical and mental health issues arising from the pandemic) as well as the students' self-efficacy and intrinsic interest in the topics of a quarter. Self-efficacy and intrinsic interest are self-motivation beliefs that are part of the first phase of self-regulated learning, which we discuss next.

Self-regulated learning (SRL) refers to cognitive, affective, and metacognitive activities that a learner performs to identify and achieve learning goals. Zimmerman's SRL framework (2002) views SRL as a cycle with three phases: forethought, performance, and self-reflection. Several meta-analyses of SRL interventions (Dignath et al., 2008; Dignath & Buettner, 2008; Li et al., 2018; Jansen et al., 2019; Theobald, 2021) show that SRL leads to improvements in students' academic performance as well as in their strategic behavior and motivation, though these studies were conducted in in-person contexts. In our project, which involves a DL context, SRL tasks, mostly in the form of self-reflection, were embedded in the science and English lessons (but not in the mathematics lessons, which, as mentioned earlier, were already very congested). Results showed moderate correlations between the performance of SRL tasks and the increase in test scores in English Quarter 4 ($r = .400$) and science Quarter 4 ($r = .475$), though the former was only marginally significant ($p = .198$) and the latter was not ($p = .341$). The lack of statistical significance might be due to the low sample size or the SRL activities focusing on only one or two SRL phases. Clearly, more research needs to be done to determine how best to train K-12 students in SRL, especially in a low-interactivity DL context.

In summary, the results showed qualitative and quantitative improvements in the works of students who used our learning materials, suggesting that technology-supported DL, even one that supports low levels of interactivity such as DLD, and even when the learning materials target higher-order thinking, might be viable for upper elementary students. However, for technology-supported DL (which includes technology-supported blended learning) to succeed on a larger scale, the actions in the next section are recommended.

Policy Recommendations for Technology-Supported Distance Learning in Basic Education

Based on our yearlong experience designing and piloting lessons and learning materials that target higher-order thinking in a low-interactivity DL context, and on the aforementioned results of our research as well as those of others (e.g., the meta-analyses of SRL studies, the findings of the World Bank and other multilateral organizations on learning poverty and loss, and the findings of DepEd's curriculum reviews), we now make the following policy recommendations for technology-supported distance learning (including blended learning) in basic education in the Philippines. It will be noted that the first three of these are important regardless of the teaching-learning modality, though they become even more important in DL, whether in high-interactivity DL like ODL or low-interactivity DL like DLD.

1. Revisit and further refine the streamlined K-12 curriculum. As discussed earlier, there is a need to further decrease the degree of congestion in terms of the number of competencies per quarter (cpq) and further increase the degree of cohesion of topics within each quarter, especially in mathematics and science.

2. Provide teachers with research-based professional development in fostering higher-order thinking skills (HOTS) (also known as analytical, critical, and creative thinking skills) in K-12 students. The need for these skills has been repeatedly emphasized by multilateral organizations involved in education, such as United Nations Children's Fund (2019) and the Organization for Economic Cooperation and Development (2019). The need to train teachers in fostering HOTS was also explicitly mentioned in the DepEd Secretary's Basic Education Report (Duterte, 2023). It will be noted that DL modalities might require additional skills for fostering HOTS on top of those that might already be effective in an in-person modality.

3. Increase the competencies of K-12 students in self-regulated learning (SRL). SRL is important so that students will not be completely dependent on their teachers and on an in-person modality for their learning. There is also a need for further research to determine how best to train students, especially elementary students, in SRL. It will be noted that the Organization for Economic Cooperation and Development (2021) has made SRL one of the two competencies in its new PISA 2025 "Learning in the Digital World" assessment.

4. Develop lessons and learning materials for K-12 science, mathematics, and English targeting HOTS using a set of well-designed frameworks and guidelines, such as those mentioned above, for technology-supported distance and blended learning. These learning materials can then be used as (a) core resources in distance or blended learning contexts; (b) supplementary or self-learning resources; and (c) resources for student tutoring. Student tutoring is a key component of the ARAL Program Act recently approved by Congress ("Sen. Gatchalian: 'Aral' bill passage," 2023) for learning recovery in the country.

5. Provide every student with a learning device and Internet connection, possibly with the help of the private sector and NGOs, and train them in the management of these and other

digital resources. SRL (recommendation 3 above) will also be needed for students to be able to effectively use these digital devices and resources for their learning.

6. If it will take too many years for enough Philippine households to have a reliable and affordable Internet connection, then provide households that already have TVs but no Internet connection with datacasting set-top boxes, possibly with the help of the private sector and NGOs, so that students in these households can easily download, view, and study the learning materials in recommendation 4 on their TV sets. Because datacasting is still essentially unidirectional, the set-top boxes could also be designed so that students could send data (e.g., answers, feedback) back to their teachers using, say, SMS technology, as mentioned earlier. The Advanced Science and Technology Institute (ASTI) of the Department of Science and Technology (DOST) has prototyped such a set-top box, on which our initial learning materials tested successfully for transmission and reception.

7. Conduct long-term research programs to evaluate DL (including the DL component of blended learning) in K-12, particularly the impact of items 1 to 6 above on the quality of technology-supported distance or blended learning in K-12. The need for research on effective DL in K-12 also appears in several of the recommendations of the National Education Policy Center's 2021 report titled "Virtual Schools in the U.S. 2021" (Molnar & Boninger, 2021).

Acknowledgment

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