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Learning With Friends: A Rational View of Remote Learning with Network Externalities in the Time of Covid-19

Higher education institutions (HEIs) around the world have shifted to remote learning mode in response to the government-mandated school closures to control the spread of the novel coronavirus. In the Philippines, an enhanced community quarantine has kept campuses closed until April 30, 2020. With prolonged closure of campuses, remote learning has become the next best alternative for HEIs to bridge the gap.

The transition to remote learning was opposed by student leaders of top universities in the Philippines in a signed petition to the Commission on Higher Education (CHED) calling for the suspension of all online learning activities (Bagayas, 2020).¹ This widespread dissent culminated in a petition from the National Union of Students of the Philippines to terminate all online classes and promote students en masse.² Disparities in the access to reliable internet, devices used and the environment in which both instruction and learning take place, along with mental health considerations fuelled these calls for a suspension of online learning activities.

Meanwhile, CHED is pushing for a hybrid “offline-online” learning modality in the ‘new norm’ given that social distancing measures are likely to stay rendering pure classroom-based learning infeasible (ABS-CBN, 2020).

Policy Recommendations

- 1) **Accessible technology for all.** The primary barrier to quality remote learning experiences is the lack of access to the internet and the appropriate device. Concerns from the academic community on differences in technology and internet access must be addressed. Our study shows that learning networks lose optimality when the rate of departure from the network is faster than its growth rate, i.e. students no longer allocating time to learn online because of poor internet or devices keep

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¹ Coincidentally, the Student Council Alliance of the Philippines (SCAP) and the Students’ Rights and Welfare Philippines (STRAW PH) also filed a similar petition to CHED calling for the suspension of online learning due to the pandemic.

² The Facebook page of the NUSP collects various calls for ending the current term and online learning, <https://www.facebook.com/NUSPhilippines/>.

malfunctioning. HEIs should consider making basic technology packages available for loan to students and faculty to mitigate departure from the learning network. With social distancing likely to influence the 'new norm' for higher education, measures to ensure access to technology will make remote learning feasible for more students and faculty.

2) **Encourage the co-creation of new knowledge within the network.** The transition from the physical classroom to virtual settings empower students with the flexibility of searching for knowledge or 'finding the dots' on the internet (i.e. through Google Search and YouTube). Instructors should consider that students can now conveniently and independently discover related course content online. Students then bring acquired knowledge with them online where they co-create new knowledge with their classmates and instructor. The instructor can then provide a synthesis to 'connect the dots', adding more value to the knowledge acquired independently.

3) **Rethink the syllabus, course content, and delivery methods.** There is likely a temptation to adopt the same style that worked in the classroom but which may not work as well in remote learning. In remote learning, the role of the instructor is not solely to create content for instruction but also to design the learning framework that enables independent study and optimizes the role of live sessions. The instructor also needs to boost interactivity in the learning process through a blend of delivery methods, content types, and platform features deepening engagement within the network.

Asynchronous learning methods can be used where students need to learn technical concepts at their own pace. In contrast, synchronous learning methods may be employed after students have spent enough time learning on their own through asynchronous means. This approach allows instructors to allocate synchronous sessions for synthesis, working on challenging content together, and encouraging deeper interactions from which knowledge accumulates further.

4) **Implement a scalable online learning management system (LMS).** A scalable learning management system, i.e., Canvas and Blackboard, empowers instructors to design learning experiences that deepen student engagement and enable the

efficient accumulation of knowledge within a learning network. Our analysis shows that as long as learners are impatient, and that the knowledge generated is sufficiently faster than the departure rate from a network, the size of the network will continue to grow. HEIs should consider providing design thinking and instructional design training to their instructors—an essential step in reimagining the courses tailored to the conditions that will make remote learning optimal.

Learning in the Digital Age

Connectivism provides the theoretical foundation of learning networks in the digital age. In Siemens (2005), learning enjoys network externalities shaped by advances in technology and a general increase in the level of socialization through digital platforms. Siemens argues that more dominant theories of learning (e.g., behaviorism) are limited in their ability to explain emergent learning patterns brought about by digitalization. With learners at the core of connectivism, personal knowledge is taken as the product of the network which, in turn, feeds into organizations and institutions. The accumulation of knowledge over time is signalled back to the learner. This process of learning in networks is characterized by cycles of knowledge accumulation made through connections created along the way.

Analytics

We model a learning community, composed of several homogenous and rational individuals, using a model of human capital accumulation. Human capital or, more appropriately for our study, education is considered as an investment by the individuals within the learning community, and that it will accrue returns in the future.

We augment connectivism and our human capital accumulation model with the concept of network externality in consumer demand (Rohlf's, 1974). This approach allows us to model the returns to education to be dependent on the number of participants within the learning community. This feature of the model implies that relatively large learning networks to have comparative higher returns, which then results in a greater degree of participation in the learning community. Denote returns to education at some period t as $r(t)$ and define it in terms of human capital accumulated or the knowledge acquired thus far, denoted by $H(t)$, and the number of participants or size of the learning network, denoted by $N(t)$:

$$r(t) = N(t)[1 - s(t)]H(t)e^{-\rho t} \quad (1)$$

where $s(t)$ is the proportion of time spent engaged in acquiring knowledge (i.e., studying). An individual from the learning community then seeks to optimize the present value of the overall returns to education. The dynamic optimization problem of the representative individual is

$$\max \int_0^T N(t)[1 - s(t)]H(t)e^{-\rho t} \quad (2)$$

where T is the terminal period, and ρ is the subjective discount rate of the representative individual.

The dynamic optimization of the individual is constrained by some law of motion equations on knowledge acquisition and the size of the learning community. Each law of motion equation indicates a net growth rate for knowledge acquired and the size of the learning community, with δ_H as the obsolescence rate for knowledge and δ_N for the departure rate of individuals from the learning community. The solution to the optimization problem determines the level of knowledge accumulated by the learning community and the optimal size of the learning network that maximizes an individual's present value of lifetime returns to education:

$$H(t) = N(t)Ce^{\delta t} \quad (3)$$

where $\delta \equiv \delta_N - \delta_H$ is the net decay of learning community.

Equation (3) implies that knowledge acquisition is increasing with the size of the network, *ceteris paribus* and that larger learning communities would have greater knowledge acquired relative to smaller learning communities. Intuitively, if more people are departing from the learning community than the rate at which knowledge becomes obsolete, the marginal contribution of the additional individual to the learning community becomes even more essential to the community. As knowledge becomes obsolete relatively quickly as new knowledge is created, the marginal individual becomes less consequential to the network.

As knowledge accumulation $H(t)$ is based on the size of the learning network $N(t)$, we derive the expression for the size of the learning network:

$$N(t) = \sqrt{\frac{2W(t)e^{(\rho-\delta)t}}{H_0/N_0}} \quad (4)$$

where $W(t)$ indicates the remaining returns to education still to be accrued in the remaining period.

Comparative static analysis shows that the growth of the learning community depends on the sign of δ as well. A positive δ implies a relatively high departure rate from the learning network. The learning network will then either grow over time, albeit at a slow rate (i.e., if ρ is greater than δ) or decay over time (when ρ is less than δ). Hence, for the learning community to exponentially grow over time, it must be the case that δ be negative, or that knowledge becomes sufficiently obsolete over time and that the departure rate of individuals from the community remains sufficiently low as well.

Concluding Remarks

Learning in a time of a pandemic is not optimal—nothing is—but to mete it with an all-or-nothing choice of abandoning all learning opportunities may not be to the learner's benefit. We find that student-centered HEIs recognize the role they play in advocating the students' welfare by providing remote learning opportunities as a rational policy countermeasure to prolonged school closure. Learning networks allow students to interact with each other, create productive linkages of knowledge accumulation even when they are necessarily apart from each other provided that instructors design an environment optimized for remote learning. In this case, we maintain that, in the time of coronavirus, learning need not be quarantined, too.

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