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A future for rural hybrid public university: Lessons from post-pandemic Panama **Un futuro para la universidad pública híbrida en zonas rurales: Lecciones de Panamá** **post-pandemia**

Nanette Archer Svenson¹; Guillermina-Itzel De Gracia²; Andrea Estefanía Palacios Castilla¹; Thais Paola Balbuena Morales³

¹ Center for Education Research (CIEDU AIP), Republic of Panama

² University of Panama – Coclé Regional Center, Republic of Panama

³ University of Panama, Republic of Panama

Email de correspondencia: *nanette.svenson@gmail.com*

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Resumen

La Covid-19 obligó a las universidades panameñas a cambiar hacia la educación virtual, al tiempo que evidenció desigualdades inherentes en el sistema nacional, particularmente la falta de preparación de las instituciones públicas para esta transición. La situación se agravó debido a los estrictos confinamientos en Panamá, que mantuvieron cerradas oficialmente las escuelas públicas durante dos años. A pesar de la magnitud de esta disrupción, hay escasa investigación sobre sus resultados, especialmente en las zonas rurales del país. Este estudio, realizado por el Centro de Investigación Educativa y la Universidad de Panamá (UP), evaluó las percepciones de 654 estudiantes y 75 profesores y administradores en tres campus rurales principales de la UP sobre sus experiencias con la educación virtual, especialmente en relación con la reincorporación de la enseñanza presencial. Se empleó una metodología mixta que incluyó encuestas y entrevistas con informantes clave mediante muestreo intencional. Las preguntas abordaron temas como las condiciones del hogar para participar en la educación virtual; la accesibilidad y confiabilidad de la infraestructura y los dispositivos; la disponibilidad de materiales académicos; la capacitación recibida para el uso de herramientas digitales; y el nivel de preparación alcanzado para el retorno a la enseñanza presencial. Los resultados de las encuestas indicaron una satisfacción general con el aprendizaje virtual improvisado, aunque con reservas sobre la infraestructura inadecuada, el acceso a dispositivos, la capacitación y la gestión del estrés. Las entrevistas reflejaron una insatisfacción más matizada con la preparación de los estudiantes, especialmente para el regreso a las clases presenciales. Los datos generados documentan los desafíos actuales de la educación universitaria pública en las zonas rurales de Panamá y ofrecen recomendaciones para la evolución de los sistemas híbridos de aprendizaje, los cuales parecen estar destinados a ser una realidad en el futuro previsible en Panamá y en otras regiones en desarrollo.

Palabras clave: educación universitaria, híbrida, rural, Panamá.

Abstract

Covid-19 forced Panamanian universities to shift to virtual education and simultaneously highlighted inherent inequities in the national system—notably that public institutions were not prepared in any way for this change. The situation was exacerbated as Panama's stringent lockdowns officially closed public schools for two years. Despite the magnitude of this disruption, research on the outcomes is scarce, especially for rural areas of the country. This study conducted by the Center for Education Research and the University of Panama (UP) measured perceptions of 654 students and 75 professors and administrators in three major rural UP campuses regarding virtual education experiences, particularly in connection with the reincorporation of in-person learning. This mixed methods study involved a series of surveys and key informant interviews with purposive samples and questions on issues such as home conditions for participation in virtual education; infrastructure and device accessibility and reliability; available academic materials; training received for digital tool utilization; and levels of preparation achieved for reintegration of on-campus instruction. Survey results indicated general satisfaction with the improvised virtual learning, albeit with qualifications for inadequate infrastructure, device accessibility and training, as well as for stress management. The interviews reflected more nuanced dissatisfaction with student preparedness, especially for return to on-campus classes. The data generated documents current challenges in rural Panama for public university education and offers recommendations for the evolution of hybrid learning



systems, which seem destined to be a reality for the foreseeable future in Panama and elsewhere, especially in developing regions.

Keywords: university education, hybrid, rural, Panama.

Introduction

The Covid-19 pandemic forced transformative change on Panama's higher education system and highlighted many of its inherent inequities. Perhaps the most notable aspect of this change is the shift to virtual education¹, for which none of the universities were prepared and with which the public universities were particularly challenged. In spite of the enormity of this interruption and the subsequent reorientation of instruction it necessitated, study of the topic and its related subthemes has been relatively scarce—and almost non-existent in areas outside the largest cities.

This mixed methods research conducted by the Center for Education Research of Panama (CIEDU) and the University of Panama (UP) Regional Center in Coclé examines three major UP campuses in the rural interior of the country to measure perceptions of students, teachers and administrators regarding the virtual education implemented in recent years, particularly in connection with the recent reincorporation of face-to-face² instruction. Methods employed include surveys, key informant interviews, participant observation and document analysis. Specific aspects of interest involve the accessibility and reliability of the digital infrastructure, the training, pedagogy and content utilized for online education; and levels of preparedness achieved for the reintegration of on-campus instruction.

The study explores and documents the context and reality of public university education in Panama's central provinces, generating data on the possibilities and limitations associated with online education outside the urban areas—where challenges are heightened—and the post-pandemic reintegration of on-campus instruction. It also reviews solutions implemented outside of Panama in an effort to offer insights on the combination of virtual and in-person instruction to create effective hybrid learning systems. This is increasingly relevant as hybrid university

¹ The terms “virtual,” “online” and “digital” can be used to signify slightly different learning and teaching modalities; however, in this article the terms will be used interchangeably to describe education that utilizes technology and the internet for delivery.

² Throughout this article, the terms “face-to-face,” “in-person,” and “on-campus” will be used interchangeably to refer to classroom-based education conducted on a university campus.



education holds the potential to serve a vital function not only in Panama but in many other parts of the world as well, especially in developing regions.

Following this introduction, the article is organized into sections that discuss the rationale and national context, concentrating on Panama's rural interior during and since the Covid-19 pandemic; the methodology employed for developing the study; the quantitative and qualitative results obtained; a discussion of the findings; and a conclusion with ideas on the limitations of the current study and recommendations for evolving hybrid university instruction and research in the future.

Rational and context

The Republic of Panama is a small country with a population of 4.4 million located at the bottom of Central America. It is known for its Canal that serves as the shortest trade route between the Atlantic and Pacific oceans, its booming economy and its faltering public education system. In spite of the nation's dynamic economic production, which has grown consistently at rates that top most regional and global averages³, Panama has struggled in recent decades to channel this prosperity into the development of an education system worthy of its income status. The World Economic Forum Global Competitiveness Report (2019) notes that in spite of relatively high school life expectancy (12.7 years on average), Panama's current workforce skills rank in the bottom quarter of all countries surveyed. Particularly low scoring indicators include extent and quality of training, graduates' skill sets, digital capacity and critical thinking. Research and development indicators score even lower (Schwab, 2019). Studies on Panama's higher education sector confirm these issues and highlight the need for significant revamping of structures, curricula and delivery (Reisberg, 2021; Svenson, 2024). For the public university system, the difficulties imposed by Covid-19 intensified an already tenuous situation, the aftermath of which is currently playing out.

³ According to World Bank data, Panama's 2023 Gross Domestic Product growth rate was 7.3% compared to 2.2% for Latin America and the Caribbean and 2.7% for the world.



Pandemic university education

Panama was hit hard by Covid-19 and the government responded immediately with a national quarantine and mandatory closure of all schools in March of 2020. In July of that year, the Ministry of Education decreed an official return to classes through distance learning, but public schools at every level remained closed for nearly two years with Panama topping global lists of countries with the longest shutdowns (Svenson, 2021). The situation was exacerbated for the public universities and these institutions did not normalize the return to on-campus learning until mid-2022 (Svenson & De Gracia, 2023).

As noted above, Covid-19 visibilized dramatically many of the weaknesses inherent in Panamanian public education, and this has been widely documented (De León, 2020; Gordon Graell, 2021; Labrador et al., 2022; Subinas, 2021; Svenson & De Gracia, 2020; Svenson, 2024; UNICEF, 2021). In addition to exposing crucial inequities between public and private—as well as urban and rural—education, the pandemic also forced the transition to distance learning and the incorporation of online education. The higher education sector had more experience on which to draw for this than did primary and secondary; and private universities were in a better position than the public institutions. At that time, the Association of Private Universities of Panama (AUPPA), made up of 15 institutions, had officially registered 196 approved online programs and over 80% of their professors had received training on how to use the technological programming (Svenson & De Gracia, 2020). In comparison, public universities had little to no virtual instruction as their programming had traditionally been exclusively in-person. With the pandemic, they quickly introduced more technological options for online delivery, but many of these efforts were not entirely successful due to the lack of experience and training for both teachers and students (Gordon Graell, 2021).

Among the public institutions, the Technological University of Panama (UTP for its acronym in Spanish) was able to address the issue of virtual education far more effectively, largely because it started well before the pandemic with the integration of this modality. Also, given its focus, the UTP has always tended to incorporate international standards for its programming, and this has included the assimilation of information technologies. However, the UTP has been the notable exception among Panama's public universities (Svenson & De Gracia, 2020).



One factor complicating the situation for public universities, which typically serve populations from lower socioeconomic levels, is the lack of accessibility for many of their students to the required connectivity. National government statistics estimate that only 40% of students in the public system have access to internet at home and barely 30% have access to a computer; in rural areas of the country, these figures drop considerably (CIEDU, 2020). Consequently, many public university students have had to manage their virtual learning with little more than a cell phone. This implies additional costs that can be prohibitive. During the pandemic, telephone companies joined forces with the government to facilitate free internet access for educational platforms; however, the implementation of these agreements was not comprehensive enough to address the numerous obstacles faced in this regard (De León, 2020; Svenson & De Gracia, 2020).

Another issue for public higher education and for the UP, in particular, as the largest of them is the increasing enrollment in recent years. This growth was exponential during the pandemic years with the student population surging 27% from 2020 to 2022 (INEC, 2023). Without commensurate adjustments in funding, administration and curricula, this has presented an enormous challenge for the quality of both inputs and outcomes.

The University of Panama and its Regional Centers

The UP is the oldest and largest of Panama's public universities. It was founded in 1935 in Panama City with the enrollment of 175 students in night school across six disciplines: education, business, natural sciences, pharmacology, engineering and law. A complete campus was inaugurated in 1953 with four major building structures (UP, 2024a). Over the next two decades, additional land was acquired and more than 25 buildings were added. From the early 1970s onward, with looser admissions policies instituted under the government led by General Omar Torrijos, enrollment soared, hitting over 40,000 students by 1985 and more than 85,000 by 2023 (UP, 2024b).

The mass influx of students in the 1970s caused economic, structural and physical upheaval, which severely strained existing classroom space, equipment, technology, library resources, and teaching staff. This led to considerable improvisation on all fronts, negatively affecting instruction and ultimately, the quality of UP graduates (UP, 2024c). Although the UP has taken various measures throughout the 1980s and in subsequent decades to address and



accommodate its bloated student population, the issue continues to challenge its ability to turn out graduates that the productive sector esteems worthy of hire (Svenson & De Gracia, 2017).

Interestingly, the post-1970 period also witnessed an increase of women in the UP. In 1975, the student population was evenly split between men and women, and women professors were few; by 2015, women accounted for two-thirds of the student body, nearly three-quarters of graduates and almost half the faculty. These advances, however, do not appear to have translated into similarly proportionate gains in labor market participation and compensation (De León de Bernal, 2017).

Rural Interior

Despite the national coverage achieved in primary and secondary education, access to higher education in rural areas has been more limited historically. As a result, the UP has been pushed to expand beyond Panama City and is now the most accessible option for these students, serving as an academic refuge and an opportunity for social mobility. National legislation in 1958 created the first UP Extension Programs in provinces and districts outside of Panama City. A number of these eventually became full regional university centers with their own campuses, faculties, departments and cultures (UP, 2024c). Today, the UP operates 10 regional centers (RCs) nationwide of varying sizes. Table 1 below lists these, along with their respective locations, years of establishment, number of faculties (schools) and enrollment figures over the past couple of decades.



| Regional Center | Location | Year established | Number of faculties | 2000 enrollment | 2023 enrollment |
|-----------------|---------------|------------------|---------------------|-----------------|-----------------|
| Azuero | Chitré | 1970 | 14 | 2,489 | 3,106 |
| Bocas del Toro | Changuinola | 1997 | 11 | 1,992 | 2,945 |
| Coclé | Penonomé | 1965 | 14 | 2,450 | 4,248 |
| Colón | Colón | 1960 | 12 | 4,975 | 7,549 |
| Darién | La Palma | 2012 | 8 | -- | 737 |
| Los Santos | Las Tablas | 1986 | 10 | 1,661 | 1,760 |
| Panamá Este | Chepo | 2015 | 7 | -- | 1,109 |
| Panamá Oeste | Chorrera | 1993 | 10 | 3,860 | 5,305 |
| San Miguelito | San Miguelito | 1993 | 9 | 3,078 | 4,965 |
| Veraguas | Santiago | 1969 | 16 | 5,331 | 5,736 |
| | | | | 25,836 | 37,460 |

Tabla 1. University of Panama – Regional Centers, 2024

The oldest, largest and most rural of the UP RCs are those located in Azuero, Coclé and Veraguas. They account for 35% of all UP RC students and represent the RCs selected for this study. Most of the UP RCs are located in and cater to student populations of largely rural areas. Even the RCs located in or near major cities—Colón, Panamá Este, Panamá Oeste and San Miguelito—serve numerous students from more remote, less urban environments. Additionally, Panamanian universities tend not to operate on a residential basis. Student dormitories are a rarity and most campuses do not include such facilities so university students throughout the country typically commute on a daily basis, which has added implications for logistics and costs.

University education in the rural RCs is of pertinent interest for several reasons. First, the RCs now account for nearly half of the total UP student population (UP, 2024d), which in turn accounts for almost 40% of the total national university population. In terms of students, the RCs have grown close to 300% from 1985 to present, whereas the main UP campus has grown 46%.

Second, in spite of the RC growth over the years, their budgets have not increased anywhere near proportionally. Neither have the household resources available in many of the RC areas, mainly due to these provinces’ reliance on primary sector production. Panama’s primary sector employs 15.7% of workers but contributes merely 2.4% to the gross domestic production (GDP) (ICEX, 2022; INEC 2022). Consequently, the GDP contributions of the provinces where the largest UP RCs are based is minimal in comparison with other provinces. Together, Azuero (Herrera), Coclé and Veraguas account for 6.5% of GDP and 17% of the national population (INEC, 2023). This imbalance affects the socioeconomic levels of the



households of the RC students, their disposable income and the range of employment options available to them post-university.

Third, connectivity in rural provinces tends to be more limited than in Panama City. Data from the latest census indicates that in the province of Panama, 80% of households have both fixed and mobile internet connectivity, whereas in other provinces, the figures are much lower. The digital divide is greater in some places than in others, with the indigenous regions being the most affected by the lack of service. In the provinces of Coclé, Herrera, and Veraguas, where this research was conducted, the percentages of households with access to fixed or mobile internet are 56%, 65%, and 55%, respectively (INEC, 2023).

Given these three factors of student population, financial resources and connectivity, the circumstances surrounding the country's rural interior impose far greater challenges for the public universities, with both virtual and on-campus education.

Methodology

The methodology for this research was presented as an exploratory study on the perception of students' evaluation of higher education during the transition period from virtual to in-person learning. It focuses on the students of the three predominantly rural RCs mentioned (Coclé, Veraguas, and Azuero) and includes the professors and administrators of these centers. It employs a series of surveys and targeted interviews.

The sample is intentional and non-probabilistic, although it was designed to be as representative and comparative as possible. Intentional samples allow for the selection of characteristic cases from a population, limiting the sample to these cases. They are used in situations where the population is variable, and consequently, the sample is relatively small (Otzen & Manterola, 2017). This is the case with the three selected RCs in rural areas of Panama's central region, and especially with the RCs' second-year students who are more directly experiencing the transition from virtual to in-person education.

For the student surveys, the sample included over 200 students in each RC, distributed across the various faculties considering the following: the Azuero RC has 17 faculties; the Coclé RC has 14 faculties; and the Veraguas RC has 16 faculties. The surveys proportionally included more second-year students because they have experienced more years of virtual education. For participant recruitment, collaboration was established with representatives of the teaching staff



at each RC to select the groups of students surveyed. The surveys were conducted in person at the RCs and in classrooms. The project itself and the concept of informed consent were explained to the participants. A link to access the online survey via their cell phones was provided. All participants who wanted a copy of the consent document had the opportunity to take a photo of the document with their phones or request a physical copy from the professor administering the survey. The data collected from the surveys was processed using identification numbers (not names), all processing was managed digitally and the students accessed and responded to the survey on their devices using a QR code, primarily via their cell phones.

For the faculty surveys, everything was also managed digitally, distributing the survey to all professors of the three RCs via email. Additionally, specific professors by department at the different RCs were selected to assist with follow-up to achieve broader representation. The survey instruments were developed using references from questions and questionnaires used in similar studies in other countries during and after the pandemic (Froman et al., 2020; UADE, 2021; School Education Gateway, 2023; Survey Sparrow, 2022).

In addition to the surveys, targeted interviews were conducted with 18 representatives from the RCs (students, professors, and administrators) and the UP main campus to understand the process of transitioning from virtual to in-person learning. The interview guides were developed using similar references as the surveys, but the questions were open-ended to allow for more freedom of response and to gather broader, more varied information than could be obtained from the closed-ended survey questions.

The data collected from the surveys and interviews were analyzed quantitatively and qualitatively, respectively. The quantitative data analysis was primarily descriptive, comparing and contrasting the information collected among the different groups of students, professors, and administrators. The qualitative data from the interviews was analyzed through a series of matrices to better understand perceptions, opinions, and experiences and include in-depth insights into the central research questions.

In addition to the surveys and interviews, the project studied global literature on the design, implementation, and evaluation of virtual and hybrid higher education in other countries through a review of secondary documentation to identify lessons learned and conceptual



framework references for building and evaluating virtual and hybrid programming. The information produced from the survey and interview data within the context of the main research questions was compared with global references to highlight potentially useful models for Panama.

The study methodology also includes a component of participant observation since one of the project researchers is a UP RC professor, while another is a UP student. This basic research technique in social anthropology, which involves fully integrating into the study subject, has allowed for a more holistic view of the students' reality from multiple perspectives. Participant observation is characterized by its provision of qualitative data that allows for in-depth understanding of the meanings, dynamics, and perspectives of the individuals or groups studied (Bohannon, 1996). For this research, the participant observation adds a more comprehensive student and teacher perspective, thus enriching the interpretation of the data.

Findings

The sample in this research included a total of 654 students and 75 professors/administrators across the three RCs of Azuero, Coclé, and Veraguas for the surveys, and four student representatives and 14 professor/administrators for the interviews (most RC educators serve in both functions), all in relatively equal proportion. A summary of key findings is presented below in line with the categorization utilized for the major survey and interview topics: demographics, connectivity, experience with virtual education and experience with the reincorporation of on-campus learning.

Demographics

Regarding gender, 76% of the participating students identified as female, 23% identified as male, and 1% did not specify. These figures align with those of the UP in general, as well as with each RC. The UP is currently predominantly female, a trend that began around 1975 and has continued to this day (De León de Bernal, 2004, 2017).

Most students participating in this study live in the provinces corresponding to their RC. However, surprisingly, 12% live in Panamá Oeste and 8% live in Los Santos, two neighboring provinces. Proportionally, more surveyed students—45%—were in their second year of university.



A significant portion of the student population, 65%, identified their ethnicity as mestizo, with 17% identifying as white, 11% as Afro-descendant, and 5% as Indigenous. Nearly all students, 92%, had graduated from the public secondary school system, and 78% reported having a family member who had completed university.

At the time of the survey, most students, 72%, were studying in person, while 28% were enrolled in a mix of virtual and in-person education. Among the respondents, 13 faculties were represented, with the highest representation in Humanities (25%), Business Administration and Accounting (22%), Education Sciences (14%), and Natural, Exact, and Technological Sciences (13%).

Among the surveyed professors, 67% are women. Similar to the student responses, 63% of the participating professors identified as mestizo, 20% as white, and 13% as Afro-descendant. Nearly 90% reported having a family member at the UP. More than half, 59%, reported having administrative responsibilities in addition to their teaching duties. Similarly, more than half, 53%, also reported having an additional job outside of the UP, and a third work more than 20 hours per week in their extra jobs.

Connectivity

One of the most interesting findings from the exploration of connectivity was that the majority of students (66%) rely on their cell phones for virtual education, while most teachers (87%) use computers. Additionally, 20% of students have to share their devices with other family members. This difference in circumstances implies many other distinctions between students and teachers in how they experience online education.

For example, almost all teachers (89%) have a fixed internet connection at home, but only a little over half of the students (56%) have this type of connection. Many more students than teachers rely on mobile data for their connection—43% versus 9%, respectively—which entails an additional cost of over \$20 per month and tends to be less stable and reliable. Nearly 20% of students cited a lack of data as a reason for missing virtual classes, while no teachers cited this reason. The most cited reasons for missing virtual classes, reported by both students (71%) and teachers (81%), were power outages and lack of internet connection.

This also means that receiving visual information (videos, presentations, lectures, written materials, etc.) on a phone screen is not the same as receiving it on a computer screen



and may negatively impact the level of learning. Researchers in Chile have found that people are more likely to develop specific skills when accessing the internet via a computer rather than a cell phone (Correa, Pavez, & Contreras, 2018). The words of one student interviewed clearly explain this difference and some of the difficulties it creates:

"I didn't have a computer, so that was a challenge when doing assignments because my major is finance. We work a lot with Excel, and for Excel, you need a proper computer because on a cell phone, everything gets jumbled or changes... it's very tedious, and that was a really, really serious problem. In the end, I had to retake the course... Some of the equipment should be provided by the government because it is already a fundamental part of education."

Additionally, each teacher in the UP system chooses which applications to use for teaching their classes. Although the UP has its own platform, *Campus Virtual UP*, its use is not mandatory, and there is no official UP policy on this matter. As a result, students, who typically take 8–9 courses per semester, have to navigate a similar number of applications, which further complicates their learning process and increases their data consumption.

As one interviewed student explained, "Each professor decides how they will operate, and we students have to adapt. There is no official policy on this, so we have to manage many different applications for different subjects."

Regarding synchronous and asynchronous modalities, all professors and students are working with both, and students did not indicate a clear preference for one over the other. As one student explained, "The synchronous class feels more natural, but the asynchronous (recorded) class can be watched multiple times if you don't understand something."

Experience with virtual education

Students and teachers reported multiple difficulties with virtual education, some related to the UP's implementation and others linked to their personal situations. Interestingly, despite the mentioned difficulties, the majority of surveyed teachers (73%) and students (59%) reported relatively high levels of satisfaction with virtual education ('quite a bit' or 'a lot'), although 40% of students and 27% of teachers reported being 'little' or 'not at all' satisfied with it. Many students constantly struggled with connectivity issues at home, which also significantly affected their class participation and learning. All of this made the process more difficult and impacted their performance.



Comments from interviewed students provided more nuanced observations:

“I liked the convenience... I could do group work sitting or lying in bed!”

“Sometimes there was no electricity, sometimes there was no signal, sometimes I didn’t have my phone...”

“With virtual learning, there are people who have a lot of questions, but out of shyness, they don’t turn on their microphone and speak.”

“Virtual classes don’t work for me because I’m a very interactive person. If you leave me alone in my room with the professor talking, I fall asleep. I need to see the professor moving in real life.”

Experience with the reincorporation of on-campus learning

When the UP reintroduced in-person education in 2022-2023, enrollment at the RCs had grown by 45% compared to 2020 enrollment (see Table 1 above), which had serious consequences for physical spaces and class logistics, forcing a continuation of virtual education to accommodate everyone. At the time of conducting this study, nearly all students and teachers were teaching with a mix of virtual and in-person education.

Similar to the survey results regarding satisfaction levels with virtual education, the majority of teachers (64%) and students (67%) reported relatively high levels of satisfaction with the return to in-person education (“quite a bit” or “a lot”), although 32% of students and 36% of teachers reported being “little” or “not at all” satisfied. Additionally, the difficulties noted by both groups regarding in-person classes were very similar to those reported for virtual education.

This suggests a level of discomfort with public higher education itself (virtual, in-person, and hybrid) among all those involved, extending beyond technology and the physical conditions of the RC, which seems to be related to the quality of education and performance and what this means for subsequent learning. All surveyed and interviewed participants agreed that in the future, UP and especially the RC will be forced to continue with a hybrid system. Considering all the challenges mentioned, the question now is how to design and implement this hybrid system in the best possible way.



Document analysis

With this hybrid future in mind and given the vast global literature on best practices related to university virtual and hybrid programming (examples from leading universities and global conferences on this include Cheung, 2023; González-González et al., 2022; Harvard University, 2023; MIT, 2022; Stanford University, 2023; UNESCO/IESALC, 2020), we focused our document analysis on models of conceptual frameworks to guide this type of program design, implementation, and evaluation. Surprisingly, we did not find many that considered the breadth and depth of necessary considerations for complete systems, but various models present valuable references for different components. For example, Zhao & Zhou (2024) offer a thorough bibliometric analysis of 8,521 articles that highlights key themes and influential countries and institutions related to higher education digitalization. Albers et al. (2023) provide insights on hybrid higher education organizational design; Cabero-Almenara and Palacios-Rodríguez (2020) and Inamorato dos Santos et al. (2023) on digital competencies for educators; Baker and Spencely (2023) on hybrid alternatives for stimulating student engagement and learning; Escamilla Martínez (2022) on strategic planning and digital training for educators and students; and Singh et al. (2021) on hybrid designs, especially regarding student-teacher communications, materials and mental health considerations, along with SWOT analyses associated with digital elements.

Still, there appears to be a clear need for more modeling tools that consider the full range of infrastructural/environmental, organizational, technical, material and capacity development considerations required for successful hybrid programming as an increasing number of universities worldwide move toward hybrid solutions. This is particularly true for developing countries with less experience in design and implementation of such systems. Along these lines, useful models we found are (1) the Inter-American Development Bank (IDB) (Alvarez et al., 2020), (2) McKinsey & Company (Child et al., 2023), and (3) the Florida Center for Instructional Technology (FCIT) at the University of South Florida (USF) (USF, 2024). Similar to best practices literature overall for hybrid university education, these conceptual frameworks originate from actors in different sectors—international organizations, private sector companies and universities.



The IDB framework is based on information gathered from the Latin American region during the pandemic and presents four fundamental pillars for the design of hybrid education: new pedagogies, teacher competencies and profiles; equipment and connectivity; platforms and content; and student data and tracking. For each of these pillars, it details key components and critical considerations to include in the development of national and institutional strategies (Arias Ortega et al., 2020).

McKinsey & Company, the multinational strategic consulting firm, also published a report in 2023, *What do higher education students want from online learning?* Within the report, the authors present a conceptual framework that identifies eight key dimensions that shape positive virtual experience of higher education students: a clear road map, easy digital experience, balanced learning formats, captivating delivery, practical learning, adaptive learning, timely support and strong community. Each dimension consists of multiple integral factors, which they describe and explore in the publication (Child et al., 2023).

Another useful framework is the Technology Integration Matrix (TIM) from the FCIT at USF, which has been widely applied by many institutions at all educational levels in various locations and contexts. This matrix provides a framework for describing and focusing the use of technology to enhance learning. TIM is built on two main axes: (1) the characteristics of the learning environment and (2) the levels of technology integration. The five interdependent characteristics related to the learning environment are as follows (USF, 2024):

- **Active learning**, where students use technology as a tool rather than just a means to passively receive information.
- **Collaborative learning**, where students use technology to work with others rather than just individually.
- **Constructive learning**, where students use technology to connect new information with prior knowledge and create broader structures.
- **Authentic learning**, where students use technology to link learning to the world beyond the instructional setting.
- **Goal-directed learning**, where students use technology to set objectives, plan and execute activities, and monitor and evaluate processes and outcomes.

These characteristics are associated with the second axis of the matrix, which details five progressively sophisticated levels of technology integration: entry, adoption, adaptation, infusion, and transformation.

Drawing elements from these three models, as well as from the studies on specific hybrid components, and considering the characteristics and objectives of the Panamanian context, we created the following framework that organizes the key factors for the design, implementation, and evaluation of hybrid university programming systems. The framework is based on five axes that emerged as essential themes in the results of our research: connection, channels, content, capacity building, and coordination and community. Each axis has its own list of basic considerations for successful hybrid programming. This framework, with details to be developed by frontline users, is presented in the hope that it may serve as a guide for the design and implementation of this type of programming for the future, as well as for its monitoring, evaluation, and adjustment, both in Panama and in other countries (Figure 1).

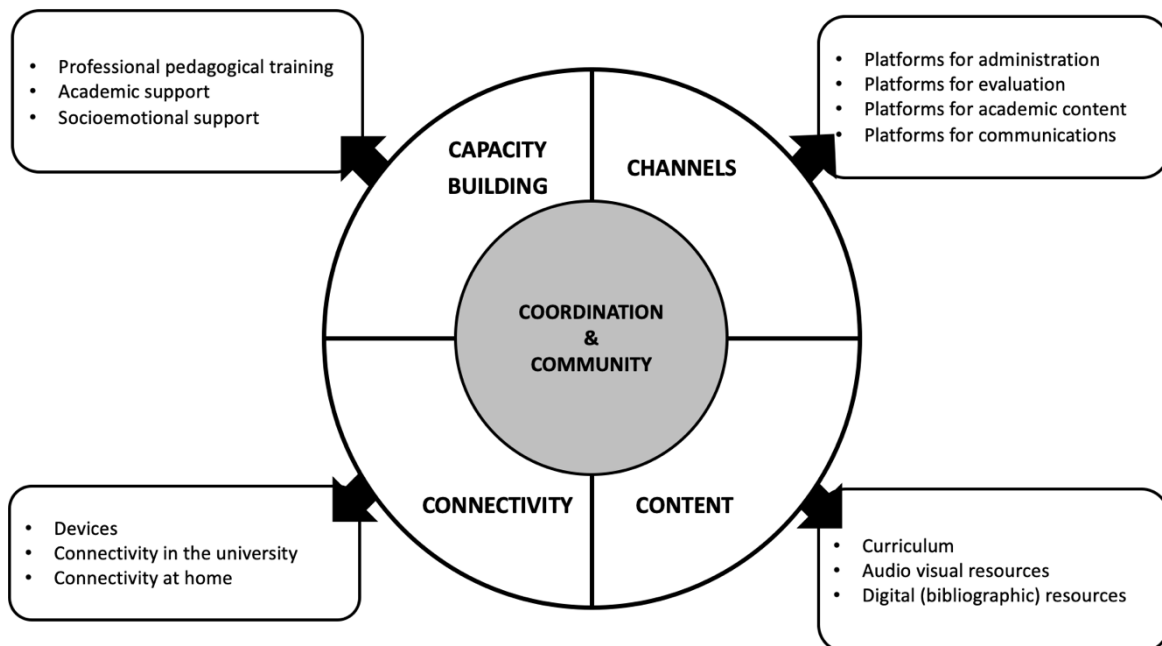


Figure 1. Conceptual framework for virtual and hybrid university programming



Discussion

The conceptual framework presented above (Figure 1) is the product of the findings of this research and the key themes that have emerged, particularly regarding the challenges associated with designing and implementing hybrid programming. First and foremost, this study has shown that virtual education is here to stay. Especially in the country's interior, public university centers have been compelled to continue in a mixed modality (in-person and virtual) post-pandemic to accommodate growing student demand. This reality raises important questions and considerations about many aspects of how to design, deliver, receive, and evaluate the new model of higher education.

Above all: connectivity. Without a stable and reliable internet connection, successful participation in virtual education is impossible. This requires a strategic approach to ensuring the coverage and reliability of the signal (as well as the availability and reliability of electricity) in university centers and in the homes of students and educators. It also entails addressing the cost of accessing and using these services and the type of devices used. While a mobile phone works well for consuming virtual information, it is not ideal for generating content or creating knowledge-based products. Additionally, having all professors working from computers while most students operate from mobile phones creates a situation rife with disparities. Advancing solutions in these areas will require a mix of public-private collaboration and targeted public policies to achieve desired goals.

The channels that facilitate connection and link all participants in the system represent the next level of consideration for virtual/hybrid education. Today's learning management, communication, assessment, and administrative platforms are numerous and diverse. It is crucial to establish uniformity among educators and students regarding the platforms used, which depends on institutional leadership. Selecting and/or developing these platforms as institutional standards requires continuous research, comparison, maintenance, and monitoring and evaluation. Research from Fabian et al. (2024) and Singh et al. (2021) provide inputs for examining these areas in more detail.

The educational content used for hybrid learning is another key consideration, particularly because what works in a physical classroom does not necessarily yield the same results in a virtual setting. The selection of digital, audiovisual, and bibliographic materials is



more complex in a hybrid system and requires an additional level of expertise, experience, and administration. In this regard, references from Baker & Spencely (2023), Fabian et al. (2024) and Singh et al. (2021) are helpful for delineating specifics.

Ongoing capacity building through training for educators, administrators, and students forms another essential component of the hybrid conceptual framework. Since the integration of educational technology is an ever-evolving process, this type of training must be a core part of institutional development. Some of the key topics to include in a continuous learning portfolio for educators are formal professional pedagogical training and coaching, socio-emotional support, and technical assistance for managing integrated ICT tools. For students, similar training in socio-emotional and technical support is critical, along with additional courses aimed at academic support and career preparation for post-graduation employment. With capacity building for digital competencies, Baker and Spencely (2023), Cabero-Almenara & Palacios-Rodríguez (2020), Escamilla Martínez (2022) and Inamorato dos Santos et al. (2023) offer strategic guidance on particular issues.

Considering all of the above, strategic, complex, continual coordination and management of all these areas is crucial—and complicated. Given the level of expertise currently available for this in Panama, the incorporation of international expertise is advisable. To coordinate, monitor, and continuously adjust the key elements of the hybrid university education system, a systematic approach to managing logistics and resources at all administrative levels is required. Additionally, serious attention must be given to how these elements can be combined to build and maintain a strong sense of community among all participants. This effort must originate at the highest level and be strategically reinforced at all subsequent levels. Here, the models from Albers et al. (2023) present relevant elements to be incorporated.

Conclusion, limitations and future research

This study's limitations include the fact that the samples are purposive and not statistically significant. Additionally, because of internal difficulties and temporary facility closure in the Veraguas RC during the time of the research, it was not possible to include the desired number of professors and administrators in the survey data. Supplemental investigation



could be considered to provide additional coverage and input from the three RCs included in this study as well as from other RCs in the UP system.

The results of this research and the development of the conceptual framework serve as a foundation for launching a second stage of research, which should focus on designing a strategy and roadmap for the UP regarding its post-pandemic hybrid programming. Ideally, this phase would include UP professionals and students, as well as experts with international experience in developing similar programs in other countries.

For the future of higher education, especially in the RCs of public universities, it is crucial to find a balance between in-person and virtual modalities that meets educational needs, as well as the preferences and abilities of students and educators. It is essential to continue exploring methods to enhance the online educational experience, as well as ways to strengthen support and training for both students and faculty in the effective use of virtual platforms.

Likewise, the findings of this study should be considered for public policy development. At the national level, a new vision is needed to expand connectivity across the country and ensure that all citizens have access to the internet, as it has become a vital public service, much like electricity, water, and sanitation. At the university level, a new vision is required to manage student demand for higher education, ensure the quality of education provided and its related outcomes, and allocate available resources efficiently and effectively to achieve these goals.

While the conclusions of this study focus on Panama, and specifically its more rural areas, the general concepts are applicable to most if not all developing country scenarios. Thus, the hope for the expansion of this data analysis is that the resulting framework will serve to guide development of hybrid systems across countries to create higher education delivery that will reach multiple communities of students, including the currently more marginalized of these.

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