

Implementing a Computerized Dean's Dashboard System at Health Workforce Educational Institutions: Experience from Three Pilot Institutions

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BACKGROUND

The global health workforce crisis—characterized by severe shortages of health personnel as well as imbalances in the skills mix and geographical distribution of the available workforce—has left millions of people without access to critical, life-saving care (World Health Organization [WHO] 2006). In 2013, the Global Health Workforce Alliance and WHO estimated a global deficit of 7.2 million doctors, nurses, and midwives—considerably higher than the 2.4 million deficit estimated by WHO in 2006 (Campbell et al. 2013). To move toward universal health coverage, institutions responsible for educating and training the health workforce must produce more health workers with the competencies needed to address local health needs; who represent the people they serve in terms of language, gender, and other socioeconomic characteristics; and who practice where needed at all levels of the health system, particularly in underserved areas.

Educational institutions around the globe are struggling to meet the demand for more health workers who are capable of providing quality health services. According to the Global Commission on the Education of Health Professionals for the 21st Century, all medical, nursing, and midwifery schools combined produce approximately one million health professionals each year (Frenk et al. 2010). At the same time, investments in health professional education represent less than 2% of the estimated \$5.5 trillion of worldwide health expenditures annually, which the Commission described as “pitifully modest for a labour-intensive and talent-driven industry” (Frenk et al. 2010, 6). To overcome the global deficit of health workers, it has been estimated that billions of dollars of new investments are needed in education and training alone (Campbell et al. 2013; WHO 2008).

Health workforce educational institutions are not limited to medical, nursing, and midwifery schools but also include dental, pharmacy, and public health schools as well as technical and vocational training institutes for allied health workers. They range from stand-alone colleges, such as a nursing and midwifery college, to schools and departments embedded within larger institutions, such as universities or faculties of health sciences. They can be publicly funded, privately funded, or can receive a mix of public and private funding. Within these complex educational systems, critical resources—such as teaching staff, infrastructure, materials, and equipment—are often scarce and poorly managed.

In the face of unpredictable funding, these institutions must find ways to produce more health workers within current, marginally expanding, or even decreasing budgets. More effective and efficient management of education and training institutions can play a major role in a country’s ability to scale up its production of competent and qualified health workers. Working in collaboration with school leaders and experts in education management systems, *CapacityPlus* assembled a guidance document and set of tools to help educational institutions take a more business-like approach to education and training. The [CapacityPlus school management package](#) includes a number of analytical, planning, and management tools to guide school leaders in a cyclical, participatory approach of self-assessment against predefined management standards or good practices, followed by prioritization, goal-setting, planning, implementation, and monitoring of progress. A free, open source, computerized Dean’s Dashboard tool is a key component of the package. The Dean’s Dashboard supports school managers in making data-driven decisions by facilitating a process of defining key performance goals and indicators and then routinely monitoring progress toward them.

THE DEAN'S DASHBOARD CONCEPT

Every day, school leaders—such as presidents, principals, deans, directors, and department heads—must make critical decisions about the operations and management of their institutions. Sometimes those decisions are based on information and data. Other times they are based on educated guesses, because necessary data are not available or are too complex to quickly analyze. Computerized education dashboards help to manage and make comprehensible the large amounts of data that school leaders must use to make decisions. Dashboards extract information from different management information systems—such as finance, admissions, personnel, and infrastructure management systems—and display it in simple data visualization objects, such as charts and graphs. By translating complicated statistical analysis into clear visual representations, a dashboard empowers school leaders to define and measure key performance indicators in order to systematically track progress toward a school's strategic goals. As high-level trends in school statistics are aggregated and visually highlighted, school leaders are able to see and quickly respond to evolving needs.

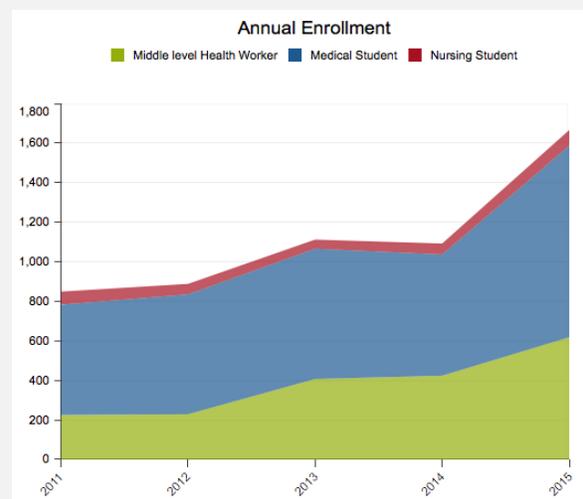
Similar to the dashboard of an automobile with its odometer and fuel gauge, the Dean's Dashboard is meant to measure progress and chart trends, indicating either improvement over time or need for strategic action. The dashboard visually displays progress and trends at the chosen level of a department, school, faculty, or other larger group. Charts, graphs, maps, and other information objects can be easily customized to adjust to changing circumstances as well as address potential “what if” questions that often arise when managing an educational institution. For example, school managers can revise thresholds and targets to encourage further progress after achieving an initial goal; add or remove key performance indicators and goals as the institution's educational mission evolves; and modify the way trends are analyzed by, for example, disaggregating groups by age or gender (see Figure 1).

Figure 1: Examples of Metrics that Can Be Tracked by the Dean's Dashboard

Trends over time: A school's goal is to increase annual enrollment numbers. The dashboard charts the number of students newly enrolled each semester and here shows increases for each year starting with 2012.

Comparisons between groups: A university aims to track the professional identity of enrolled students to understand how many of what groups are entering its programs. This figure looks at changes in enrollment for three types of health workers (as shown by the width of the three color bands). Nursing students remained stable, but middle-level health workers and particularly medical students increased in 2015.

Comparisons within groups: A school aims to track enrollments to see if they are aligning with its strategic goals. In this case, a school seeking to increase non-nursing students (i.e., middle-level professionals and medical students) can use the dashboard to track that over time—both within and across groups.



Dashboards are not meant to track single individuals or transactions. Rather, they consolidate and aggregate information collected through other management information systems. These include data

systems used for finance and accounting, facilities and estate management, student information management, student records, learning management, student assessment, human resources management, alumni management, or any type of enterprise resource planning system. Most data systems provide some level of ad hoc reporting and dashboard capability. On their own, for example, separate financial systems used for budgeting or facilities systems that track the age of furniture and computers each provide a view of the situation from their own perspective. Combining these data in a comprehensive dashboard allows school leaders to understand the financial implications of aging computers requiring replacement in the context of the annual budget. Approaches that integrate different systems into an all-encompassing dashboard application thus offer significant management and strategic benefits (Center for Digital Education 2011).

SELECTION OF THE DEAN'S DASHBOARD FOUNDATIONAL SOFTWARE

Commercial, proprietary software systems—such as the well-known iDashboards and Tableau systems—offer dashboard solutions that are specific to the needs of educational institutions. However, these two products are far more powerful than needed in most health workforce education settings, require substantial investment in infrastructure and staff to support them, and have software licensing and user fees that pose a roadblock to their adoption in resource-constrained settings. For example, iDashboards (2014) licenses for web-based installation start at \$1,995 and add \$59 per month per user, with a minimum of five users and a minimum two-year contract. The cost of Tableau's personal-use desktop software reportedly ranges from \$999 to \$1,999 (Ferguson 2014). Tableau's cloud-based solution runs \$500 per user per year.

Clearly, a different category of software is needed in low-resource settings. To build a more appropriate, affordable, and sustainable dashboard solution, CapacityPlus applied the nine [Principles for Digital Development](#), with a specific focus on providing free, open source software through the modification and extension of existing tools and platforms. More than 300 implementing partners, including USAID, defined these digital development principles in order to capture the most important lessons in the implementation of information and communications technology. Typical costs to develop a new software system range from one to several million US dollars. For example, the open source electronic Logistics Management Information System (eLMIS), which aims to improve the management of health supply chains, cost approximately three million US dollars to develop (Tariq 2014). After analyzing the components of several existing platforms, including Microsoft Excel, CapacityPlus selected the free, open source [District Health Information System, Version 2](#) (DHIS 2 2014) software to adapt and use as the foundational software for the Dean's Dashboard.

DHIS 2 was developed to capture and graphically display information on key performance indicators for health programs and service delivery at the health facility, district, and national levels. The software is a mature, powerful, and user-friendly system that adheres to best practices in software development and implementation and is endorsed by WHO (Belay and Lippevald 2013). Its origins go back to 1996 using Microsoft technologies; in 2008, it was completely rewritten to be open source using Java for its current version. The system was developed by the Health Information Systems Program (HISP), which is a global network established, managed, and coordinated by the Department of Informatics at the University of Oslo. DHIS 2 is being implemented in more than 40 countries, with PEPFAR, the Global Fund, and the Norwegian Agency for Development Cooperation (Norad) collaborating with HISP to expand and strengthen its use. Years of development and implementation have created a large community of DHIS 2

experts who can provide ongoing technical support to its users. There are also regular DHIS 2 academies for users who wish to expand their competency in the use of DHIS 2 software to meet their needs.

According to the DHIS 2 development team's final report to Norad, initial development of the software cost roughly ten million US dollars. CapacityPlus, therefore, leveraged the significant investments made in developing and implementing the DHIS 2 system around the world to expand the use of the system and adapt it to the education context. Although DHIS 2 was designed for the health context, its toolset as a dashboard follows generally accepted business purposes. Therefore, it demonstrated good potential for adaptation to other uses. The project also benefited from previous experience in building interoperability between DHIS 2 and the CapacityPlus human resources for health information system (iHRIS). Finally, HISP provided a formal commitment to assist in diversifying the use of its application.

In short, rather than develop a new software system, which typically requires millions of dollars and several years, CapacityPlus chose to use the existing DHIS 2 software and guide users in customizing the software to address graphical reporting needs within their schools. CapacityPlus first piloted the customization of DHIS 2, adapting it to the needs of three health workforce educational institutions. Based on that experience, it then created a standard dashboard that can be easily downloaded and further customized by individual institutions.

CUSTOMIZING DISTRICT HEALTH INFORMATION SYSTEM 2 TO THE NEEDS OF EDUCATIONAL INSTITUTIONS

Working in collaboration with the three pilot institutions, CapacityPlus applied a modified agile software development process to customize DHIS 2 to the needs of educational institutions. The agile approach features a repeating sequence that includes:

- Talking with stakeholders about their needs
- During the discussions with stakeholders, writing a use case statement (a list of steps that define interactions between an "actor" and a system to achieve a goal, where the actor is either a person or an external system) with the aim of designing one or more key performance indicators that track a school's progress toward strategic goals
- Drawing a picture of what the indicator(s) would look like in the dashboard
- Developing the graphical object in the DHIS 2 system in collaboration with the stakeholders, including creating a way to systematically transfer or upload relevant data.

The initial sessions with the managers at the pilot schools involved these steps. However, once they became familiar with the features and functionality of the software, the school management teams began to work on their own without continuous guidance from CapacityPlus. School representatives brought questions and issues to the fore, but often these stakeholders needed no more than an explanation or example to help them master the approach needed.

THE EXPERIENCE OF THREE PILOT INSTITUTIONS

CapacityPlus collaborated with three educational institutions to customize the DHIS 2 software for use as an education dashboard. During the process, each school received external technical inputs and

support from at least one informatics specialist with in-depth knowledge of DHIS 2 and one health workforce education expert. CapacityPlus then harvested the combined outputs and lessons learned from the three pilot schools to develop a standard version of the Dean’s Dashboard. The pilot schools were Garden City University College (GCUC) in Ghana; Walter Sisulu University (WSU), Faculty of Health Sciences, in South Africa; and Boitekanelo College in Botswana. The schools differ considerably in their structure, location, ownership, and focus, which indicates that the DHIS 2 application can be utilized in a wide range of educational circumstances.

Garden City University College

Garden City University College is a small, privately-owned institution in Kumasi, Ghana, accredited in 2004. It has more than 1,000 students attending programs in three schools: Business; Information and Communication Technology (ICT); and Allied Health Sciences (see Table 1). The school’s managers intended to use the dashboard system to monitor goals for the entire college.

Table 1: Programs at Garden City University College Involved in Dean’s Dashboard Development

Business	Information and Communication Technology (ICT)	Allied Health Sciences
<ul style="list-style-type: none"> • BSc Economics • BSc Economics and Statistics • BSc Accounting with Computing • BSc Business Administration • BBA Accounting • BBA Human Resource Management • BBA Marketing • BBA Management • BBA Banking and Finance 	<ul style="list-style-type: none"> • BSc Computer Science • BSc Information Technology • Professional Certificate Programs: <ul style="list-style-type: none"> - Computer Proficiency License - Advanced Certificate in Business Application - Power Excel - Computerized Accounting System (CAS) - Network Administration - System Administration - Database Design/ Administration - Desktop Publishing and Web Design - Computer Science - Information Technology 	<ul style="list-style-type: none"> • BSc Nursing • Diploma Nursing • BSc Midwifery • BSc Physician Assistantship • BSc Medical Laboratory Technology

GCUC was approached in December 2012 as the first school to engage in the Dean’s Dashboard initiative. Initially, CapacityPlus approached GCUC to discuss how data reporting through a computerized Dean’s Dashboard could support the school’s management decision-making processes. The school’s leadership expressed interest in the system, perceiving its utility for aggregating and graphically displaying information as the college expanded its course offerings. GCUC’s priorities for using the software included tracking information about graduates, finances, and student enrollment. School leaders were especially interested in how this information could be made accessible to both on-the-ground school leadership and to the school’s founder, who was located in the US. Since DHIS 2 and the Dean’s Dashboard can be administered as a cloud-based system, this type of dual access is inherent in the software.

Considering its size and location, GCUC was noted to have a strong ICT infrastructure, including a local server, campus-wide wireless networking to both Internet and Intranet information resources, and user support from both the ICT Department and the School of Information and Communication Technology. Representatives of both the ICT Department and School collaborated with CapacityPlus to develop some of the first indicators for the Dean’s Dashboard. Also involved in this effort were representatives of the admissions office, the business and nursing schools, and the college’s founder.

The CapacityPlus team discussed the school’s decision-making processes and data needs during a planning meeting in early 2013. Together with GCUC leadership, the team identified several issues that seemed amenable to tracking via an education dashboard. The team also identified a challenge: GCUC’s administrators stated that they lacked sufficiently robust and reliable individual-level data in several management categories. For instance, the school requested CapacityPlus’s help to design or recommend an efficient way of tracking individual student enrollment and progress. However, at the time, the school was not routinely collecting that data in a reliable electronic system. As noted above, a dashboard is not designed to track the progress of individual students or faculty members. Instead, it uses aggregated data collected from other information systems to graphically display high-level information on key performance indicators or metrics.

While CapacityPlus considered the school’s data challenge and possible solutions, school leaders and staff were shown how individual data could be imported into DHIS 2, aggregated, and displayed in easily understandable charts and graphs. Staff representatives were oriented to the DHIS 2 application and its possible uses, and were asked to use this knowledge to explore the program. They were also trained in how to develop indicators and enter organizational and data information into the program. CapacityPlus team members used the discussions held during this training and subsequent meetings to customize or develop indicators related to GCUC’s needs.

Unfortunately, during the time of the pilot exercise, GCUC was not able to fully customize DHIS 2 as a data aggregation and graphical reporting tool. This was primarily due to the challenge mentioned above: a lack of systematic, computerized data collection at the individual level. To most appropriately answer GCUC’s immediate needs, the school in collaboration with CapacityPlus decided to step back from the development of an education dashboard to focus on finding or developing an information management system to collect individual-level data. Specifically, CapacityPlus supported GCUC to identify, install, configure, and train staff in the use of a computerized student academic register information system (SARIS) that is compatible with DHIS 2. It is expected that once the SARIS software is in routine use at GCUC, the school will be able to upload data directly from this software into DHIS 2 and will from that time use the Dean’s Dashboard to produce graphical reports of aggregate data.

Walter Sisulu University

The WSU Faculty of Health Sciences is one faculty within a large public university located in Mthatha, Eastern Cape, South Africa. Although the Faculty of Health Sciences has been in existence since 1985, it was incorporated into WSU as part of the combination of the University of Transkei, Eastern Cape Technikon, and Border Technikon in 2005. The total number of students at WSU, including all campuses and faculties, is estimated at 24,000 per year. About 1,150 students are enrolled in the Faculty of Health Sciences, which offers the diplomas, degrees, and certificates shown in Table 2. Customization of DHIS 2 for use as a Dean’s Dashboard was led by the Faculty of Health Sciences, but the entire university stands to benefit from the implementation of an education dashboard.

Table 2: Programs at Walter Sisulu University Involved in Dean’s Dashboard Implementation

Higher Certificates	Bachelor’s Degrees	Postgraduate Diplomas	Master’s Degrees	Doctoral Degrees
<ul style="list-style-type: none"> • HIV and AIDS* • Health Informatics* 	<ul style="list-style-type: none"> • Nursing (Management, Education, and Community) • BS Health 	<ul style="list-style-type: none"> • Health Promotion • Chemical Pathology • District Health 	<ul style="list-style-type: none"> • Social Work • Nursing • MPH: Public Health • MS Health Promotion • MS Biochemistry 	<ul style="list-style-type: none"> • Doctor of Philosophy in Health Sciences • Doctor of Medicine (for Honorary

Higher Certificates	Bachelor's Degrees	Postgraduate Diplomas	Master's Degrees	Doctoral Degrees
	Promotion • Medical Clinical Practice • BS Orthotics and Prosthetics • Medical Sciences • Nursing • Social Work • Bachelor of Medicine and Bachelor of Surgery • Nursing • Physiological Science • Biochemistry • Medical Microbiology	Management and Leadership • Advanced Diploma in Nursing • Advanced Diploma in Infection Control*	• MS Physiological Science • MS Chemical Pathology • MS Medical Microbiology • Master of Medicine in: - Anesthesiology - Anatomical Pathology - Community Medicine - Family Medicine - General Surgery - Internal Medicine - Obstetrics and Gynecology - Ophthalmology - Orthopedic Surgery - Otorhinolaryngology - Pediatrics and Child Health - Pediatric Surgery - Psychiatry - Radiation Oncology - Radiology	Degrees)

* New programs awaiting approval from the Department of Higher Education and Training

Formal engagement for piloting the Dean's Dashboard with WSU began in 2013. Its primary implementation has been under the guidance of Jehu Iputo, professor of medical physiology and director of the School of Medicine. Professor Iputo's capabilities and leadership position served the needs of the pilot program and allowed him to play all the roles needed to customize the DHIS 2 software as a Dean's Dashboard:

1. *School administrator*: responsible for collaborating with school leaders and stakeholders to define and design the key performance indicators to be developed and tracked in the dashboard, including identifying valid and reliable sources of data.
2. *Informatics consultant*: responsible for maintaining the Dean's Dashboard, building the organizational structure within the program, and creating graphical objects and data entry screens.
3. *Data entrant*: responsible for routinely transferring or entering data to create and update the dashboard charts, graphs, and other visual objects.
4. *Project manager*: responsible for the implementation of the Dashboard and the development of visualized information to be placed within it.

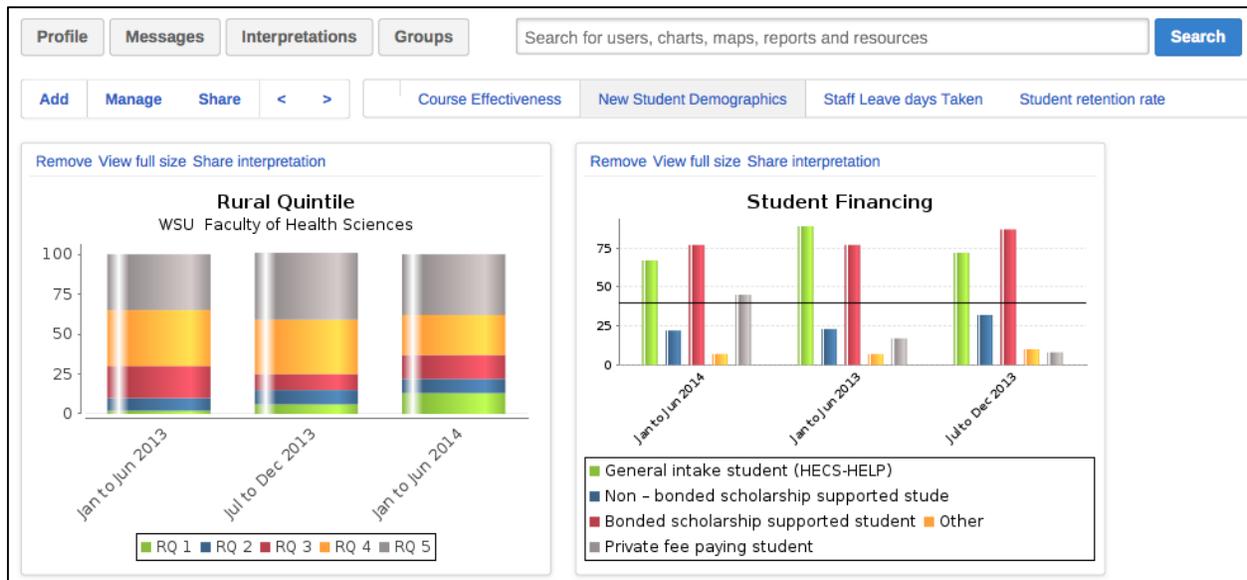
As a large public university, WSU faced challenges in collecting and consolidating information across academic programs and administrative units. Prior to beginning use of DHIS 2 as an education dashboard, the university had no central data warehouse or designated individual responsible for routinely consolidating data and disseminating required reports. WSU identified needs for tracking indicators in over half a dozen key performance areas, including finance, alumni tracking, student intake, timetabling, student accommodations, resource allocation, and human resources. The leadership also acknowledged the importance of the Dean's Dashboard for monitoring the implementation of the institution's strategic plan, which would encourage the collection of data, guide the use of the resulting information, and justify the investment needed.

CapacityPlus used knowledge gained from its experience with GCUC to orient WSU representatives to the design and structure of their Dean’s Dashboard. Because the DHIS 2 software was initially developed for health care facilities and a health service delivery context, discussions centered around how to customize it for educational environments. Both WSU and later Boitekanelo College were readily able to adapt the software to the organizational structures of their particular schools.

After these orientation sessions, WSU was able to make independent progress in the design of new key performance indicators to be tracked. What was particularly helpful in the case of WSU was having a pool of existing data sources that decision-makers were already collecting across the school, including the Consolidated Higher Education Information Management System, which is broadly used across South Africa. Review of these data sources greatly facilitated the design of indicators for the Dean’s Dashboard.

The WSU Faculty of Health Sciences was able to create a functioning Dean’s Dashboard with room to enter and graphically display data about a rich hierarchy of academic departments and programs as well as of administrative units within the school. It is currently hosted in a cloud-based data center (typically called an instance or instantiation) where the server hardware is managed by the data center, but the faculty plans to install the software on one of its local servers in the future. In addition, the faculty developed data entry pages that are used to record data needed to calculate desired indicators across the organization. Using these tools, the faculty has produced several useful graphical reports of desired indicator data (see examples in Figure 2).

Figure 2: Visualizations of Priority Data, Walter Sisulu University



Source: J. Iputo, Walter Sisulu University

Note 1: With the goal of increasing the enrollment of students from rural areas, the school monitors the origin of its incoming student body according to rural quintiles (RQs), with RQ1 representing students from the most rural areas, and RQ5 the most urban. Note 2: With the goal of predicting cash availability, the school monitors the sources of student tuition and fees: through the student loan/discount HECS-HELP program; scholarships (with or without associated “bonding” arrangements); or with personal private funds.

Leaders of the faculty were particularly interested in understanding the effects of various policy decisions on the demographics of incoming students. The Dean’s Dashboard helped the faculty to easily visualize trends, allowing the school to monitor whether policy changes are having the desired results.

Leaders were also excited to find that they can embed charts and graphs generated by the Dean’s Dashboard into the faculty’s website to use as a self-promotion tool (e.g., pass rate for students).

Boitekanelo College

Boitekanelo College, located in Gaborone, Botswana, was the country’s first privately-owned health care education institute when it was founded in 2006. In 2014, approximately 2,700 students were enrolled in degree, diploma, and certificate programs (see Table 3).

Table 3: Programs at Boitekanelo College Involved in Dean’s Dashboard Implementation

Degree Programs	Diploma Programs	Certificate Programs
<ul style="list-style-type: none"> • BA Healthcare Service Management • BA Counseling • BSc Health Promotion and Education • BSc Occupational Health and Safety • HND Pharmacy Technology 	<ul style="list-style-type: none"> • Occupational Health and Safety • Health Care Management • Health Promotion and Education • Counseling • Emergency Care Technology 	<ul style="list-style-type: none"> • Health Care Assistance • Counseling • Public Health Education • Occupational Health and Safety • Plaster Technology • Health Care Administration • Dental Surgery Assisting • Anatomical Pathology • Emergency Medical Care

CapacityPlus first engaged with Boitekanelo College about the Dean’s Dashboard in January 2014. The rapidly growing school had just opened a branch campus on the outskirts of Gaborone and reported challenges with managing that growth. It was looking for outside guidance and relationships with established institutions, particularly in the US, and had visited CapacityPlus in North Carolina to explore a possible collaboration. The school aimed to create an application to track aggregate data on student and faculty workloads as well as staff leave, and to consolidate information regarding teaching effectiveness. All school programs were involved in the pilot.

Boitekanelo has a small ICT Department. The CapacityPlus team worked with the school’s IT manager to introduce and customize the software, and also consulted with the college’s provost. ICT infrastructure at Boitekanelo consists of a small server farm, an Ethernet and Wi-Fi network on campus, and Internet connectivity to the external world. The school’s technical skill set includes systems administration and end-user support. The IT manager has a small team assisting him in managing the computational resources of both campuses. Despite its relatively good IT capacity, the school’s leaders tended to rely on basic tools, such as Microsoft Excel spreadsheets, to collect and analyze key information for managing the school.

CapacityPlus held two in-person and a number of virtual meetings with school leaders at Boitekanelo to orient them to the Dean’s Dashboard concept and the type of data involved. Once representatives of the college understood the functioning of DHIS 2, with CapacityPlus assistance, they began to define key performance indicators, enter data, and generate graphical reports looking at issues such as teaching effectiveness, staff leave patterns, and student-to-faculty ratios by term. These were “pain points” the school had identified. The CapacityPlus role was to support the school leaders in developing ways to visualize these data.

Boitekanelo’s leaders had an initial period of confusion over what kinds of data to include in the system. They were hampered by the erroneous belief that they needed to enter all of their data into the Dean’s Dashboard, rather than identifying and uploading totals, averages, and other summary statistics into the

data system. When one of the *CapacityPlus* leaders spent a day with the Boitekanelo team in Gaborone to orient them to the tool, he discovered that they needed a quick overview of data use basics. After discussions covering the general process of developing the data set needed and some whiteboard drawings exploring potential examples of data visuals, the school started to make more rapid progress. The general path that Boitekanelo took suggests a growing understanding of the need for such data and visualization systems.

During both in-person and virtual sessions, Boitekanelo's IT manager became the internal champion for data use as well as the technician best situated to customize and use the software. His drive to master the software and use it to address the information needs of his school's leaders was a huge benefit. However, it was also a limitation, as he was not directly responsible for managing educational programs and, therefore, had a limited understanding of the school's educational goals. This situation reinforced the need to involve a multidisciplinary team—representing a school's leadership, ICT, and management information systems—in the development of a school's Dean's Dashboard.

Boitekanelo College used a cloud-based server for the Dean's Dashboard to avoid the expense and support needed for setting up their own server hardware. The school stakeholders created information objects to track key performance indicators. They were most interested in tracking human resources needed to support student progress in the Occupational Health and Safety program, and created multiple visualization reports, typically graphs, to address their need to understand the priority issues in this area. The school's leaders also plan to install and implement a new education management information system, which will increase their ability to define and track a much broader array of key performance indicators. The *CapacityPlus* Dean's Dashboard initiative was a major driving force behind the school's decision to adopt a more sophisticated electronic system for data collection and management. The project demonstrated to the school the value of systematic data collection and management for strategic decision-making.

LESSONS LEARNED FROM THE PILOT SCHOOLS

Over the course of two years, *CapacityPlus* gleaned several lessons from the Dean's Dashboard pilot schools. These lessons will inform the future application and use of the Dean's Dashboard, and contributed greatly to developing a step-by-step user's guide for schools interested in developing and implementing their own dashboards. Each of the key lessons learned is briefly described below.

Institutional Planning

When key performance indicators are closely linked to the goals and objectives of a school's strategic plan, they are much more useful for monitoring and guiding the plan's implementation. Therefore, an institution wishing to customize the DHIS 2 software will be best served if it uses the Dean's Dashboard to initiate or support a strategic planning process. This approach will identify an institution's goals, indicating what information is needed and what types of data can be used; guide the use of the resulting information; and justify the investment needed to implement the dashboard software. The choice of key performance indicators is important. School leaders need to carefully think through what types of indicators will reveal priority information needed to guide and monitor progress toward their strategic goals.

Source Information Systems

Before a school can implement a dashboard, it must have access to high-quality, routinely collected, individual-level data. GCUC's experience shows that robust source data systems, such as an education management information system, are a prerequisite to the implementation of any education dashboard. While data about single individuals or transactions can be entered into the DHIS 2 system, it is much more cost-effective, efficient, and sustainable to transfer aggregated data to a dashboard system from other digital systems, such as financial, admissions, personnel, and infrastructure management systems. Most importantly, data must be of high quality to be useful. Decisions based on flawed data will be of limited value.

Boitekanelo College used paper records and Excel spreadsheets to develop Dean's Dashboard charts and graphs. This approach proved challenging, however, and led to the school's subsequent decision to invest in a computerized education management information system. While Boitekanelo seemed ready to aggregate data and display it on the Dean's Dashboard, the collection and management of data to guide management decisions was still in an early stage of development. In other settings, an initial assessment of a school's source data systems can help determine if a school is ready to implement a Dean's Dashboard and facilitate subsequent dashboard development.

Large institutions, such as WSU, tend to have a number of management information systems already in place. These are usually the result of previously adopted data systems that have not necessarily been linked together for aggregate use. For example, a campus might develop its own financial system but not make it immediately available to subunits such as individual schools. The challenge in such settings is to gain access to the information in campus-wide systems that is specific to a particular school or faculty.

Resource Requirements

Resource requirements for a Dean's Dashboard include personnel, equipment, and training costs. The pilot institutions noted that it was relatively easy to set up and implement a Dean's Dashboard, enter aggregated data (after mastering the DHIS 2 interface), and generate graphical reports. Once a representative of an institution has been trained to customize and utilize the DHIS 2 system, few resources are required to continue and expand its usefulness. As indicated in the adjoining quote, the major effort at WSU concerned the design of a new indicator and creation of the data entry (collation) form used to collect the needed data. Once data are located and their quality assured, the ongoing costs in terms of ICT staff are minimal.

"Maintaining the Dean's Dashboard doesn't take much time. It is the collation of the data that needs to be put on the dashboard that takes time. A session to upgrade the data should not take more than an hour. The number of sessions will depend on the number of items on the dashboard and on how often they need be upgraded—monthly, quarterly, or annually. After the initial training period, the time demand on IT specialist[s] is small—[it] does not merit a full-time appointment (at most 0.1FTE)."

—Jehu Iputo, Walter Sisulu University

In terms of infrastructure needed, two options exist.

Small institutions such as Boitekanelo may prefer cloud-based implementation (i.e., to access the software entirely online). The cost of renting space on a cloud-based server tends to be less prohibitive than purchasing and maintaining local servers. The cost of housing DHIS 2 in the cloud is approximately \$60-\$80 per month. However, well-resourced schools such as WSU will likely want to house the

dashboard locally, entirely on their own servers. Both options are available using the Dean's Dashboard system.

Support for New Users

While customizing and implementing the Dean's Dashboard system is not overly complex, support to new users is essential. For this reason, CapacityPlus developed a [detailed user's manual](#) with step-by-step, easily understood instructions. The guide helps users understand the concept of an education dashboard, the process a school should follow to define the indicators and data sources for the dashboard, and the process of customizing and maintaining their unique version of the Dean's Dashboard.

In addition, HISP and the DHIS 2 expert community can provide valuable support during a school's first steps toward developing their dashboard. For instance, Boitekanelo required regular communication and contact to help grow its knowledge and skill in using the dashboard, and to monitor progress in creating new graphic reports. Such support is likely best provided in real time (whether face-to-face, via telephone, or online) by an active user of the system. It is envisioned that in time, this support will be achieved by linking current users of the DHIS 2 system to newer adopters of the software. In addition, HISP sponsors regular DHIS 2 training courses for users of the system.

Internal Champion

Having at least one strong, motivated advocate or leader for the expanded use of data through a dashboard application is essential for success. The experience with Boitekanelo demonstrated the importance of that individual's role for the institution. CapacityPlus's collaboration with Boitekanelo's IT manager ensured that the school's representative had a technical understanding of the Dean's Dashboard. However, a school's IT manager may not necessarily possess the knowledge of the school's strategic goals and the institutional buy-in necessary to continue to develop and monitor relevant key performance indicators. Therefore, the internal advocate should work closely with other key stakeholders in the school to continue their progress in a stepwise fashion.

At WSU, the dean and school management officials are the primary users of the Dean's Dashboard. These leaders see the tool as useful for tracking progress on the school's strategic plan and marketing WSU to prospective students, which has helped shape the institution's interest in key performance indicators related to the demographic and geographic makeup of the student body and where students go upon graduation.

At institutions considering use of the Dean's Dashboard, holding an initial workshop for both senior leaders and technical personnel would be a good first step. Workshops could share model data objects (examples of the dashboard's possible outputs). Providing examples can offer potential users a first-person experience to show the power of the Dean's Dashboard software, as well as suggest the degree of resources needed.

Multidisciplinary Team

All three pilot schools demonstrated the need for a multidisciplinary team to successfully customize and use the dashboard application. The team should consist of administrators or managers; IT personnel; and managers or providers of source data.

Collaboration with Health Information Systems Program

The DHIS 2 software offers the support of the HISP collaborative and its global community of technical experts. In addition, applying DHIS 2 as the foundational software for the Dean's Dashboard offers several other benefits, including providing powerful, stable, and well-tested software; ensuring that schools have consistent access to the most recent version of the software and its updates; and leveraging the DHIS 2 support community to assist schools in customizing and maintaining their versions of the software.

NEXT STEPS

CapacityPlus's experience in working with the pilot institutions highlighted some challenges but generally validated the choice of DHIS 2 as a suitable platform with ample functionality for schools to develop their own education dashboards. The modified agile development process and rapid uptake of the software by two of the three pilot institutions demonstrated that the software can be modified and used in the education context. Based on the pilot experience, CapacityPlus created a standard version of the Dean's Dashboard for school leaders to download, further customize, and use in their own contexts. In addition, it produced a guided tour walk-through of the standard Dean's Dashboard and a step-by-step user's manual for the system. It also secured a formal commitment from HISP and the DHIS 2 technical community to host the standard Dean's Dashboard on their servers, provide technical support and training for users of the education dashboard, and offer access to the global network and expanding online community of DHIS 2 system users. The user's manual and support from the DHIS 2 community will greatly assist in future uptake and implementation of the Dean's Dashboard system.

The pilot experience also revealed a need for robust education management information systems to provide reliable, aggregated data for a Dean's Dashboard system. Because these systems did not exist in two of the pilot schools, the leaders of those schools faced a number of challenges in implementing an affordable, effective, and sustainable dashboard system. Future efforts are clearly needed to introduce or strengthen management information systems in health workforce educational institutions. For this reason, CapacityPlus began exploring the potential of applying the United Nations Educational, Scientific and Cultural Organization (UNESCO) open source electronic education management information system (eMIS) to the health workforce education environment. The aim is to help schools put in place the fundamental information systems needed to better manage their schools and to provide the source data needed to successfully track key performance indicators in a Dean's Dashboard.

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