ADVICE NOTE DIGITALIZATION OF EDUCATION IN ARUBA

29-06-2018, ARUBA

Contents

Preface

The minister of education would like to elevate the traditional educational system in order for it to function efficiently within our modern digital era, considering that:

- the digitalization of education plays an important role in the output of education;
- education needs to catch up on the area of ICT;
- society needs graduates with 21st-century skills;
- in the future examinations will be made on computers;
- more preconditions for the digitization of education are desirable;
- in addition to textbooks, more and more digital material is being developed;
- students should develop media literacy;
- the digitalization of education has a high priority for the government.

To set up a commission for the digitalization of education the Minister of education has decided on the following members:

- Mr. Rainier Kock, IT-specialist and also chairman;
- Mr. Kurt Thomas, teacher of mathematics at Colegio Arubano (High School Education);
- Mr. Randolf René Kock, internal mentor at EPB (Professional Basic Education);
- Mr. Edson Jacobs, IT-specialist;
- Mr. Alberto Falconi, IT-specialist at SKOA (Board of catholic schools);
- Mr. Erwin Ras, teacher at EPB (Professional Basic Education);
- Mr. Jean Marc Rosenstand, policy advisor at the Department of Education.

1. The task of the committee is to advise the government of Aruba regarding the digitalization of education in Aruba. This advice will be included in the National Education Plan 2018-2030.

2. The committee determines its own working methods and objectives. If necessary, it can call in the support of external experts.

3. The chairman of the committee reports the progress of this project twice to the Minister of Education, Science and Sustainable Development. The progress of this project will be determined by the chairman in consultation with the Minister of Education, Science and Sustainable Development.

4. The committee submits its advice and recommendations within three (3) months after the committee has been appointed. The activities take place in two (2) half-days per week, up to a maximum of one-hundred (100) clock hours per person.

5. Any cost for the implementation of the work will be charged to budget item nr: 167866003 4342.

1. Introduction

Technology has always emerged throughout history and so has the cry for educators to find meaningful ways to incorporate technologies into the classroom. Technologies such as television, calculator or a computer may have a dominant place in the classroom, but still without them strong lessons and learning objectives can be achieved. Recent technologies have given educators the possibility to be disconnected from the outside world, but they have not made optimal use of it.
Over the years several reports were written about ICT in education on Aruba. One of the most significant bottlenecks is the funding of it. In 2004 there was an advice report about ICT in our education. In 2014 there was another report written named “The use of ICT in primary education” which both described the situation then and what to do next.

In a world that is continually innovating, Aruba’s educational system has fallen behind with regards to ICT. The goal is to increase the quality of education, have fewer dropouts, produce more graduated students with 21st-century skills and increase the quality of life. Digitalization helps create many possibilities to reach these goals. While some frameworks use a slightly different list of critical 21st-century skills, they all agree on four crucial areas of development (Voogt, J. and N. P. Roblin, 2010):

- Collaboration and teamwork;
- Creativity and imagination;
- Critical thinking;
- Problem-solving.

In a data-driven community progress must be monitored and the input-output data analyzed for the proper guidance of educational policy. The concept is to collect and analyze data to make adjustments where needed. Digitalization of our education implies using technology that gives the students some control over time, place, path and/or pace. The digitalization of our education is more than just providing students with a tablet or a pc. It requires a combination of technology, pedagogical and digital content. The digitalization of our education must have an added value for the teachers, students, school boards, policy-makers and community.

Nowadays, we must cope with a rapidly changing and evolving world where personal, professional and (digital) technological skills are an essential aspect of transforming societies. As technology continues to develop many would like to extend or enhance existing classroom space. A smart classroom can be seen as an intelligent environment with technologies such as computers, Interactive Whiteboards, capture systems, specialized software and so on (Xie, W., Shi, Y., Xu, G., & Xie, D, 2001, October). A smart classroom provides more tools for the teacher to create interactive and personalized teaching materials that support the 21st-century skills.

Chapter two begins with a history of ICT in education on Aruba. Five schools were monitored when technology was implemented and the challenges they encountered are also explained in chapter two. Chapter three discusses the roadmap to digital education in Aruba, digital examination, digital environment, results and at last conditions. Section four describes the recommendations and implementations of a smart board. In the last chapter, the conclusion of this report is discussed.

2. History ICT in education

Several reports have been written about ICT in education. No adequate results were delivered. The possible motives may be the lack of financial resources as well as the lack of a clear vision regarding our digital educational system. In the table below, you find an overview of the work done in the field of ICT:

1990	Project “Personal Computers in secondary education”
1994	Project “Information Science”
1996	Project “Computer use in schools”
1997	EPB expands ICT usage
1998	EPI-center of excellence
1999	Project “Aruba Information Technology Educational System (ATES)”
2000	Renovation – Computers in Highschool “CVOA”
2002	Installation “ICT Commission”
2004	Report ICT Commission Installation ICT workgroup
2004-2005	Requirement ICT in Education; Projectplan ICT in Primary education; Training “Digital License for Education in Aruba” (DORA);
2005-2006	ICT in education; Training ICT Support Teacher Primary Education; Implementation Project Plan Primary Education;
2006-2007	Report: Pupil Tracking System: from written language to digital; Amendment Project ICT In secondary education & implementation;
2007-2008	Projectplan ICT in Primary Education phase 2; Agreement on use of Open Sources in education;
2008-2009	Project dossier FDA-ICT in Primary education & secondary education; Course pupil tracking system for the Multilanguage school for Primary Education; Report Automation Department of Education; Information Services and Automation Project proposal in connection with IT development Department of Education;
2009-2010	Advice pupil tracking system; Implementation FDA-ICT project primary- & secondary education
2014	Inventory ICT in Primary Education
2015	ICT workgroup 2004 canceled and the IT-support went to the school boards

2.1 Current state

In 2014, 36 primary schools (Vries, 2014) were visited and 83 % of the schools had their infrastructure in place. In this case the infrastructure refers to air conditioning, cabling, physical security, and furniture. The remaining 17% had issues with air conditioning, cabling, security, and furniture. Now four years later the landscape has changed. Some schools bought their own Digi boards, laptops, tablets, smart TVs (Apple), and computers. Some schools don't have their computer network up and running. The results of all this is a wild grow of digital educational devices and with limited license policies in place. A holistic research must be done regarding the IT-infrastructure in the educational eco system. The ICT landscape is outdated and must be replaced.

A lot of schools have access to the internet throughout the entire premises being limited to the staff only. This means that computers, smartphones, or other devices can connect to the Internet or communicate with one another wirelessly within a particular area. Putting all of those working devices into a network will be a win-win situation for the students and the IT-support. For the students, there is the sharing of resources, accessing digital school materials everywhere, anywhere and anytime. For the IT-support it creates access to all those devices for troubleshooting as well as control security and privacy issues.

Five schools were visited (Paulus school, Emma school, Scol Caiquetio, Scol Basico Washington, Colegio Frere Bonifacius) to identify best practices and innovative approaches that relate to ICT in education. These five schools had been selected because they had their physical ICT infrastructure in place, which makes them trendsetters in ICT usage in the classroom on the island. The traditional blackboard was replaced by smart televisions, interactive whiteboard systems or Digi boards. At these schools it was noticeable that the students were motivated, enthusiastic and were paying more attention in the classroom. The ICT infrastructures that were being used consisted of Samsung Smart TVs, Apple TVs with beamers and iPads, IPEVO Interactive Whiteboard Systems, Prowise Interactive Whiteboard Systems and a Samsung Interactive Whiteboard System and Samsung tablet. The responsibility of the technical support falls under the school boards, and currently not all the school boards have an IT-technician.

2.2 Challenges

The challenges that need to be solved before/during and/or implementation of ICT in education are:

- different ICT vision of the school boards;
- selection of the ICT technology;
- train the user to become ICT savvy;
- lack of ICT support onsite (school);
- one school board is more advanced than the other regarding ICT;
- continuity of the ICT strategy in education;
- support for teachers and students;
- realistic finance and continuity;
- roles and responsibilities;
- school infrastructure (air conditioning, cabling, physical security and furniture);
- multi-language education;
- ICT skills of the teachers;
- digital educational content;
- execution of projects regarding ICT in education (project manager).

3. Desired state – The roadmap to digital education

The main goal in Education is to develop skills to support the local economy. Therefore, the strategy of the economic development must play an important step towards tailoring the educational strategy and curriculum, and especially ICT in Education on the island. ICT in education can be divided into two main components which are ICT in the curriculum and ICT for supporting education. The brightest ideas and farfetched realistic visions regarding ICT in education can be developed, but if the economy is not ready and cannot provide the necessary jobs related to the skills acquired during the education process, then these ideas and visions will fail.

3.1 The roadmap

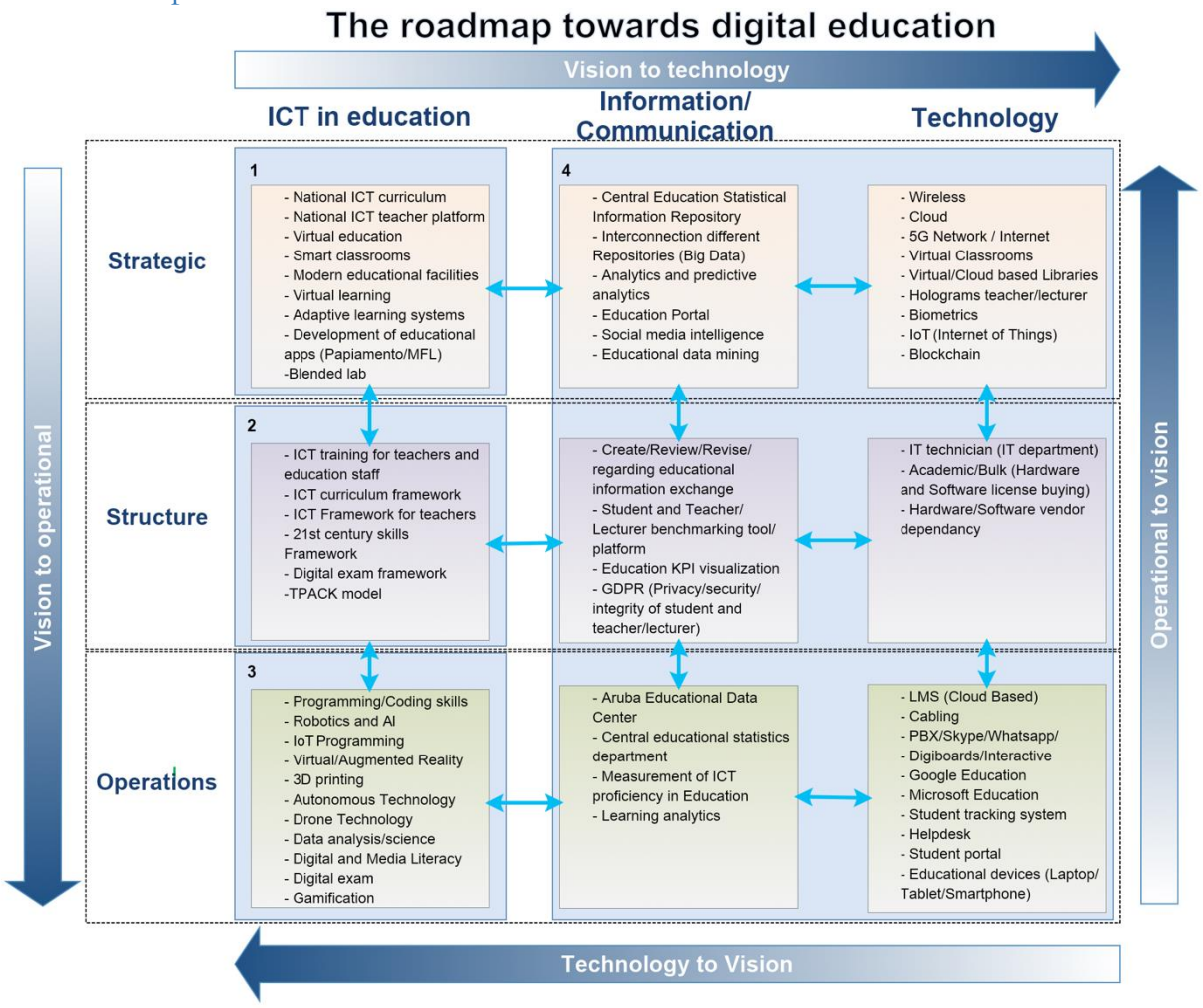

Figure 1. The roadmap to digital education

In figure 1 the roadmap towards digital education is illustrated. The map gives an overview of all components that are needed to realize digital education of Aruba. The model is taken from the Amsterdam Information Management Model (AIM) (Maes, R, 1999) and is adapted to suit the needs of the project. There are in total nine blocks. Starting from the left to the right column we have ICT in education, Information/Communication and Technology. The first column is what is called 'the primary process'. The middle column is the demand column that translates the first column (the 'primary process) to be used with the technology. The horizon report (Becker, S. A., et al, 2017) is used for the prediction of future technologies in education. The strategic row gives the overall plan, also known as long term goals. The structure are the elements that will be used to

achieve the goals. The operations row is where the realization takes place. None of these blocks can go without the other, which makes each block equally important.

Important questions that should be taken into consideration are:

- Where will the Aruban economy be in 5 to 15 years?
- What technology will be available/dominant on the island?
- What kind of jobs will be needed at that point in time?
- What skills do current students and teachers need to acquire?
- What impact will technology play in the future on the island's current jobs?

The answers cannot only be provided by the educational system but also largely depend on the economic and financial mission and vision of the island. Therefore, collaboration and coordination between ministries and government departments is absolutely a requirement. The mission and vision of the different ministries and government departments must be in synchronization and the combined plans must lead to a common goal in which education plays an important role. Developing a masterplan for ICT in Education must focus on the short, medium and long-term goals. During the development and implementation of the masterplan, we have to keep the technical and non-technical aspect of the masterplan in mind. The masterplan should focus mainly on ICT in education. A few areas where the strategic focus should be, are:

- National ICT Curriculum
- National Teacher ICT platform
- Anywhere and anytime education; personalization of learning
- Smart classrooms/educational facilities
- Virtual student
- Virtual learning
- Lecture Capture technology
- Adaptive learning tools
- Educational apps/software/hardware
- Cyber wellness

3.1.1 National ICT curriculum

In collaboration with all the stakeholders in the field of education, a roadmap must be developed for the implementation of ICT in the curriculum on all levels of education. The student must get acquainted with technology in an early stage of its educational journey.

3.1.2 National teacher ICT platform

To implement the national ICT curriculum, all teachers must understand the master plan, the way to implement and execute it, and have a national discussion about it: fine-tuning and monitoring the ICT curriculum and how to support each other in the world of ICT educational technology. All work must be done in close collaboration with the school boards.

3.1.3 Anywhere and anytime education; personalization of learning

Technology changes at an unbelievably fast pace and keeping up will be a challenge for the teacher/lecturer. With the aid of technology, a teacher/lecturer can teach multiple classes at different geographic locations at the same time. E.g. teaching a lesson for a school in San Nicolas, Oranjestad and Noord at the same time, thus bringing teaching costs down while reaching more students simultaneously.

3.1.4 Smart classrooms and educational facilities facilitating personalization of learning

Smart classrooms are equipped with sensors to capture a student's wireless device data and based on learning analysis in combination with interconnecting social media data, produces a profile of that student. Based on this profile a personal learning method or trajectory will be chosen. This valuable information can be stored secured in a central repository where strategic analysis can be conducted on, for example, student performance, curriculum deficiencies and so on.

3.1.5 Virtual student

The educational system on Aruba also focuses on inclusion. This means that all children must have access to quality education. For a disabled student, access to education should not be a dilemma or struggle. By using technology, the disabled student can attend all educational forms as a virtual student. The smart classrooms and educational facilities must be able to support a virtual student in such a way that following lessons is just a mouse click away. In the distant future, the use of holograms can also be used in this scenario.

3.1.6 Virtual Learning

A fast and stable internet connection will significantly contribute to Virtual Learning. The use of Virtual Learning will make the student and teacher/lecturer less dependent on the physical location of the school/university. Time will also play an essential role in Virtual Learning because classes can be taken anytime and anywhere on the digital Virtual Platform. Nowadays, most of the students have one or more digital handheld devices which theoretically can connect 24/7 to the Virtual Learning Platform. The use of Virtual Learning platforms has a significant impact on the physical educational institution. Fewer classrooms will be necessary for the future, and the remaining classrooms must be smart.

3.1.7 Lecture Capture technology

To provide digital educational material, a specialized Lecture Capture Technology room must be available to all teachers/lecturers. This could be one located at an educational institute or elsewhere, provided all teachers/lecturers have access to it. In this room, a teacher or lecturer can visually record, edit and publish the digitally recorded educational material.

3.1.8 Adaptive learning tools

These tools will adapt based on the answer provided by the student. For example, if questions about a particular area are answered wrongly, then the adaptive software will ask more questions based on that area. The use of these tools will strengthen and focus on the weak areas of the student.

3.1.9 Educational apps/software/hardware

To support the strategy on ICT in Education, the right apps, software, and hardware must be used. The Educational tools must be co-approved by the teacher/lecturer for them to be used or implemented

successfully. The needed apps or software can be developed locally and thus the software can be tailored to local needs. The primary input for this endeavor will come from the National Teacher ICT Platform in collaboration with all the stakeholders of education.

3.1.10 Cyber wellness

It is crucial for the student to know how to use the Internet, especially about data that can be shared fast, yet insecure or unintentional. The student needs to be aware of the risks of using technology and cybersecurity. An essential aspect of the Internet is getting the right and trusted information. There's a lot of 'garbage', fake information/data, malicious information, etcetera, on the Internet. The student must be made aware of these issues in an early phase. Once the high-level ICT in Education strategy has been crystalized then the next focus will be on implementation. The implementation will have an impact on the needed hard- and software. The selected technology for the short and medium term must be flexible enough to be changed if the ICT strategy changes. The technology of the future that will have an impact on the operations of ICT in Education are:

- Programming
- Augmented Reality
- Holographic teacher/lecturer
- Biometrics
- Robotics

In figure 2 a model is illustrated known as the *Four in Balance*. In the model there are four blocks: vision, expertise, content and applications and infrastructure block. Studies show (Reijmers, A, 2016) that in order to have optimum quality of education the four blocks need to be in balance with one another. The four blocks (figure 2) are numbered from one to four and can also be linked with the roadmap to digital education model (figure 1) with the corresponding numbers in each block.

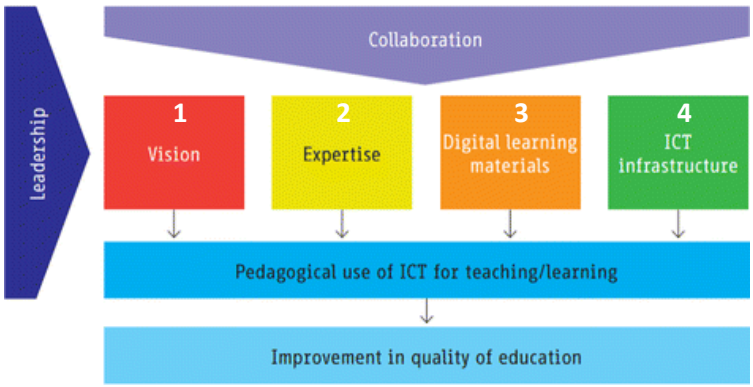

Figure 2. The 'Four in Balance' from kennisnet. Source: www.kennisnet.nl

The vision block is the guidance towards the future of education in Aruba. The commission has summarized all these elements and came with a vision that states as follows:

Our students should be:

- ***Life-long learners who empower the use of ICT technology***
- ***Innovative creators and thinkers enriching the digital sustainable development society of Aruba for the future***

As mentioned before, all these blocks need to be in balance to have a positive return on education. Of all the topics mentioned in the vision block (figure 1), a smart classroom is certainly a good starting point that can be executed on a short term. Studies have shown (Miller, D., & Glover, D. 2002) that smart classrooms have a positive impact on the students' motivation and engagement in the learning process. The study was conducted with an interactive whiteboard.

Teachers and staff members need to become competent in the use of modern technology. ICT training, as noted in the block, is very crucial and not always taken into consideration when implementing modern technology. Staff members should have the technological knowledge and teachers the technological pedagogical content knowledge (TPACK). The TPACK model is also very valuable for teachers when using technology in the classroom. The TPACK model (Koehler, M. and P. Mishra, 2009) is shown in figure 3.

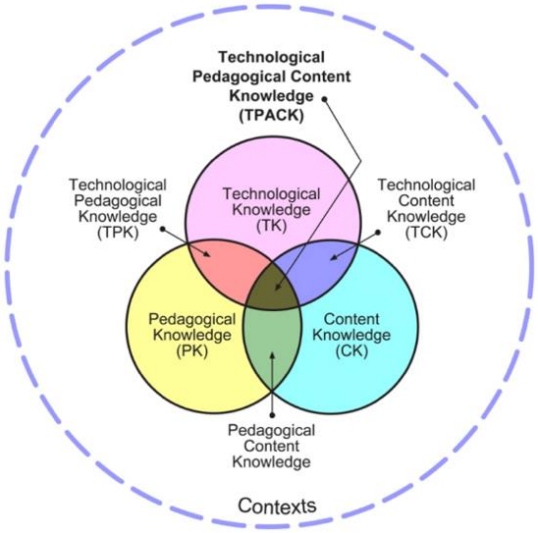

Figure 3. Technological Pedagogical Content Knowledge

The TPACK model consists of three main components; the Content Knowledge, Pedagogical Knowledge and the Technological Knowledge. The content knowledge is the subject that needs to be educated. The pedagogical knowledge is more about the methods used for teaching and learning, and technological expertise is the technology tool used. In simple terms, it is the what, how and why. By combining the three main components teaching becomes more powerful instead of just using one single component.

Modern educational content and applications are a must in educational institutions. In order to teach 21st century skills, content and applications are very crucial. Collaboration is also necessary in order to be successful. The Department of Education, School boards, teachers and relevant stakeholders should collaborate together to achieve a positive return.

3.2 Digital learning environment

The digital learning environment gives students the possibility and accessibility to digital content and applications, for example to download schoolbooks and other resources. A digital learning environment may run on a public or a private cloud platform. These platforms make it possible for students and teachers to access their resources anywhere, anytime. They can do so with any communication device through the digital education infrastructure. This digital learning environment creates a learning community that interacts with

each other for a common purpose. In addition, it contributes to providing students with 21st-century skills. Implementing a digital learning environment will enhance the following advantages:

- Using a national digital learning environment facilitates the school for better teaching, learning and student involvement.
- The digital learning environment will facilitate an entire school to understand what it means to anchor digital technologies for teaching and learning.
- It will help generate internal discussions about how the embedding of digital technologies can lead to improvements in teaching and learning.
- It can be used by teachers as a planning tool to plan and think about their daily teaching and learning practices at all levels and in all areas of the curriculum.
- The digital learning environment will also help schools and teachers to identify and plan their professional development needs in digital technologies.
- The digital learning environment promotes collaboration between teachers.
- The digital learning environment will be an important tool for internal and external evaluation of how digital technologies are embedded in all aspects of school activity.
- The digital learning environment is used by school leaders and teachers as a useful tool to identify needs.

3.3 Digital examination

A digital learning environment creates the possibility to switch from paper based to digital testing. Students will be able to use their digital devices, for example a smartphone, for taking a digital examination. The digital environment solution provides the opportunity for the students to make a digital test on a device and when finished, the results will be displayed. The opportunity exists for the use of common assessments.

Digital testing has a broader context than the current test methods. It is crucial that the implementation of digital testing happens in phases. The starting point is that all students, regardless of their background and their financial possibilities, have the same opportunities.

3.4 Actions

The installation of a committee is crucial for the implementation of the digitalization of Education in Aruba. It is very important that there is good collaboration between all stakeholders. When choosing software or hardware equipment for the schools, this must be in close collaboration with the department of curricula, school boards and school principals. An integral approach is crucial to benefit the students.

3.5 Results

The results we want to achieve are as follows:

Short-term results:

- Interactive teaching using Smartboards in the classrooms connected to the internet.
- A lifelong learner who has the ability to use the technology. Not only to use it for entertainment but to use it for projects, schoolwork and life.
- Motivated teachers working with the technology, for a common purpose and common goal.

Medium-term results:

- Teachers adjusting their approach to work on output efficiency.

- Interactive digital content (Multi-Language) available.
- The shrinking of work processes.
- Digital exams that are graded automatically after students have made them.
- Personalized learning where no one is left behind.

Long-term results:

- A digital learning environment where students' progress is being tracked.

3.6 Conditions (human and material)

Conditions, in this case human and material, are very important. As mentioned before, of the five schools that were visited all had their infrastructure in place. Also, training on the use of technology was given to the teachers and staff. For digital learning to take place, there are a few prerequisites:

- a stable infrastructure;
- a realistic budget/ continuity of the work;
- teacher training;
- support (technical);
- connectivity;
- an alarm system/secured building (Window fence).

3.6.1 Infrastructure

It is important for every school to have Wi-Fi or internet to set up the devices in a network. The benefits of this setup are the sharing of resources. Bringing content to the students and creating an information flow that ranges from the classrooms to the principals, school boards, department of education and the inspector of education.

Using cloud software, the students can access the content everywhere, anywhere and anytime. Students can access their resources from any device such as a mobile phone, a tablet, a pc, etc. There are technical solutions to keep track of students' progress and adjust the content. As such a big step is made in personalized learning. All the devices entering the schools must be connected to a network. This facilitates the support for the administrators. Digitalization must have an added value for the teachers and the students, with a minimum point of failure resulting in minimum downtime. Minimizing the workload for the teachers so they can put their energy into improving the quality of education using the PDCA-cycle (Plan Do Check Act cycle).

The world is in a data revolution, and education must take a strategic approach towards digitalization. The infrastructure is the foundation of the digital system. All schools can be connected through, for example, a VPN connection. The information and data flow in this network are encrypted.

The local telecommunication company also offers a direct line for the transfer of information between different units. The costs for this line are 100 AWG per month. The data transfer is secure because on this direct line there will only be traffic from the department of education and the schools.

3.6.2 Realistic budget and keeping continuity of the work

Funds must be made available for the digitalization of the Aruban Education. As the world of ICT is continuously changing, it is recommended to consider that this can never be a one-time investment. Money should be reserved for maintenance and adaptation.

3.6.3 Teacher training

Teachers must receive adequate training in the use of the new digital, technological environment. A group of IT experts in collaboration with the department of curricula and SAM (Multilanguage school) can assist the teachers for a suitable implementation.

3.6.4 ICT expertise

Many projects are being outsourced, but the ones who are going to deal with the ICT companies must be ICT experts to avoid miscommunications. Technical support is also required to keep the system up and running. The school(boards) must have a technician or someone with ICT know-how in place. With Papiamento also being a language in our educational system, it is vital to have programmers develop our digital learning environment in Papiamento.

3.6.5 Educational content and software

There are several technical possibilities to deliver the content to the students. The content is pushed to the students on a device and their progress is being monitored creating space for personalized learning. All students must have an email address to logon to the learning environment.

There are companies that offer platforms that make personalized learning possible. The concerning departments must decide which of these are suitable for the classroom.

3.6.6 Connectivity

For a good functioning infrastructure, more bandwidth is essential. The more devices you connect, the more bandwidth you will need. When selecting the connectivity method, the band-width of the main Internet Service Provider (ISP) must be kept in mind because of the impact on the digital infrastructures on the island.

3.6.7 Roles & responsibilities

The department of education is responsible for gathering information from the field for policymaking. The schoolboards will take care of the technical support. IT-technicians must be in place for the schoolboards to provide the necessary IT-support. Agreement on a structure, with clear roles and responsibilities, will avoid any misunderstandings during the execution, implementation and/or maintaining ICT in education.

4. Recommendations on implementing a smart board

The cost of digitalization of Aruban education is high. This advice note focuses on just one technical solution for digitalization of education in Aruba. Because of time constraint and limited resources, the committee selected Digital Boards as the first step towards digitalization of education in Aruba. Of course, there are many other forms of digitalization, but those cannot be selected and implemented shortly. In paragraph 4.7, there is a price indication of some of the digital boards. This is the price of the hardware, without the cloud software.

4.1 Educational priorities

The main objective of implementing technology in the classroom is by defining the organizational conditions for enhancing teacher commitment and thus the likelihood for successful change. In particular, the role of teacher professional development is important, and characteristics for an effective program should be defined. Suggestions from professional development programs and associated research are pointing towards a peer collaboration model for integration of IWB technology into classrooms in new contexts. The benefits of collaborative professional development (in general) can also extend beyond the areas targeted by the professional development (Cordingley et al., 2003), and can, in fact, be very wide-ranging. Teacher benefits include enthusiasm about professional learning; increase in confidence and self-efficacy; a more significant commitment to changing practice and willingness to try new things; activities to generate more effective and targeted dialogue between students; and a conscious effort by teachers to use computers (and other technology) more for both instruction and to increase the range of teaching and learning strategies targeted at specific student needs. Student benefits include a demonstrable enhancement of student motivation; improvements in performance on tests; more positive responses to particular subjects; an increased sophistication in response to questions; the development of a broader range of learning activities in class and strategies for students.

4.2 Current technology implemented in the classroom

The digital schoolboard or interactive whiteboard (IWB) technology combines a large, touch-sensitive electronic board with a data projector, specialized software with or without a computer. The board displaying the projected computer image allows direct input via finger or stylus. Software provides a variety of functions, including those that replicate non-digital technologies such as flipcharts, dry-wipe boards, overhead projectors, slide projectors, and video players (Mercer et al., 2010, p. 196). Tools provided as part of the IWB software package include those for annotating text, highlighting, drawing, hide-and-reveal, resizing and zooming.

4.3 Current Technology type to be used in the classrooms

There are several brands and types of technology available on the market that a teacher can use to implement the technology trends earlier described. Several schools have started implementing their technology systems and trends. Some schools got the system as a gift from one or more private companies while other schools have worked hard on their financial goals so they could buy their desired technology for their classrooms. In this section, we will show some of the technology types that can be used as an IWB or digital school board.

The digital board or IWB technology is divided into two types:

Interactive digital schoolboard or IWB: These are digital schoolboards or IWB and look like as a television, but they are not. A digital schoolboard does not need any additional interface to do the interactive part and might have an embedded computer.

Simulated interactive digital schoolboard: These are not real digital boards, but by installing a device and a proprietary software, it makes either a projector or TV work as a digital board or IWB.

4.4 Interactive digital schoolboards.

There are several digital schoolboard brands available on the market and here follows a list of brands that deliver several types and models of Interactive digital schoolboards:

3M	iiyama
Alphatouch	InFocus
Aver	Mimio
Avocor	Newline
BenQ	Philips
Christie	Promethean
Clevertouch	Prowise
CTOUCH	Samsung
Elo Touch	Sharp
Genee	SMART
Hero Touch	Triumph
Hitachi	Vestel
iboardtouch	ViewSonic

Figure 4. Digital schoolboards brands

Most of these brands give a 3-5 year of warranty*.

The latest models by Google is the Jam Board and the one of Microsoft Corporation is the Microsoft Hub.

It's not the intention to describe all the brands of digital schoolboards or IWB, but most of the brands have similar features.

4.5 Simulated interactive digital schoolboards.

A simulated interactive schoolboard is a device that will be used together with a projector to make a whiteboard work as an interactive board. There are also devices that can be used on television to make this work as an interactive board. EPSON has had, for some years now, some interactive projectors. These projectors require a computer on which a proprietary software driver will be installed to make the whiteboard, projector or television interactive. In this report we will discuss the following types:

1) IPEVO
2) Mimio interactive board
3) Brightlink from Epson
4) Infrared Touch frame for TV

1. Ipevo

The IPEVO has a Sensor CAM that communicates with the interactive pen via the Wireless Receiver. The location of the pen will be monitored by the Sensor Cam and passes it on to the pc that will give it its place on the computer. On the computer, proprietary software will be installed that will make communication with the interactive pen possible. To start working with the Interactive pen, the teacher needs to calibrate it before using it. This can be done once and if the projector and sensor are on a fixed location, only once a week or when needed.

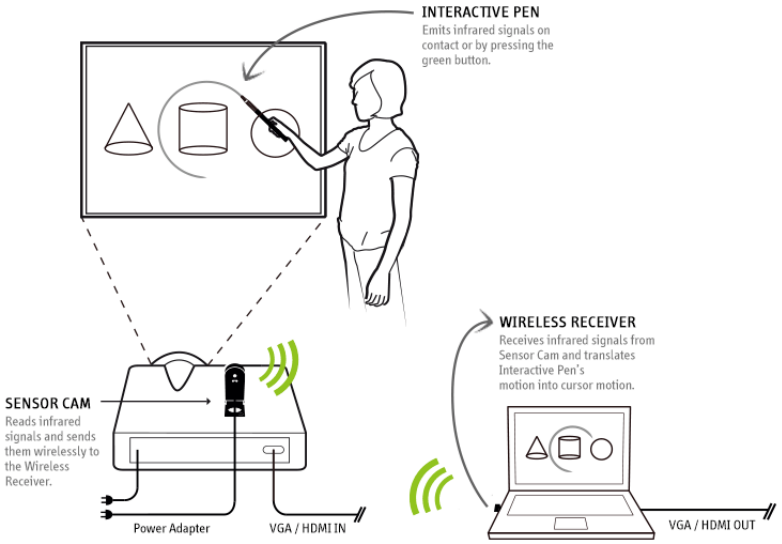

Figure 5. Ipevo schoolboard system

The price of an IPEVO varies from $169-$300 and landed on Aruba it will be Awg 475 – Awg 890. IPEVO has more options that will be useful to use in the classroom, for example the IPEVO Wireless document camera. The camera can be used to view documents on the projector screen. The latest update from IPEVO is that you can use multiple interactive pens (max 4).

Figure 6. Wireless Interactive pen with sensor cam

2. Mimio interactive Board

The Mimio interactive board is an interface that connects to a computer. This computer needs to have the appropriate software installed. The Mimio has a magnetic connector that can quickly be placed on a whiteboard. If there is no whiteboard a double tape can be used instead. Just like the IPEVO, the Mimio interactive board needs to be calibrated before using it.

The price is $1087 and landed on Aruba will be Awg 3200,-

3. Brightlink from Epson.

The Brightline 595Wi is one of several models that Epson has to offer and has a built-in Interactive option. The projector is connected to the computer via a USB and proprietary software must be installed on the computer to make the projector interactive.

The price is $1700 and landed on Aruba it will be Awg 5000,-

Figure 7. Epson Brightlink

4. Infrared Touch frame for TV

The TV frame has a USB connection and will be connected to the computer which has proprietary software installed that makes the TV work as a touchscreen.

The price is $200 and landed on Aruba is will be Awg 590,-

Figure 8. TV touch frame

4.6 Comparison Table for Digital Board or IWB: (prices for budgetary purposes)

			
PROWISE	SAMSUNG	Microsoft HUB	Google Jamboard
1920 x 1080	1920 x 1080	4K	4K
Antiglare	Antiglare	TBD	TBD
Multi Touch (10)	Multi Touch (10)	Multitouch (16)	Multitouch (16)
Multi Writing (5)	Multi Writing (6)	TBD	TBD
Stylus	Hand + Stylus	Stylus	Hand + stylus
Awg ± 6200 (65inch)	Awg ± 9500 (65inch) *	TBD	Awg 14850,-
Awg ± 9200 (75inch)	AWG ± 15600 (75inch) **	TBD	Awg 1782,- /yr (lease)

Installation not included.

***lease 36 months = Awg 470**
***lease 48 months = Awg 390**
****lease 36 months = Awg 750**
****lease 48 months = Awg 627**

4.7 Comparison Table for simulated interactive digital board.

			
IPEVO	Mimio Interactive Board	Brightlink from Epson	Infrared Touch frame for TV
1920 x 1080	1920 x 1080	4K	4K
Multi Touch (4)	Multi Touch (1)	Multitouch (1)	Multitouch (1)
Multi Writing (4)	Multi Writing (1)	Multi Writing (1)	Multi Write (1)
Stylus	Stylus	Stylus	Hand
Awg 475,- (excl. Laptop)	Awg 3200,-	Awg 5000,-	Awg 590,-

Installation not included.

4.8 Which Interactive digital schoolboard type to use?

The technology advancement is changing fast which makes it very difficult to decide on the perfect product to buy. Therefore, it is essential to focus on a user-friendly system and how well the it can adapt to changes. The advantages and disadvantages between interactive (table 1) and simulated digital schoolboards (table 2) are described as follows:

Feature	Advantage	Disadvantage
Light emitted	**Enough lumen to illuminate the classroom**	
Interactive	**Only one interactive point that can be the hand or a stylus pen**	
Proprietary driver	**Doesn't need a computer to work with. A computer will enhance the functionality**	
Installation		**Need qualified technician for installation**
Lifetime	**50000 hours**	
Cost		**AWG 6000-10000**

Table 1. Interactive Digital Schoolboard

If the budget is not a problem, an interactive digital schoolboard would best be installed in the classroom. Some of them have a database with a great variety of digital content (For example ProWise).
(price excl. digital content)

Feature	Advantage	Disadvantage
Light emitted		**Light depends on the projector. Not enough lumen and you need to turn off the lights or darken the windows to make the room darker.**
Interactive		**Need several connections to make the digital pen interactive.**
Proprietary driver		**Need a proprietary driver to install on the computer. If the driver is corrupt there will be no communication.**
Installation	**Don't need a technician for the installation.**	
Lifetime	**2 years**	
Cost		**AWG 500-5000**

Table 2. Simulated Digital Schoolboard (Except Brightlink from Epson)

Despite the disadvantage of the simulated Digital Schoolboard type, if it is installed on a fixed location, it will work without any problems during its lifetime. But if the schoolboard needs to be shared in several classrooms, then it is recommended to use the Mimio interactive board. The other technologies are not made for that type of functionality.

4.9 Collaborative buying

The prices above are given per unit, but it is recommended to purchase products collaboratively at a negotiated price that is lower than the company list price, the reason being that they will assume that more will be sold than to just one school.

4.10 Data integration capabilities.

Most of the interactive digital schoolboards use either proprietary software or can be used in combination with other software to simulate the digital trends described earlier. But it is recommended to have a content database where the teachers can prepare their lessons in advance. Some of the brands have their own content database where a teacher can find lessons that have been shared for that type or brand. Decisions must be made about which brand of database to choose or if we should develop our own database.

5. Conclusion

Our primary and secondary schools are inhabited by a generation who has never known a world without technology and are surrounded by information like no other. This makes it vital that we adapt our schools to the needs of the younger generations and prepare them for a better connection to the current and future labor market. In the current information age, technology is used globally to expand the opportunities to improve literacy amongst learners and to strengthen the educational system's knowledge, distribution, information access, quality and active learning. Research has shown that technology in the classrooms motivates students and provides more tools that can benefit the teacher.

Research shows that the use of technology will only increase moving forward and that teachers and management see technology as an essential tool to better shape the future of education. The purpose of technology has led to changes in our current society and labor market. There has been a shift from a static industrial society to a more dynamic knowledge economy, where economist identified capital deepening, higher quality labor, and technological innovation as these three factors lead to growth, based on increased human capacity. It is crucial that our education policy embraces these factors for this economic development to take place by incorporating digital literacy and knowledge deepening. Furthermore, we must add that this shift requires having a new skill set, which includes creativity, collaboration, entrepreneurship, technological applications and generating new ideas. These skills are frequently referred to as the 21st-century skills whereas the focus is on the future-oriented character of competencies and the competencies needed to participate in the rapidly changing society successfully. Young people, including those with a lower level of education, who do not have such skills, will face problems in the labor market. It is therefore crucial that attention is paid to the new skills in all types of education.

In connection to the use of technology in schools, it is vital that we focus on digital literacy, which is often described as the ability to use digital information and communication wisely and being able to critically evaluate the consequences. Digital literacy is about the effective, efficient and responsible use of technology including the combination of ICT (basic) skills, Computational thinking, Media literacy and Information skills.

Introducing a sustainable and durable use of technology in education requires finding the right balance between four basic elements, which are identified as vision, expertise, content & applications and infrastructure. Having the right technical elements in place while excluding the human factors, will not necessarily lead to the long-term use of information technology. The success of a sustainable and durable method of technology relies on the collaboration of its stakeholders, which are the teachers, schools, managers, school boards and the Department of Education. And a continuous investment in training, maintenance, update and upgrade.

There is a need for a broad-based vision and professional training on the use of ICT, which needs to be developed by policy makers, management and the educational team. As to successfully integrate digital literacy into education, ICT must become part of the classroom. The students' digital use and competence rely on the formal school setting and the out of school informal/ non-formal settings. To get the most out of digital literacy, we are obliged to make ICT accessible in all our schools to provide equal learning opportunities in a pedagogical and didactic manner. We must accommodate the right preconditions to stimulate the use of ICT in schools to make it accessible for all to ensure a better connection to the future labor market.

It is also essential that teachers are supported by training activities and broader access to additional learning materials. Teachers should incorporate the TPACK model into their teaching to effectively use technology for literacy. It is important that all stakeholders of education are aligned and well prepared. The government must financially commit to the vision and include the approach in the national strategic plan. This national strategic plan needs to be realistic and in harmony with the strategic plans of the school boards to successfully integrate ICT.

Students must be prepared for life and work in a digital society and require efforts from the government, schools and publishers of digital learning resources to ensure that current education benefits optimally from the opportunities offered. The government should support schools more in the preconditions such as Internet security and privacy, necessary infrastructure and adequate financial resources. It is essential that the educational field is more involved in digital developments. To implement ICT, it is required that expertise in the educational field is structurally expanded and not left to the hobbyist. Therefore, it is vital that schools/ schoolboards are offered space to add more workforce to the organization to support the use of ICT in their schools' settings.

We must not lose the possible downsides of the use of ICT out of sight. The potential physical and harmful psychological consequences of the frequent use of the Internet, such as tablet-necks, cyberbullying and disconnection anxiety. The broad purpose of ICT in education must not lead to a threat but a safe pedagogical didactic climate. Everyone must be able to develop and be able to grow without being confronted later with images, text or traces on the Internet.

It is imperative that teachers remain the principal actors when it comes to the full realization of an individual and a new model of development using technology together with other materials as instruments of learnings. Teachers must foster classroom environments that are respectful and secure, encourage autonomy and must use a wide range of pedagogical and didactical strategies. The integration of ICT in education implies a new teacher's role and new pedagogical approaches in education, which depends merely on the ability of teachers to structure the learning environment. The professional learning of the teacher will be a crucial component to make the classroom as dynamic as the world we currently live in.

Through the years several plans were developed regarding ICT in education. Due to lack of financing the education system of Aruba has fallen behind in the area of ICT. One school is further than the other regarding ICT in the classroom.

After exploring the current best practices, the recommendation is the installation of digital interactive schoolboards/simulated interactive whiteboards. Integrated with a digital learning environment that monitors the students' progress. The flow of data to the Department of Education is what must be kept in mind when implementing digital devices in the classroom. The Department of Education needs updated information for policymaking. Together with the relevant stakeholders of education, necessary decisions have to be made concerning choosing digital equipment for the classroom.

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