COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING

(COTVET)

STAKEHOLDERS WORKSHOP ON SMART CLASSROOM TECHNOLOGY IN THE DELIVERY OF STEM AND TVET
DATE: NOVEMBER 22, 2017, COCONUT GROVE REGENCY HOTEL, ACCRA

Ministries Branch Post Office P.O. Box MB.651Accra

1.0 INTRODUCTION

The application of ICT in the delivery of quality education is a global trend in the 21st Century. The workshop on smart classroom technology was to introduce educationist and policy makers to global trends in the delivery of quality education through the application of ICT in Science, Technology, Engineering and Mathematics (STEM) and TVET at all levels in education. The workshop was organized jointly by the Council for Technical and Vocational Education and Training COTVET and Devotra at the Coconut Grove Regency Hotel, Accra, on 22nd November 2017.

2.0 OPENING AND WELCOME ADDRESS

The workshop was opened with a message from the Honourable Minister for Education, Dr. Matthew Opoku-Prempeh. He stated that the reason for being at the workshop was because it is about ICT. He revealed to the participants that a careful observation of his speeches since he became minister shows how much importance he places on issues that concerns integration of ICT into education. He referred to the emergence of 'e' clichés e.g. e-commerce, e-judiciary, e-trading, paperless port etc. as how far ICT is permeating into every aspect of our socio-economic development as a country.

Further, the minister then called participants attention to several reforms that are on-going under the Ministry of Education. Amongst them are:

- Embedding ICT within the various stages of education i.e. at the basic level, secondary level and tertiary level to meet the transformations in the 21st Century.
- Setting up structures to ensure that all basic school (both private and public) pupils will be proficient in literacy and numeracy skills.
- Bringing all technical and vocational schools under the umbrella of the Ministry of Education.
- Improve the standards of certification
- Erase the negative perceptions of TVET and make it the preferred choice for students rather than the last resort.
- To create a University solely for the training of TVET teacher/instructors
- To get numeracy and literacy skills on the right path to the benefit of students/learners.

He said everything that surrounds us is the result of TVET. He pointed out that "there is no education without TVET" and that TVET holds the key to Ghana's development". He ended by calling on teachers to train for employment.

3.0 PARTICIPANTS

A total of 167 out of 200 invited representatives from public and private institutions across the country participated in the workshop. The participants were drawn from the following institutions:

- Government Ministries

- Educational Agencies
- Universities
- Technical Universities
- Polytechnics
- Colleges of Education
- Senior High Schools
- TVET Schools
- Ghana National Association of Vocational Technical Institute
- Industries
- Development Partners
- Media Partners

4.0 PRESENTATIONS

Presentations were made on the following topics with emphasis on how the smart classroom technology could be used as a tool to simulate reality in the classroom. The topics covered were:

- Importance and relevance of STEM and ICT in education by Dr. Joshua Mallet of CENDLOS
- Importance of Alignment of TVET with industrial demands by Mr. Theophilus Zogblah of COTVET
- GOG Education projects and initiatives by Ms. Patricia de Bruijn of Devotra/Cadena
- Smart classroom concept by Chris Rowe of LJ Create
- Education solutions aligned with industrial demands by Mr. Ambrose Ayodele of FESTO Group.
- A case study on Kenya smart classroom for TVET improvement by Ms. Patricia de Bruijn
- Demonstration of smart classroom digital learning resource by Chris Rowe

The content covered under each of the presentations is indicated in the table below.

TOPIC	CONTENT
IMPORTANCE AND RELEVANCE OF STEM AND ICT IN EDUCATION	**OVERVIEW** • ICT in education • ICT in education in ghana • Stem education • Stem education in ghana • ICT to promote stem education

	ICT IN EDUCATION
	Over time focus has been on;
	- Computer labs & learner-computer ratios (LCR) - Focus on ict literacy skills ('Teaching' word, excel, ppt) - Smart boards! (seemed to be a revolution) - Internet connectivity (electricity and sufficient bandwidth) - E-readiness (national ICT infrastructure) - Ict in education
	Integration of ICT in education can or should;
	- Improve the quality of teaching - Support teacher pedagocical- didactical skills - Change from teacher centred to student centred - Include modern technologies - Bridge the gap between theory and practical education - Prepare students for the digital society and economy - Be cost-saving - Future proof **INFODEV programmes: Survey** of ICT and Education in Africa to gather the most relevant and useful information on ICT in education activities in Africa (2007) - ICT resource inputs alone are inadequate for understanding impact of ICT on student outcomes - Also look at: how, when, why, how much and where teachers and pupils use ICT
	ICT IN EDUCATION IN GHANA
	- Policy development - infrastructure

	- ICT in Education Programmes **(ICTEP)** Unit under MOE - Can be Used for distance learning programmes and teacher training - Smart boards/ projectors are more often available (secondary schools) - Computer labs available at JHS/ SHS - i-box, my e-campus, e-learning laboratories, etc. **Some Challenges:** - Disparity between public and private schools and urban and rural areas in access to ICT - Lack of computers, electricity and internet - Linkage between classroom and practical - Difficult to "teach and learn" ICT - Some ICT teachers not qualified - Inadequate ICT teaching and learning materials **STEM EDUCATION** STEM curricula is based on the idea of educating students in four specific disciplines — science, technology, engineering and mathematics — in an interdisciplinary and applied approach. Rather than teach the four disciplines as separate and discrete subjects, STEM integrates them into a cohesive learning paradigm based on real-world applications STEM promotes (amongst others) innovation, spur creative and catalytic thinking, trigger students' exploration skills, enhance problem-solving based learning and 21st-century skills - World wide focus towards science, technology, engineering and mathematics (STEM). - Even Moving from STEM to STEAM and stream (including arts & Reading)

	- Integrate at an early age to create interest in science, engineering and technology
	- CEMASTEA: centre for mathematics, science and technology in africa (challenge to integrate technology and engineering)
	- UNESCO urged African countries to promote stem to speed up economic development!
	STEM EDUCATION IN GHANA
	Secondary Schools
	- SHS provide arts, science as well as technical, vocational and business education
	- Challenges with obtaining West African Senior Secondary Certificate Exam (WASSCE)
	- SHS 37,300 teachers - 6,000 are untrained which complicates STEM delivery
	- Growing shortage of STEM teachers
	- GOG wish to provide "adequate access to relevant and up-to-date teaching/learning materials (including ICT)
	- Despite the challenges it should be ideal place to implement STEM
	Tertiary education institutes
	- Students chose humanities instead of STEM related courses
	- Also because institutes are not well-equipped for STEM education
	- Technology and engineering do not appear attractive to students
	- Gap between theory and practical
	- Limited 'innovation' and modern technologies

	• Ghana's target of 60% of enrolment in science and technology related courses at public universities • What about integration of STEM in VET and TVET? **ICT TO PROMOTE STEM** *ICT within STEM supports* • Collaborative learning-joint intellectual effort by students • Existing and emerging pedagogical approaches • Project-based, experiential, inquiry-based and adaptive learning methods and self-paced learning • Simulations and experiments can mimic realistic situations, used to train and practice skills • Provides a wealth of digital content • Improves teaching quality • Allows for integration from primary, secondary, and tertiary education
IMPORTANCE OF THE ALIGNMENT OF TVET WITH INDUSTRIAL DEMANDS	**OVERVIEW** • TVET in Ghana • Challenges • Making TVET attractive for youth • Dialogue with industry • Skills for employment **TVET IN GHANA** TVET in Ghana aims to contribute to the development of a productive workforce by linking the education system to the needs of the economy. It equips youth with the skills necessary to enhance their employability and livelihoods and provides equitable access to competency-based training. *Key principles;* • Industry-led and demand driven • Competency based education and training (CBET) • Workplace Experience Learning (WEL)

	• Recognition of prior learning (RPL) • Life-long learning (LLL) • Access, transfer and progression **CHALLENGES** • Most children are unwilling to pursue a career in TVET, and instead have dreams of becoming doctors, lawyers, or accountants. • Often children's choice of a future career is influenced by their parents' ambitions for them rather than the abilities and preferences of the child. Professions should be considered prestigious and lucrative. • A majority of those who go through our educational system want jobs that require them to wear a shirt and tie even if it means they are underemployed, underpaid, under-resourced and unfulfilled." • Over the years, technical and vocational education and training (TVET) has come to be accepted as the preserve of those who are either too poor to pursue a higher education, or those who do not have the intellectual ability to do so. • We can encourage our children to pursue careers in TVET, but if the training is poor, and the facilities non-existent in schools, then industry will continue to rely on expatriate workers who have the relevant skills set. • The lack of attraction of today's youth into TVET is due largely to the outdated curriculum, ineffective mode of delivery and accompanying low incomes. **MAKING TVET ATTRACTIVE FOR YOUTH** The following must be addressed • Limited labour market involvement • Skills gap with industry • Career path and limited employment opportunities • Limited life skills • Attitudes • Relevance of training Bridging the skills gap, promoting and ensuring job opportunities can be achieved through:

	• Traineeships • Industry guest teachers • Occupational standards • Projects with industry • Learning in real-life setting • Job counseling services • Upwards mobility • CBET + STEM Education reform and change, modernization and TVET promotion can be achieved through: • Change attitudes • Positive branding by media • Education system reform • Recognition of Prior Learning (RPL). and LifeLife long Learning (LLL). • Grant schemes • Design and production skills • Competitions and projects **EXISTING DIALOGUE WITH INDUSTRY** ***Workplace Experience Learning (WEL) Policy in Ghana*** • Industrial attachment of students supervised by the TVET institutions • Acquaint students with new technologies, machines and equipment • Creation of simulated work environment in schools **SKILLS FOR EMPLOYMENT** Skills development is the primary means of enabling young people to make a smooth transition to work. It therefore requires: • Matching supply to current demand for skills (dialogue with industry) • Building skills for the future (dialogue with industry) • Entrepreneurial skills (learning-by-doing & create value addition) • 21st century skills (think, communicate, act)
GoG PROJECTS AND INITIATIVES	**OVERVIEW** • Government Policies • TVET Projects • Secondary Education Projects

- Other initiatives
- Next steps

GOVERNMENT POLICIES
- ICT in education policy 2008: ICT can amongst others:
    - Be applied for pre-service and in-service professional development of teachers
    - Facilitate improved teaching and learning processes
    - Improve teacher knowledge, skills, attitudes and inquiry
    - Improve educational management processes
    - Improve the consistency and quality of instruction both for formal and non-formal education
    - Increase opportunities for more student centred pedagogical approaches
    - Foster collaboration, creativity, higher order thinking skills
    - Provide for flexibility of delivery
    - Reach student populations outside traditional education systems
- ICT at universities, polytechnics, professional institutes, and colleges of education is considered crucial for the provision of the requisite educational, and training services and environment capable of producing the right types of skills and human resources required for developing and driving Ghana's information and knowledge based economy and society

- Ghana Shared Growth and Development Agenda:
    - Education priority area, including ICT, Science, Technology and Innovation
    - mainstreaming of ICT in the curricula of public service training institutions

TVET PROJECTS
- World Bank: Ghana Skills and Technology Development Project (2011-2016)
- African Development Bank: Development of Skills for Industry Project (2011-2017)
- Skills Development Fund (SDF): (2006-2020)
- Chinese Government (VARIOUS)
    - REHABILITATION and upgrading of 46 VTC's
    - Vocational and Technical Test Centre, upgrade 5 polytechnics and 10 technical institutes

	• Others: GIZ, KFW, DANIDA, DFID and JICA • All contribute to the overall objective to improve the productivity and competitiveness of skilled workforce • The development of a demand-driven, CBET based TVET system, creating industry-readiness • Much focus should be placed on innovation, ICT, and STEM related skills **SECONDARY EDUCATION PROJECTS** • World Bank: Secondary Education Improvement Project (SEIP) • GOG: Science Resource Centres: Teacher Training And Teaching Resources • 240 E-learning laboratories for Senior High Schools (SHS) • CENDLOS INITIATIVES: New interactive ways of education • World Bank: E-transform (including education sectors) • All contributing to improve quality of secondary education • Integration of ICT into STEM • Should we integrate 21st century skills? **OTHER PENDING INITIATIVES** • GOG is actively involved in the development of new TVET, science and secondary education projects. These projects should support, amongst others, one village one dam; one district one factory; and the Poverty Eradication Project. • Promote rapid industrialization at the districts level driven by strong linkages to agriculture and other natural resource endowment to create job and wealth. **NEXT STEPS?** • Review what is presented and shown today (presentations, demonstrations and trials) • Share knowledge and ideas (throughout the day) • Assess what would work for Ghana (round table discussions)

5.0 DISCUSSION AND FEEDBACK ON SMART CLASSROOM TECHNOLOGY

After all presentations were made, opportunity was given to participants to share their views and feedback on the presentations. Some of the feedback were:

- The smart classroom technology is an important tool that will make teaching and learning interesting and less stressful. Hence, teachers must be trained on the use of this technology in the classrooms and workshop.
- The Ministry of Education should try and equip each school with a smart classroom to make teaching easy in the spate of large student populations in classrooms.
- To ensure effective implementation of this technology, there is the need to ensure that internet infrastructure is robust in the schools so that some challenges suffered as in the case of Kenya could dealt with.
- Adoption of this technology should be given urgent attention by government but the need for equipment and machinery in the workshops and laboratories are also important for real practice apart from simulation.
- How do we align the STEM curriculum to current global trends and include exciting things like robotics, mechatronics etc.?
- Government should support schools with training materials for actual practical training in addition to equipping STEM and TVET departments in the schools with the smart classroom technology.
- Sustainability on the adoption of TVET is key in the Kenya case study. How do we ensure that similar thing is achieved in Ghana?
- The need for government to build STEM centers and equip them well for use as a place for researching into challenges of industry to encourage project-based learning and assessment. Projects in schools could be real ones from industry.
- How do we use the smart classroom technology and achieve e-learning since most schools especially in rural areas have no access to electricity and come to think of internet connectivity?
- To ensure effective rolling-out of the competency based learning policy across TVET schools in the country, COTVET must support TVET schools with the smart classroom technology as complementary to actual practical work.

6.0 CLOSING REMARKS

The closing remarks was given by the Ag. Executive Director of COTVET, Dr. Fred Kyei Asamoah. He reiterated the need for stakeholders in the TVET sector to embrace the 21st Century technology of delivering education and to constantly seek to upgrade skills in deploying ICT to promote quality education in the study of STEM and TVET. He lauded the presenters for their insightful presentations and especially on the smart classroom technology. He highlighted on the presentations made and entreated educational institutions especially STEM and TVET to explore the technology for the benefit of learners.

7.0 CONCLUSION

The workshop was good and well participated by key stakeholders across all levels of education in the country. Participants were excited on the smart classroom technology especially on how it can contribute to support teachers in delivering hands-on experiential learning. All the institutions that participated requested that the Ministry of Education should do it possible best to equip schools with this technology to promote effective teaching.

Appendix 1: Photo Gallery

The Honourable Minister for Education being welcomed by Devotra team

The Honourable Minister delivering his opening address

The Ag. Executive Director of COTVET shows excitement on the demonstration of the smart classroom technology

Theophilus Zogblah interacting with the Honourable Minister of Education

The Minister of Education delivering his address and participants listening

Theophilus Zogblah of COTVET delivering his presentation

Patricia de Bruijin of Devotra/Cadena delivering her presentations

Chris Rowe of LJ Create shows a demonstration of how the smart classroom technology

Ambrose Ayodele of Festo delivering his presentation

Joshua C. Mallet of CENDLOS delivering his presentation

The Ag. Executive Director of COTVET with the team from Devotra and COTVET

Participants observing presentations and giving feedback

Participants listening to presentations and taking notes

Principal of Takoradi Technical Institute asking a question

A lecturer from COLTEK making a contribution

Devotra makes a presentation to the Executive Director OF COTVET

Appedix 2: Workshop Programme

SMART CLASSROOM WORKSHOP
STEM AND ICT INTEGRATION AT ALL LEVELS IN EDUCATION
WORKSHOP – 22ND NOVEMBER
COCONUT GROVE REGENCY, ACCRA

Time	Program
08.30-09.00	Arrival and registration
	Opening Prayer Volunteer Clergy
09.00-09.05	Welcome Address Dr. Fred K. Asamoah, Ag. Executive Director, COTVET
09.00-09.15	Opening Statement Hon. Dr. Matthew Opoku Prempeh Minister for Education
09.15-09.35	Presentation: Importance and relevance of STEM and ICT in education. Dr. Joshua Mallet, CENDLOS
09.35-09.55	Presentation: Importance of alignment of TVET with industrial demands Mr. Theophilus T. Zogblah, COTVET
09.55-10.15	GOG Education projects and initiatives Ms. Patricia de Bruijn, Devotra/ Cadena
10.15-10.35	Coffee break
10.40-11.00	Presentation: Smart classroom concept Mr. Chris Rowe, LJ Create
11.00-11.20	Case study Kenya: Smart classroom for TVET improvement Ms. Patricia de Bruijn, Devotra/ Cadena
11.20-11.50	Presentation: Education solutions aligned with industrial demands Mr. Ambrose Ayodele, FESTO East Africa
12.00-12.30	Demo Smart Classroom Digital Learning Resource Library Mr. Chris Rowe and Ms. Patricia de Bruijn
12.30-13.00	Lunch
13.00-13.45	Round table discussion 'Industry led TVET for Ghana' Smart Classroom trial and demo for selected teachers
13.45-14.40	Presentation of Smart Classroom findings by teachers Round table discussion 'Smart Classrooms for Ghana
14.40-15.10	Presentation of outcomes of day and round table discussions
15.10-16.00	Wrap-up and final remarks by Dr. Fred K. Asamoah Informal drinks/coffee and networking

Presentation 1.
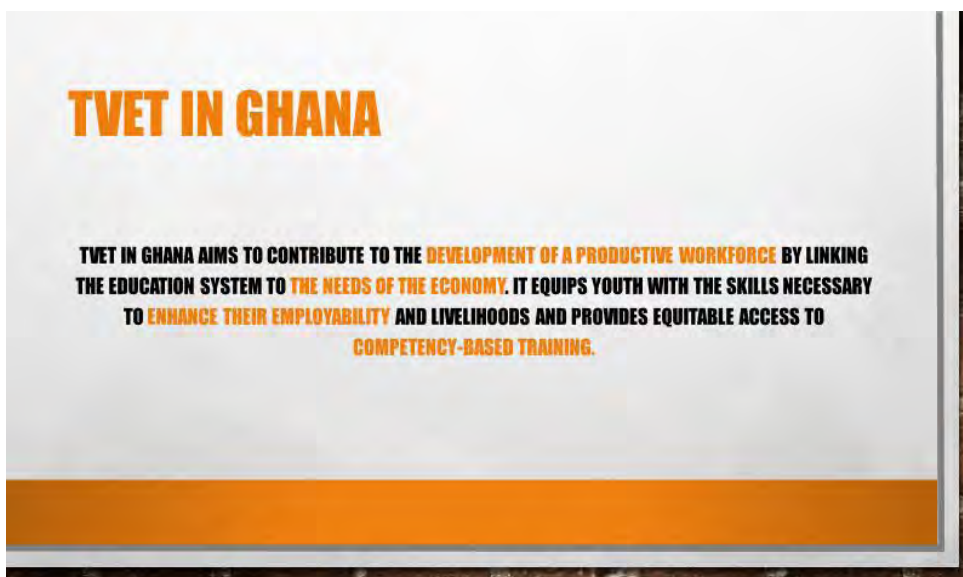
TVET IN GHANA

KEY PRINCIPLES:

- INDUSTRY LED AND DEMAND DRIVEN
- COMPETENCY BASED EDUCATION AND TRAINING (CBET)
- WORKPLACE EXPERIENCE LEARNING (WEL)
- RECOGNITION OF PRIOR LEARNING (RPL)
- LIFE-LONG LEARNING (LLL)
- ACCESS, TRANSFER AND PROGRESSION

CHALLENGES

"Most children are unwilling to pursue a career in TVET, and instead have dreams of becoming doctors, lawyers, or accountants."

"Often children's choice of a future career is influenced by their parents' ambitions for them rather than the abilities and preferences of the child. Professions should be considered to be prestigious and lucrative."

"A majority of those who go through our educational system want jobs that require them to wear a shirt and tie even if it means they are underemployed, underpaid, under-resourced and unfulfilled."

"Over the years, technical and vocational education and training (TVET) has come to be accepted as the preserve of those whom are either too poor to pursue a higher education, or those who do not have the intellectual ability to do so."

"We can encourage our children to pursue careers in TVET, but if the training is poor, and the facilities non-existent in schools, then industry will continue to rely on expatriate workers who have the relevant skills set."

"The lack of attraction of today's youth into TVET is due largely to the outdated curriculum, ineffective mode of delivery and accompanying low incomes."

CHALLENGES

- BAD IMAGE / DIRTY HANDS
- OUTDATED INFRASTRUCTURE
- OLD CURRICULUM
- OLD EQUIPMENT AND TECHNOLOGIES
- LIMITED SKILLS OF TEACHERS
- SKILLS GAP WITH INDUSTRY
- LIMITED UPWARDS MOBILITY
- LIMITED CAREER PATH

EXISTING DIALOGUE WITH INDUSTRY

INDUSTRIAL ATTACHMENT POLICY IN GHANA

- INDUSTRIAL ATTACHMENT OF STUDENTS SUPERVISED BY THE TVET INSTITUTIONS
- ACQUAINT STUDENTS WITH NEW TECHNOLOGIES, MACHINES AND EQUIPMENT
- ALSO CREATION OF SIMULATED WORK ENVIRONMENT IN SCHOOLS

INDUSTRY INVOLVEMENT: INDUSTRY TRAINING ADVISORY COMMITTEE (ITAC)

- RESPONSIBLE FOR SETTING OCCUPATIONAL STANDARDS AND EDUCATIONAL PROGRAMMES
- SUB-COMMITTEES ARE INDUSTRY-LED WITH EXPERTS FROM INDUSTRY AND EDUCATION AND TRAINING
- MAIN ROLE IS TO GENERATE OR VALIDATE OCCUPATIONAL STANDARDS

SKILLS FOR EMPLOYMENT

SKILLS DEVELOPMENT IS THE PRIMARY MEANS OF ENABLING YOUNG PEOPLE TO MAKE A SMOOTH TRANSITION TO WORK

- MATCHING SUPPLY TO CURRENT DEMAND FOR SKILLS (DIALOGUE WITH INDUSTRY)
- BUILDING SKILLS FOR THE FUTURE (DIALOGUE WITH INDUSTRY)
- ENTREPRENEURIAL SKILLS (LEARNING-BY-DOING & CREATE VALUE ADDITION)
- 21ST CENTURY SKILLS (THINK, COMMUNICATE, ACT)

THANK YOU FOR YOUR INTEREST!

- QUESTIONS AND SUGGESTIONS?

Presentation 3

STEM AND ICT INTEGRATION AT ALL LEVELS IN EDUCATION

DEVOTRA
WWW.DEVOTRA.NL

CASE STUDY KENYA: TVET – SMART CLASSROOM PROJECT

Overview

- Turn-key approach
- Kenya Project Phase I: Rehabilitation and upgrading of KTTC and 9 Regional Centres of Excellence
- Kenya Project Phase II: Smart classrooms for TVET improvement
- Q&A

DEVOTRA

Turn-key approach

Based on more than 30 years practical experience in education and training projects (STEM / TVET) working with a wide variety of clients and donors in developing countries and upcoming markets

Devotra decided to develop a turn-key approach in order to improve impact, relevance, quality, effectiveness and efficiency within education projects in Africa.

Turn-key approach + holistic thinking

- Covers design, implementation and operational support
- Integration of all project components
  - Infrastructure improvements
  - Equipment supply, installation and commissioning
  - Technical assistance (long-term)
  - Teacher and staff training (long-term)
  - Warranty and after sales

Turn-key approach: Design to Operation

CASE STUDY KENYA

Kenya: Phase I

KENYA PROJECT KE/GZ07010

Kenya Technical Teachers College (KTTC) - Nairobi
Kabete Technical Training Institute - Nairobi
Machakos Technical Training Institute - Machakos
Nairobi Technical Training Institute - Nairobi
Ramogi Institute of Advanced Technology (RIAT) - Kisumu
Sigalagala Technical Training Institute - Kakamega
Meru Technical Training Institute - Meru
Nyeri Technical Training Institute - Nyeri
Mombasa Technical Training Institute - Mombasa
Rift Valley Technical Training Institute - Eldoret

Rehabilitation and Upgrading of KTTC and nine Regional Centres of Excellence in Kenya	
Client	Ministry of Higher Education, Science and Technology
Value	14,9 mln euro
Duration	July 2010– July 2012 + support phase to May 2016
Staff	3 installation teams + 6 long-term experts + 12 trainers
Description	Design and implementation of turn-key TVET project covering 10 Technical Training Institutes in Kenya

Services	1) Design and feasibility study
	2) Technical, Financial and Financing proposal
	3) Train-the-trainers programme (60 teachers in the Netherlands)
	4) Nationwide Technical Assistance and training program (600 teachers)
	5) Rehabilitation of workshops
	6) Supply of vocational training equipment (140 containers) for:
	  • Mechanical • Electronics
	  • Welding • Electrical
	  • Sheet metal • Building and Construction
	  • Automotive • Carpentry
	  • Plumbing and pipefitting
	7) Long term technical support, training and maintenance

Kenya: Phase II
Smart Classrooms for TVET improvement

Smart Classrooms for TVET Improvement in Kenya	
Client	Ministry of Education, Science and Technology
Value	4,1 mln euro
Duration	March 2016 – December 2018
Staff	2 installation teams + 6 trainers
Description	The Smart Classroom improves the traditional TVET teaching at the 10 TTIs through further introduction of student-centred learning, interdisciplinary work, Competence Based Education and Training (CBET), and will maximize the use of the existing equipment at the workshops.
Services	• Project design • Site-surveys and recommendations • Creation of a virtual learning environment • Digital Learning Resources Library • Small scale practical demo units • Integration of ICT based learning in TVET • Establish IT infrastructure • Supply, installation and commissioning of equipment • Training of teachers and managers • Long term technical support, training and maintenance

Smart Classrooms for TVET improvement

The Smart Classroom enhances:
- Traditional TVET teaching
- Teacher performance and delivery
- Attractiveness of TVET
- Interdisciplinary work
- Self-paced learning
- Modular use of different workstations
- CBET and STEM
- Maximize the use of existing workshops

The Smart Classrooms include:
- Presentations & digital lessons
- Student investigations
- On-screen simulations
- Virtual experiments
- Assessments and tests
- Reporting mechanisms
- Practical exercises
- Project and group work

The ❤ of the smart classroom is the Digital Learning Resource Library

Digital and Practical Hands-on Workstations

Telecommunications **Hydraulics** **Automotive** **Electrical**

Materials/ Processes **Mechanisms** **Robotics** **Renewable energy**

Digital and Practical Hands-on Workstations

Pneumatics **Transportation** **Industrial Controls** **Eng. Construction** **Electronics**

CNC Simulation **3D Printing** **Laser cutting** **Machine Tools & CNC** **2D/3D Design**

Output Kenya phase 1 and 2 turn-key project

- Implementation from 2010 and still ongoing till end 2018
- KTTC and 9 TTIs upgraded and rehabilitated
- 80 workshops equipped
- 10 Smart Classrooms installed and operated
- 60 teachers trained in Netherlands
- 600 teachers trained in Kenya
- Continued increased enrolments per TTI
- Higher pass rates
- Industry involvement
- Better job placement
- 21st century TVET systems in place at 10 TTIs
- Continued involvement through teacher training and extended training

21st Century Education Systems

- Flexible and adjustable to labour market requirements
- In line with new technologies
- Trigger design, exploration and production skills
- Creativity, innovation and entrepreneurial skills
- Integration of ICT based learning/ digital content in TVET
- Bridging the gap between theory and practical
- Competency Based Education and Training
- STEM: Integration from primary, secondary, TVET and HE

Included in Smart Classroom concept

Create a safe and modern learning environment, with inspiring materials, teachers and projects!

Bad image
Dirty hands
Outdated facilities
Old equipment and technologies
CBET and STEM not applied

SMART CLASSROOM IS TAILOR-MADE AND CAN BE APPLIED AT ALL LEVELS OF EDUCATION

Presentation 3

FESTO

Learning How to Learn

- In the future, students could learn in flexible and customized learning environment designed to meet their needs.
- Plethora of choice to chose from a virtually unlimited quiver of tools and devices
- Teachers could continually assess and adapt curriculum to best support their students
- Technology playing a very pivotal role-
- ubiquitous access to mobile technology
- Elimination of time constrain-
- learning is no longer constrained by an arbitrary time period
- Learning becomes easy and smarter.
- Robots?.....I would not want robots teachers

Industry and Education: A good Mix

Education Plus Skills

Future Learning Curve

A Quantum Leap

Food the biggest changer

Evolution

The World Bank projects that agriculture and agribusiness in Africa will grow to be a US$1 trillion industry in Africa by 2030
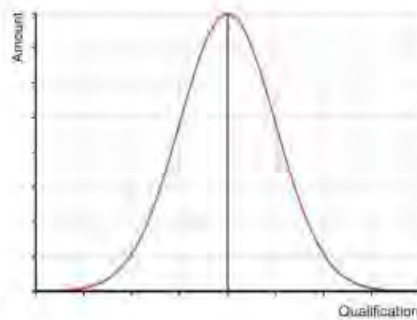
America: Cars
Europe: Fashion
Africa: Agriculture

## Education solutions aligned with industrial demands

Impact Beyond Academia

**For the Future -
Qualification is the key**

Economical and social success

One of the most important parameter for economical success and stability is a strong middle class. The relation in a society should be according to the **Gaussian normal distribution** as shown in the graphics whereby we can see, that most processes in the nature as well as mathematical distribution possibilities are according to that function. That means, a society should have only a few uneducated people (left lower level) and a few highly educated people (right lower level) but a very strong middle class level, which corresponds to the vocational education program
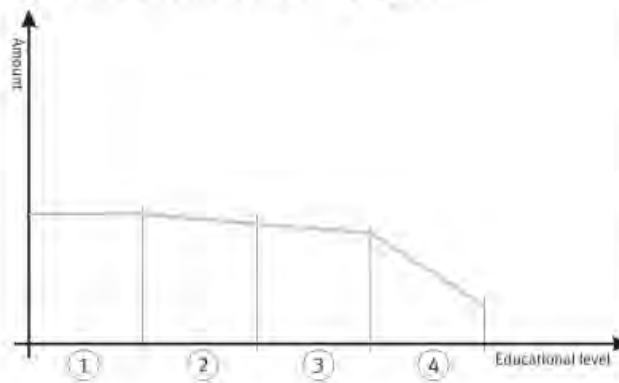
A perfect relation of employees
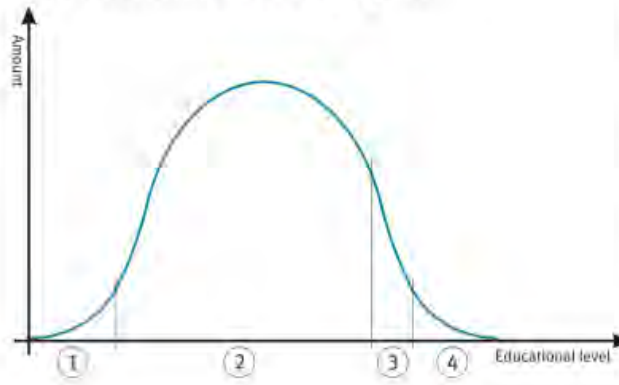
A perfect relation between:

1 = Highschool
2 = Vocational
3 = Techn./Bachelor
4 = Higher education

level following the natural law of a Gauss normal distribution

The actual relation of employees

The actual relation between:

1 = Highschool
2 = Vocational
3 = Techn./Bachelor
4 = Higher education

level has been evaluated in 168 companies in 13 countries

Festo Group

An independent family enterprise

Industrial Automation and Education Solutions

Turnover: 2.8 billion EUR in 2016
Active in 176 countries with 61 Festo subsidiaries Employees word-wide 18.800

Innovative
3.000 patents
more than 100 innovations each year
Research and development investment: 7,5 % of sales

Committed to quality and environment
Quality- and environmental certificates
(ISO 9001, VDA 6.1/6.4, ISO 14001)

Experienced in many industry sectors and a leader in the field of education

From fundamentals to a complete training center

- Electrical Engineering
- Mechatronics
- Machining Technology
- Green Energy
- Metallography and Material Testing
- Factory and Process Automation
- Robotics
- Automotive Technologies
- Agricultural Engineering
- Building Construction
- Water and Wastewater Engineering

Experts in many industry sectors bringing you the right learning solutions.

Synergies between Didactic and Automation are clearly visible

Automation		Increase of performance	Didactic	
Components	Systems and Solutions	Machines and Systems	Training and Consulting	Learning Systems

and ↓ ↑

People and Organization

Win-Win-Situation:
Together we are strong!

Hands-on learning systems help staffs and studends learn quickly and effectivly

Background:

Local and global manufacturers from a wide range of fields and backgrounds increasingly **need skilled workers.**

Education programs in schools and in universities often fail to give **students** the practical skills they need, leaving them **unprepared for the job market.**

Target:

Practical vocational education and training programs offer students **early hands-on work experience** and prepare them for production environments.

Challenges and demands of education

Digitalization / Internet of things	Industrialization / Re-industrialization	Globalization / Mobility of workers	Employment / Youth employment
Demands:	Demands:	Demands:	Demands:
Education solutions for new technologies	Integration of technology fields in education systems	Internationalization of learning content and certification	Skills development programs with market orientation
Integration of digital learning and digital topics in technical education programs	Practice-oriented education programs	Digital learning / Mobile access to education	Practice-oriented education programs
Work 4.0 – Enablement of workers to solve problems and act as entrepreneurs	Holistic education offerings / Flexible learning paths	Turnkey education environments	Enablement for a direct entry into the job market

We maximize learning success and productivity

Managed services	Curricula, programs und certification	Educational and consulting services	Turnkey equipment
Operation of learning centers	Development of curricula, programs and certification	Services in the fields: people, technology, organisation	Design and equipment of laboratories, schools, universities and training centers

We maximize learning success and productivity.

Customers: Educational institutions / Governments / Government institutions / Industrial companies

950 employees worldwide / in 61 countries / 42.000 training participants annually / 46.000 Festo Labs

Learning Environment for Virtual Mechatronics Training

Web-Based Training Packages	Programming and Simulation Software	Tec2Screen

Highlights of the Laboratory

- WBTs combined and managed via Classroom Manager
- Programming and Simulation Software to develop programming skills in different technologies
- Connected Learning with T2S; an innovative learning methodology that makes complex technologies easy to understand

Web based training (WBT)

The most important point of our e-learning concept are the learning programs.

In total we offer about 35 different topics not only in the field of automation technology and mechatronics but in the field of management and soft skills as well.

As a standard most of the learning programs are available in 4 languages (English, French, Spanish and German), a lot of them are also available in other languages

→ Digital training programmes

Tec2Screen - Connecting Learning

The product innovation "Tec2Screen ®" enables a mobile multimedia learning connecting itself to our learning hardware.

The product combines a clear way digital learning content with real technical components of the learning units.

Science Technology Engineering Math

Bridging the gap between industry and education

Bring industry into the classroom.

Then the step from classroom to industry is easy.

Integrative STEM education by Festo Didactic

Integrative STEM education by Festo Didactic

The Integrative STEM solution is flexible and works with both new and existing classroom settings.

The "learning cluster" approach of Festo's Integrative STEM solution is inherently flexible and allows a STEM classroom to consist of modules from all clusters, specific clusters, or a variety of each.

A "learn-by-doing" philosophy

Integrative STEM education by Festo Didactic

- ✓ turn-key solution for implementation of secondary education STEM programs ($9^{th}/10^{th}$ grade)

- ✓ 14-16 year old students explore real world problems, reflect on the problem solving process, and develop design solutions

- ✓ emphasizes innovation, problem-solving, critical thinking, and creativity

- ✓ students complete projects using the engineering design process

- ✓ comprehensive and well-rounded approach to ensure that both students and teachers are on a path toward success

"How" we teach fully optimizes "what" we teach.

Our solution

Advanced Manufacturing	1. Engineering and Stress Analysis	project-based learning with real-world scenarios
	2. Exploring Electricity	
	3. Plastics	Each course is presented with a **Project Challenge** path
	4. CNC Mill	
	5. CNC Lathe	
	6. Computer Aided Design (with 3D printing)	**Learning Approach**
	7. Introduction to Process Engineering*	
	8. Fiber Optics and Lasers	subject-based learning
	9. Aerodynamics	
Mechatronics	10. Exploratory Electronics*	problem- based learning
	11. Exploring Mechatronics*	
	12. Automation and Robotics	entrepreneurially- minded learning
	13. Exploring Mechanisms	
Environmental Discovery	14. Alternative Energy	
	15. Environmental Technology/Water	

Learning environments for every field of technical education
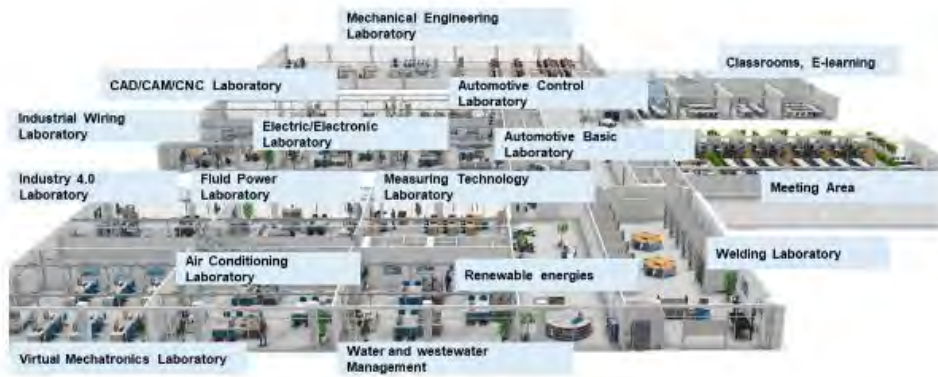
MEDAASE!

THANK YOU!

MERÇI!   DANKE!

Presentation 4

STEM and ICT integration at all levels in education

Relevance of STEM & ICT in Education

Joshua C. Mallet

CENDLOS-MOE

Coconut Grove Hotel, Accra, 22 November, 2017

cendlos-cotvet-devotra/cadena. 22 Nov 2017, accra

How Literate are You?

- Vocational education is "education and training for work; it is an education where skills are taught for the purpose of gaining employment through exposure to practical experience for self-actualization. *

- There can be no Education for All (EFA) without first achieving TVET for All (TVETA). *. . . *(para from Jeffrey Sachs)*

- Education For All (**EFA**) *is/was* a global movement led by UNESCO aiming to meet the learning needs of all children, youth and adults by 2015.

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From MDGs *(2000-2015)* to SDGs *(2015-2030)*

• After 2015, what next?

• SDG 2030 – Living in a world where

. . . nobody anywhere lives in extreme poverty

. . . every one goes to school

• Don't these dreams require TVET? ***TVET at every level of education?***

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STEM Education, the Answer?

• **Computers**
• **Electricity/power**
• **Practical space**
• **Teachers/mentors**
• **Diversity of content**

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STEM Education, the starting point?

- **STEM** – science, technology, engineering, mathematics
- **STEAM** – STEM + Arts/Reading
- **STREAM** – STEM + Recreation

- . . .Taking us back to SDGs with <u>TVET as core value</u>
- CENDLOS has taken the initiative with <u>e-learning by the iBox</u>
- We, as a team (+ COTVET & other stakeholders) need to move **NOW**

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This is how we began; let's go forward

The history of technology in education…

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EW OF RPL