When prioritizing ICT in education in Ghana, the TVET sector, was not immediately prioritized. While significant time has passed, and much has been accomplished with ICT in education at various levels, the time has come to introduce a proven concept in Ghana which will be supporting Competency Based Education (CBE), quality, access and relevance of the TVET sector. While studying the Ghanaian TVET education system it became clear that there is a gap between theoretical and practical skills of both teachers and students. The Smart Classrooms support CBT with an emphasis on experiments, investigations and virtual learning, ensuring that teachers and students are better prepared to use practical training equipment.

Devotra Smart Classroom integrates all of the above and brings 21st century education systems to Ghana. The Smart Classroom is available for TVET, Primary-, Secondary- and Higher Education, allowing for smooth integration of teaching and learning at all levels.

The Devotra Smart Classroom seamlessly integrates the following components:
- Digital Learning Resources Library with 8,500 ready-made learning units
- Learning units mapped against curricula and programmes
- Practical demo and training units which are linked to the Digital Learning Resources Library
- State-of-the-art ICT laboratory for hands-on exploration, investigation and production
- Using on-screen simulations, virtual experiments and presentations
- Top quality ergonomic designed furniture for a safe and modern learning environment
- Future proof solution that is available offline or online via a suitable e-learning platform
- Teacher training, technical support and after-sales support

The Devotra Smart Classroom acts as an incubator area for ideas based on industry and labour market requirements. It changes students and teachers mind-sets and brings innovation, spurs creative and catalytic thinking, triggers students’ exploration skills, enhances problem-solving based learning as well as competency based education and provides the opportunity to teach and learn designing, programming, engineering and production skills.

The GOG has acknowledged that ICT can, amongst others, contribute to improved teaching and learning, teacher knowledge, skills and attitudes, consistency and quality of instruction, student-centred pedagogical approaches, and foster collaboration, creativity, higher order thinking skills. The Devotra Smart Classroom provides a unique TVET teaching and learning concept, combining state-of-the-art ICT based technologies and hands-on practical education, making TVET realistic. Future proof. The TVET Smart Classroom harnesses emerging technologies and fully integrates ICT based training and best practices in TVET.

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Primary Education

The Government’s Education Sector Plan (ESP) covering 2010-2020, aims to “increase equitable access to high quality secondary cycle education that prepares young adults for the various options available within tertiary education and the workplace.” The Ministry of Education is implementing the Secondary Education Improvement Project (SEIP) with the objective to increase access to senior secondary education in underserved districts and improve quality in low-performing Senior High Schools in Ghana. SEIP also includes the expansion of ICT to achieve strengthened science, mathematics and other subjects through digital content for teachers and students.

The Digital Learning Resource Library provides students with a wide range of educational experiences that integrate Science, Technology, Engineering and Mathematics (STEM). Modern technologies, with an emphasis on exploring science are featured. With a wealth of practical hands-on and virtual assignments the Smart Classroom can significantly contribute to improved West Africa Senior School Certificate Examination (WASSCE) outcomes.

Students are prepared for a career within their field and for deferred study or college through a blended mix of hardcopy and online resources.

Secondary Education

The primary education Digital Learning Resources Library covers more than 1,000 lessons, including 300 exciting inquiry-based digital investigations and simulations.

The typical primary education STEM lab configuration includes the following 12 themes:

- Architectural technology
- Construction engineering
- Electronic technology
- Energy in buildings
- Engineering design
- Biomedical technology
- Mobile robotics
- Mechanics
- Manufacturing technology
- Mass transportation
- Industrial robotics
- Transportation technology

Secondary Education STEM programmes

Higher Education

Within the ICT in Education Policy in Ghana, Higher Education has been prioritized. Integration of ICT at (Teacher) Universities, Polytechnics, Professional Institutes and Colleges of Education is considered crucial for “the provision of the requisite educated, skilled and trained services and environment capable of producing the right types of skills and human resources required for developing and thriving Ghana’s information and knowledge-based economy and society”.

With the online applications, the Smart Classroom can also contribute to Distance and Open Learning which has become a significant alternative mode of delivery at tertiary education level. Furthermore, Ghana participates in the knowledge exchange initiative “Partnership for skills in Applied Sciences, Engineering and Technology” (PASET) which acknowledges that STEM education is critical for developing research capacity, skills in critical thinking, creativity, and scientific collaboration.

The Smart Classroom Concept for Higher Education can include the following rooms:

- Teacher led presentation rooms
- Student exploration and investigation rooms
- Teacher led presentation rooms
- Practical demo and training units linked to the Digital Learning Resource Library server
- 16 workstations with direct access to Digital Learning resources
- Based on maximum 32 students
- Numerous presentations and background materials
- Example topics for Research, Design & Technology
  - Mechanical & fluid power
  - Automotive Engineering
  - Computer programming
  - Electronics
  - Control & Instrumentation
  - Machine tools
  - Rapid Prototyping/Industrial Manufacturing
  - Manufacturing technology
  - Manufacturing technology
  - CNC simulation
  - CNC machining
  - Mass transportation
  - Rapid Prototyping/Industrial Manufacturing

The Smart Classroom can be used to improve the provision of higher education science, technology, engineering, and mathematics (STEM) programmes.
The Ghana Education Sector Plan (2010-2020) has the strategic goal to provide equitable access to good quality child-friendly universal basic education by improving opportunities for all children in the first cycle of education. As such the strategic framework include provisions of access to relevant up-to-date teaching and learning materials, as well as the provision of relevant opportunities for ICT and skills development.

The Smart Classroom active learning program for primary education is composed of creative hands-on tasks and interactive virtual software applications that work flawlessly together. These activities encourage children to explore scientific scenarios themselves and enables them to explain what they have learned about STEM. A combination of high quality content and practical experiment kits, provides teachers with the necessary tools to ensure the STEM learning experience becomes very exciting and understandable for young children.

The specific primary education Digital Learning Resources Library covers more than 1,000 lessons, including 300 exciting inquiry-based digital investigations and simulations. The typical primary education STEM lab configuration includes the following 12 themes:

- Life science
- Earth Science
- Physical Science
- Mathematics
- Engineering
- Science Practices

The Government’s Education Sector Plan (ESP) covering 2010-2020, aims to “increase equitable access to high quality second cycle education that prepares young adults for the various options available within tertiary education and the workplace.” The Ministry of Education is implementing the Secondary Education Improvement Project (SEIP) with the objective to increase access to senior secondary education in underserved districts and improve quality in low-performing Senior High Schools in Ghana. SEIP also includes the expansion of ICT to achieve strengthened science, mathematics and other subjects through digital content for teachers and students.

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The Smart Classroom Concept for Higher Education can include the following rooms:

- Teacher led presentation rooms
- Student exploration and investigation rooms
- Research & Development projects
- Industry collaboration
- Social and media projects
- Student presentation rooms
- Virtual lab spaces
- Hardware and software resources

The Ministry of Education has prepared for a scenario within which students choose and for instruction and development through a blended mix of hardware and software resources.

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The Smart Classroom meets the specific needs of Junior and Senior High Schools in Ghana, similar to improve access, quality and relevance of the secondary education system. Students are prepared for an alternative learning format of their choice and for instruction and development through a blended mix of hardware and software resources.

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Primary Education

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The Smart Classroom active learning program for primary education is composed of creative hands-on tasks and interactive virtual software applications that work hand-in-hand together. These activities encourage children to explore scientific phenomena themselves and enable them to explain what they have learned about STEM.

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The Smart Classroom meets the specific needs of Junior and Senior High Schools in Ghana, similar to primary education, quality and relevance of the secondary education system and the educational delivery of science and technology. Secondary education in Ghana is considered critical for the provision of the requisite educated, skilled and trained services and environment capable of producing the right types of skills and human resources required for developing and thriving Ghana’s information and knowledge-based economy and society.

The Smart Classroom active learning program for secondary education includes the following 12 themes:
- Architectural technology
- Construction engineering
- Electronic technology
- Energy in buildings
- Engineering design
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- Manufacturing technology
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Higher Education STEM programmes

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With the online applications, the Smart Classroom can contribute to distance and open learning which has become a significant alternative mode of delivery at tertiary education level. Furthermore, Ghana participates in the knowledge exchange initiative “Partnership for skills in Applied Sciences, Engineering and Technology” (PASET) which acknowledges that STEM education is critical for developing research capacity, skills in critical thinking, creativity, and scientific collaboration.

The Smart Classroom Concept for Higher Education can include the following rooms:
- Teacher-led presentation rooms
- Based on maximum 32 students
- Direct access to Digital Learning Resource Library for lecturers
- Numerous presentations and background materials available

Student exploration and investigation rooms
- Based on maximum 32 students
- 56 workstations with direct access to Digital Learning Resource Library
- Practical clerical and training units linked to the Digital Learning Resource Library
- Example topics for Research, Design & Technology
- Biomedical technology
- Mechanical & fluid power
- Automotive Engineering
- Computer programming
- Control & Instrumentation
- Machine tools
- Electronics
- Computer & its applications
- Automotive Engineering
- Mechanical & fluid power

Example topics for Research, Design & Technology
- Transport and mass transportation
- Manufacturing technology
- Computer & its applications
- Mechanical & fluid power
- Electrical
- Construction engineering
- Architectural technology
- Construction engineering
- Electronic technology
- Energy in buildings
- Engineering design
- Biomedical technology
- Mobile robotics
- Mechanics
- Manufacturing technology
- Mass transportation
- Industrial robotics
- Transportation technology
- Mechanical & fluid power
- Electrical
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Introducing a unique TVET teaching and learning concept, combining state-of-the-art technologies, software, simulations, experiments and hands-on practical education, for a future-proof learning environment.

When prioritizing ICT in education in Ghana, the TVET sector, was not immediately prioritized. While significant time has passed, and much has been accomplished with ICT in education at various levels, the time has come to introduce a proven concept in Ghana which will be supporting Competency-Based Education (CBE), quality, access and relevance of the TVET sector. While studying the Ghanaian TVET education system it became clear that there is a gap between theoretical and practical skills of both teachers and students. The Smart Classrooms can fill this gap by integrating ICT-based learning and hands-on practical training.

The Devotra Smart Classroom seamlessly integrates the following components:
- Digital Learning Resources Library with 8,500 ready-made learning units
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The Devotra Smart Classroom acts as an incubator area for ideas based on industry and labour market requirements. It changes students and teachers mind-sets and brings innovation, spur creative and catalytic thinking, triggers students' exploration skills, enhances problem-solving based learning as well as competency based education and provides the opportunity to teach and learn designing, programming, engineering and production skills.

The Government of Ghana (GOG) wishes to include ICT in education at all levels to improve access, quality and relevance of education. In the ICT in education policy it is acknowledged by the GOG that ICT can, amongst others, contribute to improved teaching and learning, teacher knowledge, skills and attitudes, consistency and quality of instruction, student-centred pedagogical approaches, and foster collaboration, creativity, higher order thinking skills.

The Devotra Smart Classroom is available for TVET, Primary-, Secondary- and Higher Education, allowing for smooth integration of teaching and learning at all levels. The Devotra Smart Classroom for TVET includes the following components:
- Project design
- Site surveys and recommendations
- Creation of a virtual learning environment
- Digital Learning Resources Library
- Small scale practical demo units
- IT infrastructure
- Supply, installation and commissioning of equipment
- Training of teachers and Smart Classroom managers
- Long-term technical support, training and maintenance

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Smart Classrooms for Education Improvement in Ghana

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