



Smart Classrooms for Education Improvement in Ghana

DEVOTRA Smart Classrooms for Primary -, Secondary -, Higher Education and TVET



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.

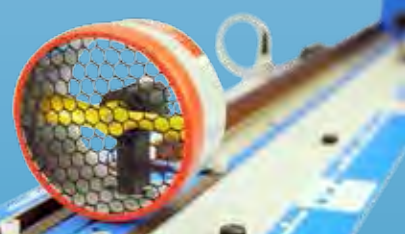
The Devotra Smart Classroom integrates all of the above and brings 21st century education systems to Ghana. The Smart Classroom is available for TVET, Primary-, Secondary- and Higher Education, allowing for smooth integration of teaching and learning at all levels.

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

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, enhance problem-solving based learning as well as competency based education and provides the opportunity to teach and learn designing, programming, engineering and production skills.

Maglev workstation



Primary Education

The hands-on digital programme teaches Maths, Science, Engineering and English language skills to primary school children.

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 provision 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.

This 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 (content and experiment kits) covers 6 STEM learning areas:

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



Secondary Education

The Smart Classroom meets the specific needs of Junior and Senior High Schools in Ghana, in order to improve access, quality, and relevance of the secondary education system. Students are prepared for a career in the sector of their choice and for continuing education, through a blended mix of hardware and software resources.

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.

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.

The Digital Learning Resource Library for secondary education covers 3.000 lessons. The typical STEM ICT-based lab configuration includes the following 12 themes:

- | | |
|---|--|
| <input type="checkbox"/> Architectural technology | <input type="checkbox"/> Mobile robotics |
| <input type="checkbox"/> Construction engineering | <input type="checkbox"/> Mechatronics |
| <input type="checkbox"/> Electronics technology | <input type="checkbox"/> Manufacturing technology |
| <input type="checkbox"/> Energy in buildings | <input type="checkbox"/> Mass transportation |
| <input type="checkbox"/> Engineering design | <input type="checkbox"/> Industrial robotics |
| <input type="checkbox"/> Biomedical technology | <input type="checkbox"/> Transportation technology |





The Smart Classroom can be used for the improvement of Higher Education Science, Technology, Engineering, and Mathematics (STEM) programmes.

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 educational, and training 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

- ☐ Based on maximum 32 students
- ☐ Direct access to Digital Learning Resource Library for lecturers
- ☐ Numerous presentations and background materials

Student exploration and investigation room

- ☐ Based on maximum 32 students
- ☐ 16 workstations with direct access to Digital Learning Resource Library server
- ☐ Practical demo and training units linked to the Digital Learning Resource Library

Example topics for Research, Design & Technology

- ☐ Rapid Prototyping/Industrial Manufacturing,
- ☐ Laser cutting/engraving
- ☐ 3D printing and 3D scanning
- ☐ CNC simulation
- ☐ CNC manufacturing
- ☐ Machine tools
- ☐ Control & Instrumentation
- ☐ Electronics
- ☐ Computer programming
- ☐ Automotive Engineering
- ☐ Mechanical & fluid power



Technical Vocational Education and Training

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 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 (CBT), 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 supports CBT with an emphasis on experiments, investigations and virtual learning, ensuring that teachers and students are better prepared to use practical training equipment.



The TVET Smart Classroom provides a world-class learning facility introducing a unique TVET teaching and learning concept, combining state-of-the-art ICT based technologies and hands-on practical education, making TVET institutes future proof. The TVET Smart Classroom harnesses emerging technologies and fully integrates ICT based learning and best practices in TVET.

The Smart Classroom optimizes the use of the existing equipment at the workshops, through better understanding of engineering subjects, amongst others, through;

- ☐ Presentations
- ☐ Digital lessons
- ☐ Investigations
- ☐ Engineering simulations
- ☐ Virtual experiments
- ☐ Practical exercises
- ☐ Projects and group work

The 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



Smart Classroom workstation examples

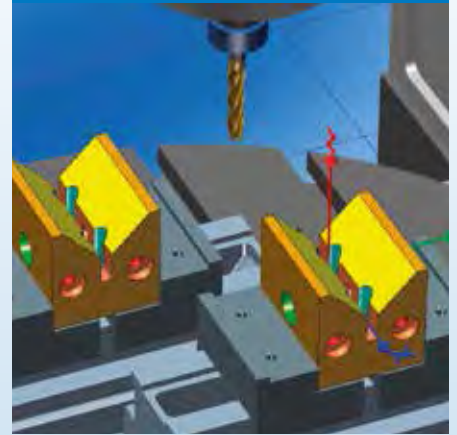
RENEWABLE ENERGY



MACHINE TOOLS & CNC



CNC SIMULATION



MATERIALS & PROCESSES



INDUSTRIAL CONTROLS



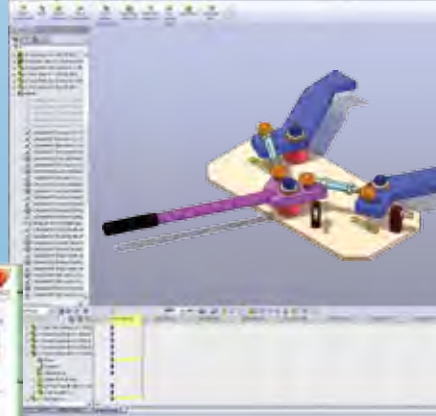
HYDRAULICS



AUTOMOTIVE



2D/3D DESIGN SOFTWARE



PNEUMATICS



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