# Virtual models in the PBL of production automation

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***Abstract*** *— Virtual models and e-learning environments offer great possibilities for training of production automation. In this study we have developed different types of virtual models for teaching production automation and evaluated their suitability for support learning process. It is important to know how different models could support different phases of learning process.*

*In Hame Polytechnic teaching of automation is based on PBL. The amount of lectures is decreasing and practical training is increasing. Web-based interactive exercises are developed also for supporting this progress. Exercises in virtual environments may improve student's abilities to manage in practices with real automation systems. In principle the virtual environments can offer the same challenge as the real system without the pressure caused by the fear of a mistake. Commercial simulators are used to some extent in training of production automation, especially in off-line programming of robots. We are also developing a lighter, software independent simulator with browser interface for the same purpose. There are many e-learning environments developed for PLC-programming. The basic ideas could be studied with interactive web-based exercises and with virtual laboratories. In virtual laboratory applications a student can control real laboratory equipment via web by using remote control methods. The recent web technology offers also handy ways to create browser-compatible graphical interfaces. At the same time the student can see the real system with a web-cam. Virtual processes can offer better possibilities for practising advanced controls. In virtual processes there is no real process; the model of process is running in our server and it can be controlled via web. Simple (but mayby interactive) Flash 2D-animations can be used especially in practice instructions. Large scale 3D-models of production systems support orientation. These kinds of models may used as detailed animations or they can be freely explored as VRML-worlds. With those models a student can understand the role of the single equipment in the whole production system. All models and learning objects are stored in database and individual objects can be connected in several courses.*

*With different models we can improve student's motivation and orientation. With models students can also make experiments which are based on their theoretical knowledge. In some way students can also evaluate and control their learning process. Anyway, usually the main purpose for using virtual models in training of production automation is to improve student's motivation, orientation and understanding. In this case practices with real automation systems are used for utilizing theoretical knowledge in new situations.*

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***Index Terms*** *—e-learning, learning objects, PBL, virtual models .*