MC4VED
Mass Customization
For Vocational Education

MC4VED – Handbook

Cases of Mass Customization in Vocational Education
Ideas, Experiences and Lessons Learned

LEONARDO DA VINCI

Leonardo da Vinci Transfer of Innovation
Project No. DE/09/LLP-LdV/TOI/147 203

BILDUNG FÜR EUROPA
Nationale Agentur beim
Bundesinstitut für Berufsbildung BIBB

GD Bildung und Kultur
Programm für lebenslanges Lernen

Imprint

Leonardo da Vinci Transfer of Innovation Project
"Mass Customization for Vocational Education – MC4VED"
Handbook – Cases of Mass Customization in Vocational Education

Publisher:
Landesakademie für Fortbildung und Personalentwicklung an Schulen
Standort Esslingen
Steinbeisstr. 1, 73730 Esslingen, Germany
www.lehrerfortbildung-bw.de

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Printing & Production:
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First Edition 2011

For orders please contact:
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Steinbeisstr. 1, 73730 Esslingen, Germany
http://lehrerfortbildung-bw.de/lak/es/
Reference: MC4VED Handbook

The project MC4VED (Mass Customization for Vocational Education)
has been funded with support from the European Commission.
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Wolfram Büchel, Alexander Benz (eds.)

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Mass Customization for Vocational Education (MC4VED)
Individualization and Personalization in vocational Education

November 2011

This publication has been funded with support from the European Commission.

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About this Handbook

What is it?

This handbook is intended to provide a short introduction to the ideas and first implementations of Mass Customization (MC) in education. It displays possible applications in vocational or even general education and introduces the readers to the inevitable diversity-efficiency-dilemma of customization. It sheds some light on the ideas behind the industrial concepts of Mass Customization and how the ideas can be transferred to educational organizations to overcome the barriers in handling complexity and cost connected to the individualization of learning.

Its aims are to

- help innovators create and present project ideas;
- clarify or solve matters and questions arising around the Mass Customization idea;
- provide practical information and experiences that may be referred;
- provide guidance on the method and lessons learned on Mass Customization;
- promote the sound and long-term management of an MC project;
- encourage change and transition in relation to the parties and stakeholders involved

by setting out an operational framework for the project.

However this handbook includes also information useful for anyone interested in learning; for him/herself or in general.

Who is it for?

The handbook is for anyone who is involved and interested in personalizing education. It is for the teachers rethinking their methodological approach; for the principals

reorganizing their organizational infrastructure and culture and for the students looking for new ways how to cope with pending challenges.

Whether you are looking for project ideas, lessons learned or if you are trying to avoid common mistakes, this guide will give you some insight into the experiences and findings of four very different educational institutions which all dared to embark on the journey of individualizing education with Mass Customization.

What does it contain?

The goal of this handbook is to introduce the interested audience to the benefits and general idea of individualizing education and why it might be necessary to reorganize educational institutions so they can provide this individualization.

It familiarizes the reader with the ideas, history and background of Mass Customization and the ideas and scientific findings behind the concept.

Furthermore this booklet tells the story of the MC4VED Leonardo da Vinci Transfer of Innovation and displays the four developed pilot cases of implementation at the participating schools with the experiences, findings and lessons learned.

Finally in its last chapter it offers some perspectives and links for further reading, so the readers can follow up and find some more motivation and inspiration to get started with own activities.

Where can you find more information?

If you are interested in further information on the project or any of the presented cases or issues covered in this handbook, please do not hesitate to address the respective contact person or send an email to info@mc4ved.org.

Alternatively you can find more information on the program websites at **www.mc4ved.org** or in the Adam Archives of the EU Leonardo Da Vinci Program.

The MC4VED Story – Origin and History of the Project

Wolfram Büchel, Alexander Benz

Over the past decades the commitment to education and innovation in Europe has steadily grown. Europe needs to strengthen its intellectual capital and its capacity to innovate in order to respond effectively to the challenges of the rising knowledge society and to stay competitive in economic and social terms.

Today, however, nobody knows what kind of toolset will be needed for the future. Therefore, education and learning must, at least in parts, become customized to the needs of the individual learners to prepare and equip them for the complex and rapidly changing challenges.

The endeavor to personalize and customize learning has been a crucial component of EU and OECD's programs for quite some time and originates from the awareness that "one-size-fits-all" approaches to learning are ill-adapted both to the individual learners' needs and to the knowledge society at large.

However, individualization and customization in education faces the traditional dilemma that an increase of diversification inevitably leads to the inevitable decrease of efficiency or increase of cost; a fact that today's educational systems cannot compensate (diversity-efficiency-dilemma). This phenomenon of the efficiency to individualization dilemma is well known and has been addressed in various ways in industry. Customers desire individual high quality services at the price levels of mass-products.

For certain areas and products industry has created a solution to this dilemma with the concept of Mass Customization. It solves the diversity-efficiency-dilemma by enabling enabling customers to tailor services or products to their individual needs. To achieve this result a co-creative interaction process of designing the desired personalized service or product is instated within a predefined solution space. In short: personalized products and services are configured or "pulled" by the customer instead of being "pushed" by the supplier (see the McKinsey Strategy Paper Push2Pull).

But as with all visions and concepts the Mass Customization ideas have to be transferred and tested in the respective learning context to evaluate the potential of the idea. As an outcome of various research, conference talks (e.g. Festo/State Academy Zukunftsforum Lernen in 2007) and sparked by intense discussions and arguments during an MIT Conference on Mass Customization and Personalization in 2007 an EU initiative to transfer, test and evaluate the Mass Customization ideas in the context of vocational education was initiated.

In the following months the State Academy for teacher training Baden-Wuerttemberg in Esslingen-Zell, Germany, gathered, together with the industry partner Festo, a group of organizations for vocational education to discuss, transfer, and evaluate Mass Customization ideas for implementation in vocational education.

A funding application under the European Commission Lifelong Learning Program in the Sub-program Leonardo da Vince Transfer of Innovation was initiated, filed and granted in summer 2009. Accordingly each of the regional partners had to design, implement and evaluate a local pilot project focusing on the individualization of the students learning process and the added competence of teachers as facilitators. Local industries, authorities and communities were to cooperate in creating and applying Mass Customization cases. A coaching-on-demand option was offered to the partners to train teachers as process owners and multipliers of Mass Customization at their local institutions.

To ensure the sustainability and further dissemination of the idea ongoing documentation and communication through the web and social networking was to be initiated. The partner Festo, a multinational company, was to contribute its experience and concepts of Mass Customization in industry embedded with developed scientific insights from a project at the Ludwig-Maximilian-University, Munich. The Dutch partner, Deltion College, Zwolle, was to bring in a network of educational institutions for life-long learning. The Austrian partner, a vocational school in Villach, was to bring in experiences of modularization closely related to the concept of Mass Customization. The Danish partner, Køge Business College, was to contribute excellent skills and know-how in the field of educational psychology, differentiated learning approaches and experiences with international educational projects. The Slovenian partner, the Technical School Centre of Nova Gorica, who was and still is actively participating in the reform processes of the vocational education system in Slovenia, was to provide its multi-level experiences of MC in vocational education. Together with Festo the State Academy for teacher training Baden-Wuerttemberg in Esslingen was to act as the promoter being responsible for teachers' in-service training, academic support and the documentation of results.

To transfer and transform the innovative idea from the partner institution in Germany to the international partners a 5 phase-transfer process was developed. The project design was based on Peter Senge's ideas of The Fifth Discipline: The Art and Practice of the Learning Organization. Accordingly any promising change process should address and adjust or harmonize three fields: developing the common view of aims and necessary changes (Vision) – incorporating a solid theoretical foundation (Theory) and providing the required tools methods and resources (Infrastructure). To address these 3 fields the projects transfer process was split into five phases:

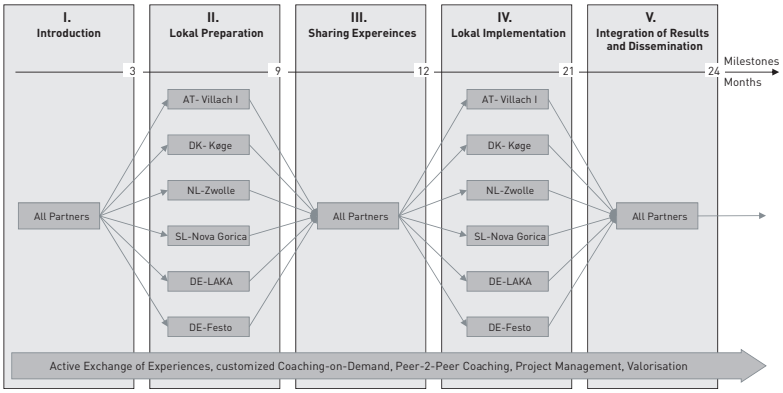


Figure 1: The five Phases of the Leonardo MC4VED Project

Phase 1 of the project started in November 2009 with the initial Workshop at the State Academy in Esslingen-Zell, Germany. For the first time the teams met to form the community and find common ideas, ground and goals. As a result the participants agreed after thorough discussions to test and transfer the well-proven industrial concept of Mass Customization of Products to the educational context to compensate for the cost, structural and organizational challenges connected with individualized and customized education and learning.

To prepare and enable the involved educational organizations the methodological framework, the experiences, tools and lessons learned in industry had to be transferred into the vocational education context to create the possibility to overcome the educational diversity-efficiency dilemma. Concepts and pilot courses were to be designed, implemented and evaluated in the local vocational schools providing success stories and encouragement for future schools to follow.

To initiate the necessary changes which would enable the shift from a "push" to a "pull approach" and to empower the involved stakeholders the partners were introduced to

a wide variety of scientific findings from neuroscience, communication science, educational psychology and systems theory. These findings created a foundation for an efficient, customizable learning process which acknowledges that learning is a highly complex and individual, almost unique process organized only in and by the individual's brain. A process which can neither be directly influenced nor controlled from outside but one that is open to setting co-creatively common goals. Acknowledging this essential milestone of any sustainable learning process a commonly agreed goal provides a stronger motivation of learners and better and longer-lasting learning results.

To introduce the pull-oriented cooperation idea affiliated with the Mass Customization framework the participants had the opportunity to experiences Mass Customization first hand in the production process of the industry partner Festo. For quite some time Festo had implemented MC concepts in certain parts of their production process to combine an incredible number of varieties with a robust and fast production process – allowing Festo to provide individualization and customization for their customers at high speed with still reasonable prices and costs. The implemented customer co-design process for the offered products and services met the needs of the individual customer with regards to certain product features but limited them to a fixed solution space to ensure a stable but also flexible and responsive production processes.

In compliance with the presented scientific findings the partners were encouraged to experience the Mass Customization process by themselves in transferring the newly acquired concepts and methods to their own school contexts. All of the partners draft-

Picture 1: Partners at the Festo Berkheim Plant

ed individual project plans and committed themselves to a co-creatively defined goal which they pursued during the course of the entire project.

In Phase 2 the regional partners prepared a localization of the concept for their own institutions. They identified local context of curricula, drafted possible cases and initiated the necessary changes to provide infrastructure, processes and motivated educators. Pilot cases and classes were selected for the regional MC4VED implementation in phase 4. Special emphasis was put on the communication plan as any Mass Customization initiative can be seen as the start of a new form of communication at the level of teachers, school administration, students and trainees.

Phase 3 was built around the status quo workshop in which the partners shared and discussed first experiences and lessons learned. The fostered exchange of experiences was used to identify common difficulties and to create best ideas and practices to provide for the best possible starting position for local implementation of the concepts. The local implementation happened in phase 4. During this critical phase of the project the local activities were implemented in everyday classes at the vocational schools of the regional partners. To support this implementation the German partners provided "coaching on demand" and individual input for the partners. To review the acceptance and success of the pilots the partners carried out local evaluations and documented the problems and outcomes.

During the final work shop in Phase 5 the partners presented and evaluated the local results. They identified best practice, shared lessons learned and reflected the specifica of regional results considering the nations contexts. As an overall result common denominators for success or failure were to be identified and combined to enable others to further individualize education.

In the closing phase the results, experiences and lessons learned were presented to a wider audience during the MC4VED Final Conference to further disseminate and mainstream the ideas of Mass Customization.

As most readers will not be too familiar with the ideas, history and concepts behind the industrial concepts of Mass Customization and why this concept could be a feasible approach for individualization in education a short introduction to the project idea will be presented next. The following chapter is a summary of an article presented by Dr. Hermann Klinger, Festo AG & Co. KG. and Alexander Benz ,Ludwig-Maximilian-University, Munich, at the MIT Conference for Personalization and Customization at the Massachusetts Institute of Technology in 2007 and published in the Handbook of Research in Mass Customization and Personalization (World Scientific Pub Co; 2010).

Mass Customization for Individualized Life-long Learning: Needs, Design and Implementation

Hermann Klinger; Alexander Benz

For more than 100 years the concept of mass production has been at the core of industrial development. Advantages and disadvantages are obvious: low production costs, high quality of products, and amortization models for high development and marketing efforts, but also highly standardized products with low potential for individualization. Interestingly enough, the first concepts of Mass Customization (MC), aiming at balancing benefits from mass production and individualization appeared in 1899 in France in a picture by Jean Marc Cote.

After management consultants had recognized that not only mass production but also the individual and customized product sold could add to the company profit or even provide a competitive advantage (Joseph Pine II. 1999, 2000; Chris Anderson; 2004), companies had to find concepts to overcome the inherent diversity-efficiency-dilemma associated with customized production: the concept and the oxymoron of Mass Customization was created.

In 2006 Piller thus defined Mass Customization: "Mass Customization (MC) refers to a customer co-design process of products and services which meets the needs of each individual customer with regards to certain product features. All operations are performed within a fixed solution space, characterized by stable but still flexible and responsive processes. As a result, the costs associated with customization allow for a price level that does not imply a switch to an upper market segment." However, MC did not reach the masses until effortless and cheap communication and collaboration tools became available. Interestingly, it was not enough just to have e-mail, as in the 1990s. The key to success was sharing individual experiences, pictures, media, ideas, and emotions within a broad community.

Keywords for this new quality of internet are WEB 2.0 and social computing. Websites like flickr.com, youTube.com, and del.icio.us are representatives for this new type of service and use.

Social computing opened the doors for innovative partnerships between customers and suppliers. More or less Mass Customization, Mass Personalization, and Open Innovation merged into one field, which is now called MC. Supported with configuration tools provided by the supplier; customers are configuring and customizing products to meet their personal needs. Supplier and customer are co-creatively developing and/or enhancing individualized products and services within a framework called solution space. Product specifications, like drawings and lists of parts, are directly transferred into the production process without further costs for marketing and sales. Typical "MC products" are individualized snowboards, wrist watches, shoes, sporting goods, customized bicycles, clothes, and T-shirts (see e.g. www.spreadshirt.com; www.dell.com, www.selve.net; www.mymuesli.com).

Today the concept of MC finds growing acceptance not only in B2C markets, but also in the B2B markets. In various situations suppliers face the diversity challenge that the chance of producing certain systems or components more than once is close to zero. Speaking with Chris Anderson's "The Long Tail" (Anderson 2006), the tail in B2B is sometimes long, very long. Further interesting concepts for other B2B branches, e.g. the plastic industry, can be found in a series of articles on strategic innovations (Plastics Industry 2008).

Growing Need for Education

As globalization has reached the individual the connectivity between education and work has become both an individual and a global issue: Closely linked with reduced costs and transportation risks, communication and knowledge exchange. Nevertheless the ongoing argument in Germany still is to simply raise the quotes for students to go to university from some 30 % to 95 % over the next 5 to 10 years (see Schleicher 2008). A generalizing and blunt demand even though nobody knows what kind of education will be needed then.

Therefore, education for individualized, lifelong learning must at least in parts become configurable by the learner. To keep up with the new process needs to ensure connectivity or, even better, to provide a bidirectional interface between education and work place.

Reflecting these changes, the aim of personalizing learning is becoming increasingly prominent in scientific and policy discussions on the future of education. It is a natural component of the OECD's CERI program on "Schooling for Tomorrow" (Centre for Educational Research and Innovation 2006). Personalizing education springs from the awareness that "one-size-fits-all" approaches to school learning and organization are ill-adapted both to individuals' needs and to the knowledge society at large. …

"personalization" can mean many things and raises profound questions about the purposes and possibilities for education.

Raising the issue of personalization Charles Leadbeater (Leadbeater 2006) concludes in one section: "A mass personalized learning service would be revolutionary. By giving learners a growing voice, their aspirations and ambitions would become central to the way services were organized. At the moment the heart of the system are its institutions and professions – schools and teachers – that lay down what education is and how it should proceed. Studies of performance management across a wide range of organizational fields show that productivity invariably rises when people have a role in setting and thus owning their targets. The same is true for learning."

This implies far-reaching changes in the role of teaching professionals and schools. Schools would become solution-assemblers, helping children to get access to the mix and range of learning resources they need, both virtual and face-to-face. "Schools would have to form networks and federations which share resources and centres of excellence. An individual school in the network would become a gateway to these shared resources …"

Faced with the diversity-efficiency dilemma, private companies applied Mass Customization strategies to add diversity without adding costs. As schools are urged to become more personalized and customer-oriented, they also face this inherent diversity-efficiency dilemma.

Trying to implement MC strategies schools decompose the curriculum into standardized modules, leaving it mainly up to the students to construct their own learning pathways by mixing and matching modules. While modularization itself is nothing new in education, the modularization that schools have to employ crosses the usual organizational boundaries between tracks and year groups, and that is certainly new. However the question remains how to organize and streamline the learning process and how to involve and motivate the learners to take more responsibility for their own learning.

Design Elements for a System of Individualized Lifelong Learning

Following the findings mentioned above the challenge of future education is to deal with increasing dynamics and complexity and to simultaneously handle the diversity-efficiency dilemma. Considering the limited resources it appears promising to focus on the core processes of value creation in learning. To achieve this several promising areas for learning innovation have to be synergetically integrated: Neuroscience, systems theory, logistics, and communication.

Neuroscience

Recent findings in neuroscience indicate that efficient and sustainable learning is a highly individual process, depending on the individual's background, the lessons learned, interests, emotions, attitudes, motivation and more. However there is a common framework humans share in our brain functions and therefore also in learning. It is the interconnected functional structure consisting of the 4 function blocks for perception, memory, evaluation and activation.

As we all know it is not very efficient for example just to try memorizing something. The first hurdle already is to overcome the "evaluation barrier" and to reach the memory at all. The evaluation function of the brain decides mostly unconsciously whether a signal from the outside world, it may be pictures, noises, speech or words, is relevant or not. If not, the signal is not accepted for further processing. There are no dedicated areas for each function in the brain. Each neuron is linked with about 10.000 other neurons; they inhibit or fire, influenced by each other. They are forming ensembles of neurons in a most flexible and dynamic way.

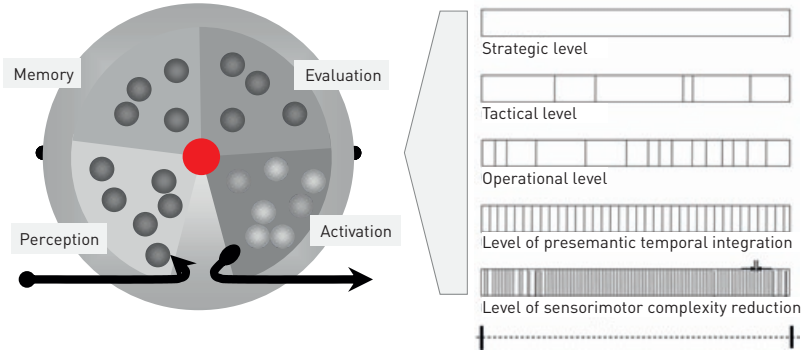


Figure 2: The functional and hierarchical time structure of the brain.

Timing is a very important strategy to structure and coordinate processes (Poeppel 2007). Time windows in the brain can be observed from outside looking into the electromagnetic spectrum transmitted continuously from the brain. Induced emission of radiation or changes in the blood chemistry show other time windows.

Various time windows from about 30 milliseconds, in which the brain synchs all signals to the "now" to the time windows of 2 to 3 seconds for conscious activities form a hierarchical model. As Poeppel points out, the automatic temporal integration of

successive events is provided on the next higher level. To make this happen there must be an anticipatory control mechanism on any higher level. The underlying mechanism is well known as a generalized reafference principle (Holst 1950). This basic principle originating form sensory motor learning states that with any motor control command an internal efference copy with its predicted movement and its resulting sensations is created enabling the brain to estimate the sensory feedback from movements. As a general neuroscientific (learning) principle this prediction of outcomes or the setting of a goal can be seen as a crucial step to any achievement.

According to Poeppel et al. "optimal learning must be embedded in a structure allowing goal orientation or anticipation of what could and should be attained by learning. Without the definition of a goal, the knowledge seeker would be treated as a passive learner neglecting the possibilities of intrinsic motivation provided by the goal, which is the driving force of successful learning and the creation of knowledge."

Systems theory

Heinz von Förster (1988) calls systems which show deterministic input-output relations trivial machines. Non-trivial machines are systems with internal stati, depending, for example, on their previous experiences or learning history. As opposed to trivial machines, non-trivial machines do not display the same output for the same input.

In this sense the human brain as each individual learner is clearly a type of non-trivial machine, and it should be treated as such. We have to take the human brain as a typical example of a "black box". If we see the educational environment as the input the outcome from the learning brain will only be determined by the learners' brain itself. Through the "pull line" only the learner requests a supply of appropriate knowledge and input from the educational environment, a promising argument for a guided self-organization of successful learning scenarios.

Logistics

Industrial experience from complex material flow and production planning (see e.g. Womack 1990), clearly indicate that the complexity of delivering components just-in-time can only be handled with a "pull-type" control mechanism. "Push type" control implies that the flow of material is planned from the past into the future as carefully as possible, and the material flow will follow in reality as planned. Due to the likelihood of unforeseeable events, this type of regime only works as efficiently as anticipated if conditions are sufficiently stable over time. However in complex and unpredictable times "Pull" mechanisms have to organize the flow.

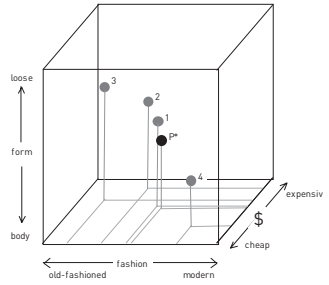
Communities and collaboration

History has shown that human learning is not stable. The developments in social computing, WEB 2.0, open innovation, and crowd sourcing are neologisms based on "co-operation and resonance" as an innate human behavior (Bauer 2007). Best practices, like Wikipedia, Linux, and numerous blogs, are known and used worldwide. To build sustainable communities in media or in learning, all individuals involved must share common visions and goals, trust in the co-creation of value, and are motivated to achieve.

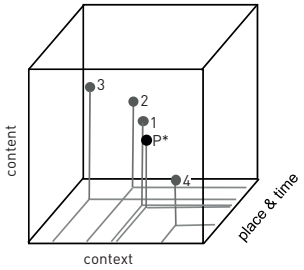
Mass Customization for Education (MC4ED)

All these above mentioned ideas contribute to the concept and feasibility of individualizing education and suggest that the initially presented MC definitions of Piller (Piller 2006) could be a realizable option to handle the diversity-efficiency dilemma for individualized education.

Mass Customization for Education (MC4ED) refers to learner co-designing educational products and services to meet their own individual needs with regard to a 3-dimensional solution space consisting of learning content, learning context, and time and place to learn. Within the solution space offered (Figure 8, building in a conceptualization by Piller 2006), learners are empowered by the providers of education to find their best solutions, configure it in the best way possible, and get it "delivered on demand" and "just-in-time". The pull type learning process is seen as a co-creative and co-operative process between providers of education and learners.



Buying decision dependent from meeting distance to „ideal point"



Learning ability dependent from meeting distance to „ideal point"

Figure 3: Solutions space for clothes in comparison with education.

Initial tests and pilots have shed some light on the feasibility of the approach to apply MC strategies and experiences to an educational framework. All activities were based on the same structural building blocks, processes, and tools. The piloted program consisted of a variety of modules to cover curricula for vocational education, in-house company training, and university-level programs. The learning process was configured to take place in a project-type style manner. To encourage the participants to find their real-life task generic cases typical for the topic taught were presented and the students were encouraged to seek their tasks in their typical context of their own working environment.

Standard structures for case assignment with a description of a starting point and a task to solve were defined. Any changes are documented and are part of the reflection process in following phases

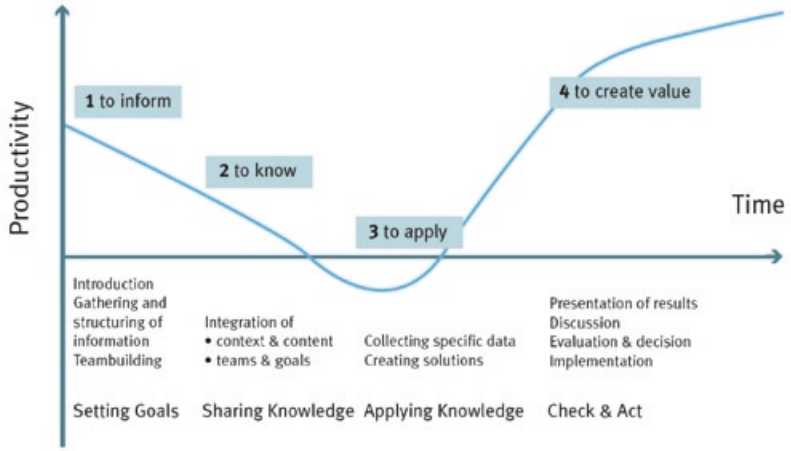


Figure 4: Standardized learning process for MC Learning.

Consistent with findings from neuroscience and systems theory, the learners had to become the process owner of their individual learning processes. Teachers and educators had to become learning facilitators. They enabled the learners to select and configure appropriate cases, assisted in the team

Lessons Learned

Feedback from participating learners of all ages, all educational levels, and various industries and organizations has been very positive. Consistent with the initial assump-

tions from neuroscience and systems theory, it seems that learners are willing and able to select and configure individualized cases, even though the content areas are new to them. However, to actively define tasks and create sustainable motivation for the learner to self-organize the learning steps, milestones, and evaluation criteria have to be rigorously maintained to synchronize the individualized learning process.

And even though some learners had initially "complained" of having spent much more time than they anticipated, they commented in the end that they enjoyed doing so. According to their new role as facilitators and coaches, educators will spend more time on the core process of learning with the individuals and the teams. Additionally a lot of knowledge transfer is shifted to "just in time" and "on demand" processes through peer to peer communication.

To evaluate these pilots of customized education, the innovative paradigm of "output orientation" was consequently used. This is in open contradiction to the more mechanistic traditional philosophy of education – first pre-defined bits of knowledge have to be delivered like components in a parts list to be assembled later for any indeterminate application by the learner himself.

The results of the pilots indicate that learning and applying knowledge are two sides of the same coin. Therefore we should start to change the traditional mindset and paradigms of education on the individual level. To achieve this goal it is clear that the MC approach should be used.

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To validate the ideas and scientific hypothesis connected with the concept of Mass Customization for Education the at hand Leonardo-Da-Vinci Transfer of Innovation project was initiated in 2009 by the Festo AG and the State Academy in Esslingen. Within the vocational different educational organizations from different vocational systems were contacted to test the ideas and feasibility of the ideas on a broader scale.

In the course of the project the partners had the opportunity to create their individual local implementations of the MC ideas within their own organizations. A wide variety of experiences was gained by the partners and numerous lessons learned were created. To document and spread these experiences and lessons learned each partner provided a case description as a summary of his project.

If you have any further questions please do not hesitate to contact the partners. Their addresses and contact persons will be in the credits of each summary.

The MC4VED Case of Deltion College, Zwolle, Netherlands

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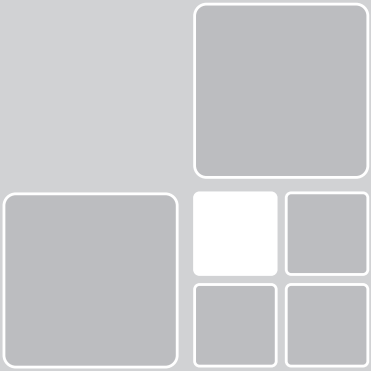


Case Abstract in the Partners Language

Project Mass Customisation levert bijdrage aan ons techniek-onderwijs

Het Internationale samenwerkingsproject Mass Customisation heeft een concrete, studentgerichte, nieuwe en internationaal verankerde begeleidingssystematiek opgeleverd voor het Deltion College. Sinds 2009 zijn een aantal docenten van de opleiding Middenkader Engineering met de richtingen Werktuigbouw, Elektrotechniek betrokken bij het internationale partnerschapsproject Mass Customization for Vocational Education. De nieuwe studentbegeleidingssystematiek, ontwikkeld in Duitsland, wordt inmiddels in het Deltion onderwijs toegepast.

Deze 'learning on demand' methodiek werd ontwikkeld door professor Klinger. Klinger is verbonden aan het van oorsprong Duitse bedrijf Festo AG & CO. KG. Festo deelt wereldwijd al decennia lang haar kennis op het gebied van hydraulische, pneumatische en elektrische aandrijftechniek en bijbehorende besturingstechniek. Binnen de methodiek worden opdrachten voor studenten ontwikkeld, waarin de voordelen van massaproductie gecombineerd worden met de voordelen van maatwerk. Studenten krijgen een opdracht om een technische constructie te maken en krijgen vervolgens in het ontwikkelingsproces keuze uit een aantal maatwerkopties om het eindresultaat te realiseren. Zo krijgen leerlingen de kans om binnen een correct kader eigen keuzes te maken en is het ontwerpproces beheersbaar. Deze werkwijze past prima binnen een modulair onderwijsprogramma zoals Deltion aanbiedt.

Deltion heeft deze methodiek inmiddels al op meerdere vlakken ingevoerd. Binnen de opleiding Technicus Middenkader Engineering kunnen de studenten zich specialiseren in Werktuigbouw, Elektrotechniek, Installatietechniek, Mechatronica of Industrial Design. Volgens het principe van Mass Customization is o.a. het project 'Basic Car' ingevoerd. Dit project laat al deze werkgebieden gedurende de eerste tien weken van de opleiding aan bod komen. Studenten ontwerpen een auto waarin alle vijf genoemde technieken zijn verwerkt. Op deze manier hebben niet alleen studenten en docenten internationale ervaring opgedaan, maar is ook het onderwijs concreet versterkt en is een stevige relatie gelegd binnen het internationale beroepenveld.

Michiel Bilstra,
Sectordirecteur Techniek en Vormgeving, Portefeuillehouder Internationalisering

Description Deltion College and One Pager

Deltion College is a regional education centre active in nearly every discipline offered at senior secondary vocational education level. Our Sprint Lyceum offers fast track courses at pre-university education, senior general secondary vocational education and preparatory secondary vocational education level. We also offer adult courses and are experts in providing company training courses. With a staff of over 1000 employees, Deltion College currently offers its training and education services to 18.000 students and course participants.

Education Our Way

Deltion College encourages students to 'learning by doing' in an actual professional context. Our students learn everything they need to know to be proficient in their chosen profession. By practicing professional skills students develop the competences – a combination of knowledge, skills and attitude – required by their chosen profession, their future employers or a special institution. At Deltion College, this approach is supported by theoretical training, work placements, working groups and practical instruction provided in fully equipped, modern facilities, designed to reflect the actual working environments.

The Deltion MC4VED One-Pager
Defining Project Objectives and Goals

Project name	
Design and implementation of a MC4VED configurator for a mechatronics and mechanical engineering curriculum to improve students motivation and learning outcomes/sustainability	
Project ID / Versions	DE/09/LLP-LdV/TOI/147203
Date	5 November 2009
Problem (measurable)	
Students motivation, high dropout rate, lack of commitment among teachers, Environment and students do not fit the current curriculum.	

Target (measurable)

Reducing dropouts, commitment among teachers, reducing costs,
Increase rate of students leaving the school with a diploma
Increasing involvement of students and companies, re-improvement Deltion curriculum to regain a high standard

Background

We want to develop a new curriculum fitting the students' needs and make the curriculum suitable for the new learning environment.

Milestones / An Evaluation Criteria

Developing two cases, testing these cases and adjusting the cases.
Implementing the cases in the curriculum.
Measuring students' and teachers' satisfaction.
Measuring companies' involvement.

Scope

We want to change the content of the curriculum during the project period.

Follow ups (Scale)

Develop cases and improving the curriculum

Project Start/End November 2009–June 2011

Assumptions

Commitment of two team managers responsible for these courses.

Communication plan

Informing the colleagues in team meetings, presenting progress on Deltion Internet and Intranet, articles in local and regional papers, Link on Deltion webpage to website project

Risks/Threats

Lack of commitment among teachers.

Advantages/Benefits

More students leaving school with a diploma, improvement students' satisfaction, effective educational route, tempo differentiation, recognition of earlier acquired skills and reducing costs.

Project Team (Stakeholders):

Roles/Responsibilities	Names
Project Sponsor*	Leonardo da Vinci
Project Leader*	Herman Hempen, Gert Wagenvoort
User-Representatives*	Students, companies, parents
Team Expert 1 + Tasks	Haico van der Kolk
Team Expert 2 + Tasks	Bart Stomps
Project Coordinator	Herman Zwakenberg

Opening and Description of Problem Situation/Case

In December 2008 three colleagues from Deltion College participated in a preliminary meeting in Nova Gorica in Slovenia to develop a project plan with the transnational partners. At the same time the department of mechatronics had decided to revise the content of their curriculum and modularize the courses. To utilize the ideas and concepts provided in the MC4VED EU-proposal a small team of motivated teachers and administrators was formed to develop cases and create practical tasks more attractive for our students.

During the kick off meeting in Esslingen this team was introduced to the ideas of Mass Customization and accordingly developed the Deltion MC4VED One-Pager.

In the period from December 2009 until July 2010 cases were developed by our team experts according to the Mass Customization approach. Additionally they restructured the content of the curriculum and redesign the curriculum correspondingly. During a coaching-on demand session in March 2010 Dr. Hermann Klinger, the representative of the partner Festo, visited our college to discuss and evaluate our progress. As the preliminary work was already finished and first trials were already running, he was surprised and impressed with what the Deltion MC4VED Team had done so far.

To recruit and convince additional members of the faculty, 15 Colleagues from the department of Mechatronics attended a course for Mass Customization in April 2010 in Esslingen offered by Dr. Klinger and the State Academy. Due to the course the com-

mitment of colleagues to work with the MC cases in the renewed curriculum improved and created the necessary awareness to continue the efforts at Deltion College.

During the second project meeting, which took place at our College in Zwolle in 10 June 2010, our team experts presented and discuss the cases and the first experiences to our partners' colleagues. During the school year 2010-2011 many students worked on these cases. The poster shows the cases and the proud students with their products from the cases. The students were highly satisfied with the new methodology and the content of the cases as it is indicated by the evaluation results below. The students' comments have led to minor adjustments of the content and the delivery of the cases.

Evaluation of the Pilot

The evaluation was offered to 45 students from mechatronics and engineering courses. The results are shown in the questionnaire below:

Organization of the Class	strongly	agree	so-so	disagree	strongly
Course sessions were organized to help me learn efficiently.	29	12	3	0	1
The time structure of the course was well organized.	29	10	6	0	0
The course was well equipped (Handouts, materials and tools).	30	10	5	0	0
Educator and administrative support were available when needed.	26	6	6	4	3
Objectives and goals of the module/ class were discussed with you/ us and were clear to me.	32	3	7	2	1
I did like the class.	36	6	0	2	1

Support/Facilitation during the Course	strongly	agree	so-so	disagree	strongly
The educator was able communicate the importance of the topic/ course for my future professional life.	28	6	7	2	1

The educator adjusted the class to the individual levels of the participants.	38	4	1	2	0
The educator was able to assist in learning and solving the problem at hand.	26	12	5	1	1
The educator was open to other opinions and encouraged alternative approaches for solving the problem.	35	5	3	0	2
The teacher was able to maintain a positive learning environment.	22	17	6	0	0
The teacher was well prepared for classes.	41	4	0	0	0

Methode – MC – Problem-based Learning	strongly	agree	so-so	disagree	strongly
The practical problem-based approach of the course was helpful to understand the topic.	40	3	2	0	0
I enjoyed the self-organized independent work on my individual case/problem.	19	14	5	4	3
I was able/allowed to make mistakes and and was able to learn from them and the mistakes of the others.	22	18	2	1	2
The presented cases were practical and authentic.	38	3	3	0	1
The case work was quite time consuming.	41	3	1	0	0
Working on the case was fun.	42	2	0	0	1
The students were actively involved in the evaluation of the results.	42	2	0	1	0
Participating in this class I learned more than just the content of the course topic (soft-skills, project management, etc.)	21	13	5	3	3
I would like to have more classes/modules taught in this way.	22	14	3	3	3

The following students' remarks were translated from Dutch into English:

I LIKED THIS COURSE BECAUSE ...

- It became our own project. (3 times)
- I could choose my own project partners.
- We got good results
- I could do my own planning

THIS COULD BE IMPROVED ...

- Send teachers to a foreign county more often (serious!)
- More money for building materials
- My project partner did not really participate.
- We would have liked to have more assistance and understanding in workshop.
- During the building process our project was partly demolished while stored in the workshop.
- Give us faster laptops.
- More time to work on the project.
- Next time I will choose other team-mates.

Results and Prospects

Status Quo at the end of the MC4VED project

What did we achieve so far?

First we managed to implement Mass Customization in the entire curriculum by re-arranging the entire curriculum into a modular structure.

Secondly we implemented M.C. into several of these modules. A very important item in this process was the implementation of a configurator.

M.C. was implemented both in Mechanical Engineering and in Mechatronics. Using a modular structure enabled us to be very flexible in providing our students with the education they need:

- Students with prior acquired skills are allowed to skip a module, or only do the test to show that they are competent.
- All the modules are well structured, there is not too much input-information and each module can be completed in a standard period of time.
- The sequence of the several modules can vary; within boundaries the students can choose the module to start with and the one to finish.
- Many modules are implemented in the curriculum of several disciplines. Mechatronics and Mechanical Engineering, for example, do have numerous interfaces.

- Students are able to do their assignments at a time of their convenience and their own pace. And they are able to decrease the duration of their entire education.

The overview of the curriculum is used as the configurator for this process.

Conclusion:

We designed a modular curriculum for all our students (Mass) that easily is adapted to the needs of every individual student. (Customization).

We implemented Mass Customization in several modules and projects (a project contains several modules that are linked/connected).

We named all these projects by the product that is made. This implies that the product is very important, but that is not true! The products are only means to reach the goal. The goal is always knowledge or a skill.

Examples of projects: The Flying Dutchman, the de-stacker, the mover, the basic car, the flame eater.

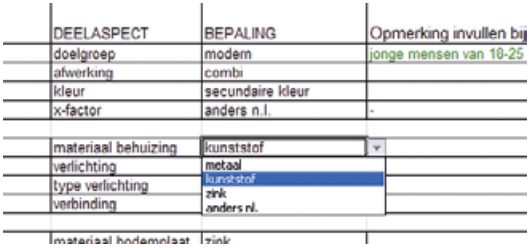
To provide some inside into the created modules the example of the Flying Dutchman is described in more detail. We invented this project to replace the project that we used to run and which was unsatisfying for teachers and students alike.

The module or task was originally a go-cart driven in an alternative way. Alternative means that it is not allowed to use a chain and sprockets …
Our second year mechanical engineering students used to make a product of their own choice including technical drawings, calculations, manual, etc. …

However the problem we encountered with this project was that it was consuming far too much time; mainly because the students needed too much time to reach an agreement on what product to make.

To solve this problem the provided Mass Customization concept seemed a very good solution!

We designed a configurator for a new product, the Flying Dutchman, and gave it a try …



Where does Mass Customization fit in?

The designed configurator is the key element in our Mass Customization concept. It enables us to get our students started with the project directly from the first lesson. And even though the configurator guides them they perceive the decision process to be at their hand and will.

We can use this project and the configurator for all our students (this is the Mass component – contrary to the previous one-on-one help to decide) and all Flying Dutchmen are customized to the wishes (configurators) of the individual students.

To streamline the project we scheduled the Flying Dutchmen project in only half a school year instead of using up an entire school year as before! This made it possible to finish two projects in this school year, both a machining project and a design project.

Obstacles and Problems

Of course we encountered some problems!

We found out that the configurator is very important and should be made with care. Selections had to be planned well, and an abundance of choices disturbed the students.

Without a configurator Mass Customization is hard to implement in class.

Another problem was that the product easily shifted from the means to the goal side. … Our students got enthusiastic very fast and the flying Dutchmen grew bigger and more complicated by the week!

The second year we made included restrictions in the configurator, especially on the size, i.e each Flying Dutchman had to fit through a door and had to be made for a child of approximately 10 years of age.

Example of a Flying Dutchman made last schoolyard:

We also noticed that students tended to over- design, i.e. some of the Flying Dutchmen could easily carry an elephant

In our project "The basic car" we use this car to let students get acquainted to all the different educations we offer in our cluster. In the Basic car project there are elements of Mechanical engineering, mechatronics, electrical installation, mechanical installations and industrial- design.

We used Mass Customization to be able to finish this project in approximately 8 weeks. During this time students got acquainted with the basic skills of all different educational fields.

For students at the age of 15–18 making a "basic car" was a difficult task. Using a configurator helped our students designing and building this basic car.

After the configurator was set the students had the guideline for what their basic car should look like. The configurator worked as a guided project description and determined shape, materials, design, etc..

The biggest advantage of the configurator was the time it saveed our student to discuss what this car should look like, how many wheels it should have, what engine should be used, etc…

Without the configurator and the concept of the solution space we would not have been able to do the basic car project with unexperienced students in such a short time! And even though the concept of Mass Customization was never explained to the students it simply offered them the configurator and guided them to make their choices.

Furthermore it enabled both students and teachers to have a clear overview of both the process and the progress of the project. The ongoing monitoring kept them motivated!

Additionally Mass Customization improved teamwork. Our students planned their activities in the configurator using it to get started and work together. It helped them to actively build teams, reflect on strength but also weaknesses of their team colleagues and forced them to deal with the internal conflicts.

This way our students were offered an education that was highly flexible, and also gave them the opportunity to make several choices that influenced the lessons and the duration of their education. A concept that was carried through the entire program and curriculum and that enabled the good and motivated students to shorten the duration of their education up to one full year.

The MC4VED Case of the Køge Business College, Køge, Denmark

Mona Engberg, Jan Ingemansen, Steen Roar Hillebrecht

Leonardo da Vinci Transfer of Innovation
Project No. DE/09/LLP-LdV/TOI/147 203

Mass Customization
For Vocational Education

Case Abstract in the Partners Language

MC4VED i Køge handler om at overføre erfaringer angående "Mass Customization" fra industrien til uddannelses-sektoren. "Mass Customization" er kort sagt en måde at lave individuelt tilpassede produkter indenfor rammerne af et modulopbygget produktionsapperat.

Centralt for Mass Customization står "pull metoden". Her er det kunden som definerer produktet, hvorefter producenten leverer(i modsætning til "push", hvor man producerer løs i håb om at kunden vil have produktet). Multimediedesign uddannelsen har arbejdet med problemorienteret semesterprojekter siden 2000. I 2007 blev tilgangen i undervisningen justeret for at give de studerende endnu mere erfaring med at etablere deres egen måde at lære ved at kombinere almindelige klasser med korte projekter baseret på fælles temaer.

Dermed har vi fået værdifuld erfaring i "Mass Customized learning". Også i form af at finde vigtige problemer – især når det kommer til internationale studerende.

Vores internationale studerende har ikke samme uddannelsesmæssige baggrund som vores danske studerende, som er vant til at navigere i et program, baseret på en kombination af klasseundervisning og case opgaver, som kræver et stort ansvar for egen læring proces.

I vores del af MC4VED projektet er fokus derfor på en videreudvikling af "Mass Customized learning" for internationale studerende ved at finde måder at hjælpe de studerende med at blive bedre til at søge om hjælp fra lærere, når det er relevant for deres læring.

Vores analyser viste, at:

- de internationale studerende er vant til læring gennem reproduktion og ikke gennem reflektion, analyse og selvstændigt arbejde
- at de internationale studerende hellere undlader at lave noget end at aflevere/fremvise arbejde, som er fejlbehæftet. Dette er meget hæmmende for et projektorienteret læringsmiljø
- de internationale studerende er modvillige til at søge hjælp hos deres undervisere. Hvilket også er hæmmende for læringen i et projektorienteret læringsmiljø.

Som hovedstrategi til at løse ovenstående problemer har vi arbejdet med at udnytte vores internationale studerendes respekt/frygt for autoriteter til at tvinge dem ud i situationer, hvor de oplever at selvstændigt arbejde og stillingtagen betaler sig. Og hvor de oplever undervisere som hjælpere snarere end autoriteter.

I praksis har vi implementeret følgende i vores nuværende 1. semester:

- Showcase som test: Vores studerende arbejder hele tiden med praktiske projekter (multimedie-produktioner). Faktisk når de 20-22 produktioner i løbet af uddannelsen. Hver afsluttes med en showcase, hvor det enkelte gruppe præsenterer deres produkter. Som noget nyt har vi introduceret en rating af produkterne, således at showcases emulerer en egentlig prøve.
- Specifikke opgaveformuleringer: Vi har gjort vores opgave formuleringer mere specifikke, med bl.a. lister over produktkrav. Vores danske studerende kan godt forholde sig til mere løseligt formulerede opgaver, men de internationale paralyseres af frygten for at lave fejl, og føler sig derfor mere trygge desto mere præcist opgaverne er formuleret.
- Indlagte test: Vi har eksperimenteret med at lægger interne prøver i undervisningen. Disse er anvendt til at give de studerende faglig feedback og hjælp. Igen er idéen at bruge deres autoritetstro som basis for at give dem oplevelser af at undervisere er til for deres skyld: ingen straf for dårlige resultater osv.
- Skemalagt vejledning: Danske studerende er i reglen gode til at bede om vejledermøder selv, men de internationale undgår vejledning, hvis de ikke har noget komplet fejlfrit at vise frem. Vi har derfor indført mere planlagt vejledning, hvor de studerende er tvunget til at møde op, og dermed oplever undervisere som hjælpere og konsulenter snarere end autoriteter.
- For at styre nogle af disse processer har vi udviklet software (i en meget foreløbig alpha version), hvor vi kan administrere og disseminere gruppedannelse, projekt bedømmelser m.m.

Evalueringen af projektet indikerer tydeligt, at de ovennævnte tiltag virker. De studerende udviser en større tryghed overfor undervisere og deres motiver. De er mere tilbøjelige til at søge hjælp, og det faglige bundniveau er hævet. Som bonus har vi oplevet, at også de danske studerendes niveau er blevet hævet.

Description Køge Business College

Køge Business College was founded in 1897 and is a well-established institution with close ties to Danish and international business life.

We offer a wide range of educational programmes from business studies on a basic level to further and higher programmes, including programmes for adults. For our customized programmes participants and target groups are e.g. ministries, businesses, local authorities as well as unemployed people. All departments co-operate closely with the business world in designing the programmes, and as a result the programmes reflect the demands of the labour market to a high extent.

Furthermore a wide range of international project activities promoted by the college has given international recognition and a wealth of experience – particularly within modern didactics.

The Køge Business College MC4VED One-Pager
Defining Project Objectives and Goals

Project name	
Mass Customization and Cultural differences	
Project ID / Versions	MCCD
Date	November 5. 2009
Problem (measurable)	
International students at our academy are not as readily equipped to navigate in the Mass Customization model based program in comparison to our Danish students.	
Target (measurable)	
The target is to shorten the time of international student's adaption to the mass customization teaching approach.	
Background	
The international students do not have the same educational background as our Danish Students who are used to navigate in a program based on a combination of class	

teaching and case assignments which requires a great deal of responsibility for one's own learning process.
It is evident from our experience that they can acquire these skills during the first 3 semesters. But they would benefit greatly from an earlier adaption of the "pull" approach as it is reflected on their academic results.

Milestones / An Evaluation Criteria

Nov 2009–April 2010: research phase
April 2010: Preliminary research report
June 2010: Presentation of research findings
June–August 2010: Development of new methods
September 2010: Implementation of developed methods based on research
1. February: Start of evaluation of case implementation
1. April 2011: Evaluation of case implementation
1. August 2011: final report

Scope

The Multimedia-design education at Køge Business College –
International track (with possible derived benefits for the Danish track).

Follow ups (Scale)

Adaption of the evaluated methods will be an integrated part of the international multimedia design program. If possible and relevant we will develop the Danish program as well.

Project Start/End

Learning processes never end. But we refer to the milestones.

Assumptions

We assume that international students are able to adapt to learning based on MC. We assume that a better understanding of the cultural background and derived student strategies will provide ideas for more effective approaches towards this group of students.

Communication plan

1. Introduce project to management group to get endorsement
2. Include colleagues in process by asking for their help and advice
3. Contact external partner by network combined with project description.
4. Communicate plans and results through our homepage and through project share point.
5. If possible publish results in scientific media.

Risks/Threats

1. Loss of focus due to project members main assignments as teachers
2. Lack of support by management and colleagues
3. External partner's different interests (co-ordination)

Advantages/Benefits

- An even stronger and more beneficial program for our international students.
- Better coordination of the Danish and International tracks of the education.
- Decrease the dropout rate.

Project Team (Stakeholders):

Roles/Responsibilities	Names
Project Sponsor*	Jørgen Heramb
Project Leader*	Jan Ingemansen
User-Representatives*	
Provider- Representative*	Steen Hillebrecht
Affected Stakeholders (not participating in the project)	Henrik Bøll Larsen, Henrik Mikkelsen, Stine Dahl, Lars Arnfred, Mike Brandt, Annette Finnsdottir
Team Expert 1 + Tasks	Steen Hillebrecht, Plan and design research, coordinate with partners
Team Expert 2 + Tasks	Jan Ingemansen, Plan and design research, coordinate with partners, development of IT-tools

* regional steering committee

Opening and Description of Problem Situation/Case

Køge Business College has been working with problem oriented semester projects since 2000. In 2007 the approach of teaching was adjusted in order to give the students even more experience with forming their own way of learning by combining ordinary classes with short projects based on common themes.

The pedagogical approach in Køge is based on group work, where the students are solving different problems. Starting with the second semester most projects are done for real clients like companies and organizations. During the fourth semesters of the programme every student participates in 13-16 projects.

Workings with international students (mainly from Asian countries like China, India, Nepal and Bangladesh) unveiled particular problems for a large group of students with this group work-based pedagogical approach.

Due to school systems very different from the Danish the students are not used to navigate in a programme based on a combination of class teaching and case assignments which requires a great deal of responsibility for one's own learning process. These problems are:

- The students have a reproductive approach to their learning. They can reproduce their knowledge but not adapt.
- The students confuse project work with free time with no need for working.
- The students are not able to "pull" knowledge from their supervisors (ask for supervision).
- The students are used to answer isolated questions in tests not to solve complex problems by developing own research strategies.

The aim of the project is to use the nature of the student's challenges in the attempt to raise the professional level of the students.

History and Development of Project

After the initial identification of the problems the project team designed a project with the following steps:

1. Definition of assumptions
   a. We assumed that international students are able to adapt to learning based on MC.
   b. We assumed that a better understanding of the cultural background and derived student strategies would provide ideas for more effective approaches towards this group of students.
   c. We assumed that the international student feared mistakes and associated teachers as respect persons rather than resources.
   d. Their approach is rather subservient than being a client.

2. Research of the character of the problem
   We conducted a number of focus group interviews with students representing the largest groups of students (Chinese and Nepalese). Here we got most of our assumptions confirmed.

3. Development of new pedagogical tools
   a. Practical tools and application – limitation of solution space

b. Specification of requirements and deliveries
   i. using authority to create comfort
   ii. Pushing students through a process and make the experience with the use of tools in the creative process
c. Development of supporting software
   (see http://groups.46hope.dk/index.php?page=projects)
d. Implementing scheduled supervision
e. Students evaluate teachers work
f. Tests as a motivation tool

4. Implementation of the new MC methodology

5. Evaluation of the new approach

Milestones

The milestones where:

- Nov 2009–April 2010: research phase
- April 2010: Preliminary research report
- June: 2010: Presentation of research findings
- June–August 2010: Development of new methods
- September 2010: Implementation of developed methods based on research
- 1. February 2011: Start of evaluation of case implementation
- 1. April 2011: Evaluation of case implementation
- 1. August 2011: final report

Events

The focus of the project has been on internal development of the pedagogic approach. Therefore most events were small internal events supporting the goal of the project. The following events have occurred:

- May 2010: Focus group interviews
- August 2010: Presentation of new tools to colleagues at the academy
- September 2010: Implementation of tools at 1. semester classes (international and Danish Classes).
- December 2010: 1. evaluation of the project
- February 2011: Coaching event

Outcomes

The different activities have been implemented and are now fully integrated in all parts of the multimedia design program.

Results and Prospects

Status Quo

All elements of the project are integrated in the education of multimedia design students (both international students and Danish).

The first version of the supporting software is under further development based on the feedback of teachers and students.

Involvement of Students and Faculty

All students are involved as well as all teachers at the Multimedia design programme. Also the bachelor programme in E-concept development is using the same tools as developed under this project

Experiences and Lessons Learned

When implemented the developed tools and concepts have shown a satisfying effect on the problems identified.

There have been some minor elaborations – mostly on the supporting software.

First results indicated that a stronger focus on individual efforts would be useful. Therefore individual assignments have been implemented with very promising results.

Teachers say:

- The bottom level of project work has been raised.
- Changing of student's scope: less 'what' and more 'how' and 'why'
- The exam results have been raised significantly and the international students are now on par with the Danish students.

The students say:

- Slight improvement of teachers' professional efforts
- Significant improvement of teachers' pedagogical efforts
- Very significant improvement of teachers' abilities to make academic contents comprehensible

- The teachers' abilities to involve practical examples have improved significantly.
- The students consider themselves to participate more actively than before.

Summary

The MC4VED project has made a significant raise of the bottom level of our students possible.

The teachers have become important tools for developing student projects supporting the pedagogical objectives. They have become tools for better following up on the single student and student's group and better tools for evaluation.

For the Køge business academy the project has been an important improvement which has strengthened the profile of the school.

Outlook for your project and the Idea

The Køge Business Academy will continue the development of the pedagogical approach supported by the results of the MC4VED project.

The teachers continuously develop the project assignments based on the experience of the MC4VED project and the supporting software will be advanced.

Our results are disseminated to the rest of the academy. Although the approach has been designed very specific for the didactics of the multimedia design programme a transfer to other programmes is of course possible.

The supporting software on the other hand opens possibilities for programmes based on project work. Therefor we expect it to be implemented in other programmes in the future.

The MC4VED Case of Fachberufsschule Villach 1, Villach, Austria

Werner Walter, Brigitte Velikogne, Nadine Bucher, Andrea Fanzott

Leonardo da Vinci Transfer of Innovation
Project No. DE/09/LLP-LdV/TOI/147 203

Mass Customization
For Vocational Education

Case Abstract in the Partners Language

Mass Customization ist ein in der Industrie bereits eingeführtes System, in dem aufgrund von Komponentenzusammenführung eine große Vielfalt von individualisierten Produkten entsteht.

Weitläufig bekannt sind die Systeme in der Autoindustrie, wo der Käufer durch das Zusammenstellen seiner persönlichen Wünsche(aus einem vorgegebenen Pool), sein „Auto" erwirbt. Dieses in der Industrie entwickelte System soll nun über das System der Schulbildung gestürzt werden.

Grundidee

Der Schüler ist im Supermarkt und sucht sich seine Produkte (Bedürfnisse) selbst aus, im Wissen, dass die im Projekt vorkommenden Arbeitsbereiche von ihm erwartet werden und – gemäß der Gesetzeslage – überprüft werden.

Der Lehrer wird zum COACH, er leitet mit Fragen, Tipps und eventuell SOLL-BRUCH-Stellen, um Problempunkte aufzuzeigen und hilft mit theoretischen Hilfestellungen und Inputs weiter.

In der Idee des MC4VED wird davon ausgegangen, dass Wünsche und Bedürfnisse (NEEDS) der entscheidende Punkt für den erfolgreichen Abschluss eines Projektes sind. Es ist jedoch allgemein bekannt, dass Wünsche und Bedürfnisse auf der einen Seite unbegrenzt sind und auf der anderen Seite auch geweckt werden müssen. Das Leben (beruflich wie auch sozial) setzt Grenzen und Erfordernisse. Um dem gerecht zu werden, soll durch einen Generator(CONFIGURATOR, in unserem Fall-„PULL-POOL") die Möglichkeiten beschränkt und geleitet werden.

Unsere IDEEN für das PROJEKT

Nach längerer Überlegung haben wir uns dazu entschlossene, eine neue „Unterrichtsform" für unsere Bürokaufleute ab dem Schuljahr 2010/2011 (1. Klasse) einzuführen. Damit sich die Schülerlnnen eingewöhnen können, wird die Lehrzeiterweiterung im 1. Semester stattfinden (zwei Schultage hintereinander).

Grundidee

Offener Unterricht mit einem Konfigurator, dem PULL-POOL, dieser beinhaltet Lernmaterialien (eventuell unterteilt in MUSS-, SOLL und ZUSATZ-Aufgaben), allgemeine themenbezogene Informationen, Zusatzinformationen via Internet, Schülereingaben, Lehrer-Workshops zu Schwerpunkten, Spezialistenvorträge, Lernzielvorgaben zur Selbstkontrolle.

Cases

Ein Arbeitsauftrag beinhaltet mehrere Gegenstände, jedoch nicht immer zwingend alle Gegenstände! Der Lernstoff der Unterrichtsgegenstände soll immer wieder neu „gemischt" werden, um vernetztes Denken zu fördern. Eine Kombination aus Lernfeldern und Fallstudien ist das gewünschte Ziel.

Arbeitsumgebung

- Eine große Klasse mit verschließbaren Kästen (um die Materialien wegschließen zu können, wenn an anderen Schultagen andere Schüler den Raum benutzen)
- pro zwei Schülerlnnen ein PC mit Head-Set, Internetanschluss und Möglichkeit zur Disc-Nutzung
- Flip-Chart und Medienkoffer
- Lehrer-PC mit Beamer und Internetanschluss
- PC-Tische im Randbereich; Arbeitsbereich im Mittelteil; eventuell Sitzecke für Selbststudium
- Freie Gestaltungsmöglichkeit im Bereich Farben, Blumen, Musik …

Description Fachberufsschule Villach 1 and One Pager

About 1000 trainees are visiting the vocational school in Villach. The school system is based on the dual system, that means that the education takes place in two different places – the companies (4/5 of the time) and in the school (1/5 of the time). The vocational school will supplement the skills of the students with result oriented instruction and promoting the independence of the pupils. The strong high practical orientation strengthens the apprentices to act in vocational situations with professional, personal

and social responsibility. A goal of the school is also to take place in international projects to get another point of view and open the school for new ways of teaching and learning. "One can lose its work, but not its occupation"

The MC4VED One-Pager from Fachberufsschule Villach 1
Defining Project Objectives and Goals

Project name

Designing and implementing individualized learning targets, methods and progress schedules in office clerk classes, to encourage students to be self-learning and self-actualizing.

Project ID / Versions 1

Date 5 November 2009

Problem (measurable)

Lack of students' motivation, curriculum and students' job experiences don't match, lack of commitment among teachers, process of examination.

Target (measurable)

Increasing involvement of students and companies,
using individualized learning targets.

Background

We want to maximize motivation, initiative and creativity of students and teachers and want to encourage students to be self-learning and self-actualizing.

Milestones / An Evaluation Criteria

Nov. 2009–Feb. 2010: adapting classes for the new way of teaching/learning, informing and convincing teachers / companies of MC-methods collecting data out of the curriculum to develop different case assignments
March 2010–May 2010: developing of two case assignments
June 2010: presentation of the progress discussing the cases
June 2010–August 2010: developing two further case assignments
Sept. 2010: implementation of developed case assignments
Sept. 2010–Feb. 2011: testing and adjusting the case assignments
March 2011–???: evaluation of the case assignments

Scope

1st class of the office clerks in the Fachberufsschule1 in Villach in autumn 2010.
If the project is satisfactory for students, teachers and companies, we will also implement MC-learning in higher classes.

Follow ups (Scale)

Developing case assignments for different occupation groups
– developing and changing the curriculum

Project Start/End November 2009–June 2011

Assumptions

The combination of class learning and case assignments requires a great deal of responsibility for one's own learning process. As we assume, that the new form of individualized learning will be accepted by students, teachers and companies as well, MC-learning will lead to better results in the vocational education.

Communication plan

Reporting, working groups, homepage, take in other teachers as advisor

Risks/Threats

- acceptance through employers
- acceptance through teachers
- acceptance through responsible persons for school education

Advantages/Benefits

- for students: act on one's own, presentation skills, process-oriented organization, training on personalized tasks;
- for school: reputation, motivated teachers and students
- for companies: competent problem-solvers as co-worker;

Project Team (Stakeholders):

Roles/Responsibilities	Names	Time
Project Sponsor*	Leonardo da Vinci	[h/week]
Project Leader*	Walter Werner	[h/week]
User-Repräsentativem*	Students, companies	[h/ week]
Provider- Representative*	Walter Werner	[h/ week]
Affected Stakeholders (not participating in the project)		[h/ week]
Team Expert 1 + Tasks	Nadine Bucher	[8/ week]
Team Expert 2 + Tasks	Brigitte Velikogne	[8/ week]
Team Expert 3 + Tasks	Andrea Fanzott	[8/ week]
Coordinator	Walter Werner	[1/ week]
Team Expert 4 + Tasks		[h/ week]

* regional steering committee

Opening and Description of Problem Situation/Case

In Austria the training for apprentices takes place at two different learning places:
- at the training enterprise (80%)
- at the vocational school (20%).

This vocational education is called "The Dual System". The attendance of the vocational school is compulsory for all apprentices.
The vocational school should supplement
- the operational training
- the specialized theoretical knowledge
- the general knowledge
- the practical training.

In this kind of education Austria has a long history. Our dual system is a very well working system. But time, education and students are changing. So we want to provide our students with skills that will help them during their professional life, which now includes lifelong learning and private, self-organized studies. This project gives us a possibility to open new ways of learning.

objectives:
- self-content young adults who don't hesitate to ask questions and demand answers
- promote and demand expertise and strengthen personalities
- internationality not only for university studies but also for standard apprenticeships
- new possibilities of teaching and coaching
- meet the students in their real way of life and learning
- an efficient partnership between the students, the teacher's team and working surroundings in everyday life

How do we want to achieve these objectives?
- Shared and standardized preparation-work among the teachers involved
- More time for the individual needs of students;
- Implement a controlled "pull-pool" for the students for their studies;
- Research other systems in other countries;
- Learn from our project partners;

History and Development of the Project

To begin with ...
at our school we have the tradition of finding new ways of education, trying out different ideas for the benefit of our students and teachers. Our students have changed but the traditional school system hasn't which means that rather problems cannot be avoided. We don't want to think about history, but about future developments. Where can we "fetch" our students, where are their strengths? Some say, you can't motivate people, you only can demotivate them – so what do we have to do for NOT demotivating our students?

Before starting to implement cases ...
we were working hard on our project, sometimes with a lot of fun, sometimes with a lot of frustration, because there were a lot of pitfalls in the realization, sometimes with situations you didn not expect to occur!

Our first step was the information of our colleagues. We designed a leaflet about the start-up in Germany, about the idea of MC and also about our point of view to this kind of teaching/coaching. Some of our colleagues liked the idea at once; some were sceptic about the outcomes.
After a lot of discussions I think we did find a way, which could work properly for our students and teachers. Since our students are not used to work on their own, to plan their time and work, we had to lead them to the new system. Normally the apprenticeships take three years. We will start slowly with the new system:

- First year: 40 % of open learning and MC4VED, the rest the traditional system;
- Second year: 65 % of open learning and MC4VED, the rest the traditional system;
- Third year: 90 % of open learning and MC4VED, the rest the traditional system;

First we had the idea of a laptop-class with wireless internet to be free of the rather stolid school-net, but this created a lot of new problems such as:

- We can't force our students to have private laptops;
- We don't want to be "laptops-doctors";
- How do we handle the situation with broken-down laptops and missing data?

Then we had a meeting with the IT-specialist of the Carinthian "Landesschulrat". Because of his experience with different types of internet- and IT-based tuition he had some very good ideas for the implementation of our project.We have now established

a classroom with 4 standard computers, a printer and internet for the students (it looks somehow like a small internet-café in the classroom) and another computer with projector for the facilitator which is the new tole of teacher/coach. Our students are allowed to use their own laptops, but everything has to be stored in "open workspace", i.e. their work at the school computers or on their private computers.

Our "pull-pool" is also established in open workspace, so our students have the possibility to do their work on either computer systems. We also have special boxes with written and illustrated material, learning-games, brochures, books, dictionaries, because we don't want our students to work only via internet, because in today's education social and interactive skills are extremely important.

At the moment we are working on two worksheets. They are based on the MC4VED-system. The students get a problem/task to solve; when they need help they can use the "pull-pool". This pool is loaded by the teachers. The "working-task" is situated in the surrounding, which works well with the curricula and includes different subjects of the school year...

Our Tasks and Experiences during the Project

We started with 2 cases:

First case: **START-UP CASE**

Second case: **Initiation of a purchasing contract**

Since these cases are already known and documented on the internet-platform, we want to present here another one:

"Just an ordinary day at work"

A new case:

"Just an ordinary day at work"

WORKLOAD:

The manager of the company has scheduled a meeting because of the start-up of a new colleague from Brighton. To make her welcome they have to organize a traditional English breakfast.

"Just an ordinary day at work"

Each department has to present their work in general but also within the new project.

.... what to do with the bill?
.... how to start the calculation?
.... different taxes .....
.... new ideas about transportation incl. costs and packaging;

"Just an ordinary day at work"

Our aims with this case:

- Organisation of office-life
- Presentation of the own company (German and English)
- Personal presentation (German and English)
- Handling and controlling of a bill
- A small calculation for the copier
- Handling of a document for the accountancy
- Working with different currencies and rates of taxation;
- "mail-merge"-function for letters to clients (German and English)
- Conditions of delivery and payment – INCOTERMS;

Results and Prospects

After the first term we had an informal meeting to discuss our results and monitoring of our class where we are trying to do MC4 VED.

Our aim for the first year was to do about 40% in the new system. We will top this aim, but in another fashion as planned. Our coaching-team is working well. We discuss a lot, often just a short exchange of information between the lessons. Especially in the curriculum of the 1st year, there are a lot of data contents you can't link in a professional way.

Since we do have the possibility to work in rather a free way within our given borders, we have started to do the other contents in form of small "workloads". We don't change the subjects anymore, but we do for example 4 hours of "office organization" in one afternoon – so the students can work properly and self-organized on their workloads and the next day we do a different subject. So at the end of the year, all our "duties" will be done– and hopefully better successful than in the old system.

At the moment we are following three different routes:

- Small workloads, done within 1 or 2 days, self-organized, the students have to find and evaluate the information, assimilate the information to the workload and present the outcomes.
- Some bigger workloads including a couple of different subjects, also self-organized, the students have to find and evaluate the information, assimilate the information to the workload and present the outcomes.
- Forsome other parts we didn't find a better solution, we are doing the "old way". But our students like these parts too, as they told us. They wouldn't like to work on their own the whole time.

We found out, that the project-class should be rather a small group (max. 18 persons) with students who are very interested, enthusiastic and willing to work. At the beginning you must work very hard to get a socially high skilled group, i.e. with a lot of social intervention to get them to know each othrer. A change of the working surroundings – from a classroom to an open space room – is necessary.

Everything worked perfectly until the examinations started. Then our students found out that doing workloads in teams does not match with the old structured exams.

Summary

Point of view – STUDENTS – BENEFITS

(evaluation of 12 interviews)
MORE FREEDOM – MORE CONFIDENCE – MORE SELF-ORGANISATION – MORE GRIT TO ASK AND TO DEMAND – ADDED VALUE OF THE ANSWERS (teacher's input is then, when needed) – AMENDED INTERCOURSE WITH TEACHERS (they are coaches now)

Point of view – TEACHERS – BENEFITS

(evaluation of 3 interviews)
INTERDISCIPLINARY WORKING – MORE DISCUSSIONS INBETWEEN THE TEACHERS – NEW FORM OF TEACHING ALSO IN OTHER CLASSES – "COURAGE TO GAPS" IN KNOWLEDGE – MORE CHANCES TO BRING FORWARD AND TO DEMAND – AMENDED INTERCOURSE WITH STUDENTS (they are partners now) – MORE "BEING UP-TO-DATE" – MORE CONTACTS WITH COMPANIES

All together we can tell now:

The project has been a chance and a big change within our school in regard of colleagues, students, equipments und attitudes. We have now a view "in the future" and we have stopped thinking about problems but about solutions. Teamwork is not anymore a slogan, we are doing it now. Everyone tries to give his/her best – failures are a possibility to learn and nothing to be ashamed of! A project like this can't be ordered, it has to grow within the teaching staff and within everyone.

Our new ideals will work on, even when the project is closed and we are working on our own. We will implement our knowing also in other professional educations and we want to become "market-leader" within the vocational school system of Carinthia.

Dissemination and Valorization

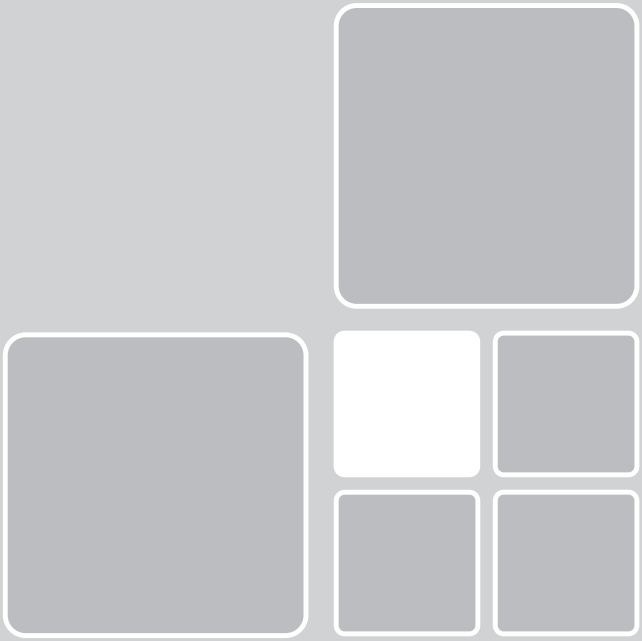
- Several project presentation in front of colleagues, school headmasters of Carinthia and also at other vocational schools in Carinthia;
- Presentation in the context of a seminar in front of teachers throughout Austria
- Presentation and discussion about the new idea and implementation at the vocational school in Villach throughout an international conference of headmasters from Italy, German, Switzerland and Austria;
- Presentation at the Ministry for Education by students and one teacher for a group of principals and administrative staff responsible for teacher training in Austria;
- Because of a lot of PR we will get a new branch in Villach (Automobil-Berater)
- There is a progression project happening (Netherlands – Austria – exchange of teachers);
- Our students are working as multiplicators in their companies;
- More teachers are interested in the new ways of teaching;
- It's easier for our headmaster to find "helping hands" for his new ideas;
- Several rooms are now renovated and adapted to this kind of coaching;

The MC4VED Case of the Technical School Center Nova Gorica, Slovenia

Primož Šteckar

Leonardo da Vinci Transfer of Innovation
Project No. DE/09/LLP-LdV/TOI/147 203

Mass Customization
For Vocational Education



Case Abstract in the Partners Language

Na Tehniškem šolskem centru Nova Gorica že dobro desetletje delujemo na področju projektnega dela. Bogate izkušnje inovativnih in kreativnih zasnov ter realizacije pripomore k pozitivni delovni klimi in doseganju vidnih rezultatov na področju učenja in poučevanja.

V projektu MC4VED smo si zadali nalogo pripraviti take učne vsebine (učne situacije, projektno in raziskovalno delo ter zaključne in diplomske naloge), ki omogočajo učencem večjo možnost samostojne izbire in dela, hkrati pa od njih zahteva večjo odgovornost za lasten učni proces. Usmerjanje in podpora učiteljev in mentorjev je v tem procesu ključnega pomena ravno tako kot priprava in dostopnost ustreznih gradiv kot pomoč pri učenju.

Nadaljni koraki so vsekakor usmerjeni k pripravi vsebin v rednem izobraževanju, ki bodo omogočali učencm pridobivanje znanj, in samostojnim delom ter iskanjem lastnih rešitev, analizo in samorefleksijo. Vloga učitelja preide iz predavatelja in posredovalca vsebin v usmerjevalca in spodbujevalca ter predvsem moderatorja inovativnega in kreativnega učnega procesa tako posameznika kot skupine (razreda).

V Slovenskem izobraževalnem prostoru že nekaj let govorimo o uvedbi modularnega sistema, v praksi pa še vedno ni zaživel. Vzroke za to lahko iščemo v načinu organizacije pouka, določenih poklicnih standardih, načinu poučevanja ter načinu in vrsti sodelovanja izobraževalnih institucij z delodajalci.

Priprava in oblikovanje učnih sklopov, učnih situacij in izvedba projektnih nalog.

Smernice dela (okvir) – učenci lahko izbirajo med različnimi ponujenimi možnostmi v okviru danega kurikula, pri čemer je vloga učitelja kot mentorja in usmerjevalca. Učenci tako samostojno in pod mentorstvom učitelja načrtujejo, izvedejo in zaključijo (predstavitev, demonstracija, zagovor) svoje delo Pri tem procesu je pomembno oblikovati take podlage, ki omogočajo učenje skozi poskuse in napake in ne zgolj teoretične in praktične podlage, pri katerih so učenci pasivni poslušalci in reproducenti podane snovi. Iskanje lastnih pogledov in rešitev je za večino udeležencev velik izziv in motivacija tako za učitelje kot učence.

Medpredmetna povezava (priprava več učiteljev).

Pripravljena in testirana gradiva ter sama izvedba so pokazali pravilno usmeritev pri čemer pa je potrebno poudariti veliko in ključno vlogo pripravljalcev gradiv (učiteljev), kar pa vzame veliko več časa in truda kot za klasične tradicionalne učne priprave. Tudi v šolskem sistemu postaja individualizacija študija vse pomembnejša. Vse več je različnih izobraževalnih modelov in različic programov, tako učitelji kot učenci pa za svoje potrebe v vse večji meri pričakujejo specifične rešitve.

Individualizacija študija pa postavlja organizacije (šole) pred nove izzive saj ob stalni zahtevi po zagotavljanju operativne učinkovitosti in pravočasnosti izvedbe povečuje kompleksnost delovanja organizacije. Pri tem je pomembna organizacija pouka, načrtovanje zasedenosti učilnic, predavalnic in delavnic ter usklajevanja tako teoretičnih kot praktičnih predmetov z delovno prakso pri delodajalcih.

S takšnim konceptom je omogočeno doseganje večje konkurenčnosti in predvsem prilagodljivosti programov gospodarskemu okolju, ki potrebuje usposobljene in marljive zaposlene z ustreznimi znanji, veščinami in spretnostmi.

Pri tem je ključnega pomena razvoj, izvedba, trženje in distribucija takih storitev (izobraževalnih programov), ki z zadostno mero raznolikosti in individualizacije nudijo posamezniku tisto kar ga zanima in išče.

Informacijsko podprta konfiguracija proizvoda

Konfiguracija produkta – v našem primeru učnih situacij, predmtov in modulov predstavlja proces pretvorbe zahtev poklicnih standardov in kurikulov v dokumentacijo potrebno za izdelavo ustreznga izdelka, storitve ali izvršitve določene naloge v izobraževalnem procesu (npr. od ideje, skice, kosovnice, tehnološkega postopka, tehnične risbe do izdelave).

Gre torej za opis celotnega postopka oblikovanja produkta (izdelka ali storitve) vključno s ceno in dobavnimi pogoji (komercialna konfiguracija) ter pretvorbo tega opisa v operativna navodila za izdelavo načrtovanega produkta (tehnična konfiguracija). Uporaba IKT omogoča večjo preglednost in pravočasno odkrivanje možnih napak.

Razvoj produktov na osnovi skupne platforme

Skupna platforma za določen program, modul ali skupino omogoča učinkovit, pregleden in uspešen razvoj in izbiro produktov.

Izraz platforma se nanaša na različne značilnosti produkta – osnovne sestavne dele, kriterije evalvacije in procese skiupne vsem produktom, ki jih želimo razviti.
Določiti je torej potrebno katere produkte (projektno delo, učne situacije, diplomska dela...) želimo razvijati, katerim skupinam jih bomo ponudili (poklicna, srednja, višja pola) in v čem se bodo ti produkti razlikovali med seboj.

Evalvacija procesa:
Ob koncu projekta izvedena evalvacija projektnih aktivnosti kaže na ustrezno zasnovane korake dela. Učitelji usmerjeno izvajajo izobraževalni proces in pripravljajo ustrezna gradiva in učne pripomočke, ki omogočajo kvalitetejšo izvedbo pouka.
Učenci so bolj motivirani sam lahko v okviru ponujenih rešitev najdejo svojo lastno rešitev, pri čemer učitelj spremlja njihovo delo in jih usmerja.

Osnova za nemoteno delovanje sistema je vsekakor postavitev minimalnih standardov, ki jih mora doseči posameznik za dosego predpisanih ciljev.

V samem procesu so integrirani kazalniki evalvacije tako da lahko vsak posameznik že med samim procesom sam spremlja stopnjo doseganja pričakovanih rezultatov.

Description Technical School Centre Nova Gorica

The Technical School Centre Nova Gorica is among the six biggest technical centres in Slovenia. We are focused on technical programmes in the field of mechanical engineering, computer science and informatics, electronics and energetic, wood processing and design, agriculture and horticulture, health & care, traffic and logistics. In the last years the centre was a national pilot for developing and implementing some new educational programmes like automotive servicing. We also offer a wide variety of programmes for adults and employees.

After finishing those courses our participants pass the exams and get a National Vocational Qualification as an approval of their knowledge, skills and competences. All these activities strongly depend on the knowledge and experiences of our teaching staff which is improved by in-service training and exchange with partners in other European countries.

The Nova Gorica MC4VED One-Pager
Defining Project Objectives and Goals

Project name

Utilize MC4VED concept and tools to initiate and manage changes in VET in SLO

Project ID / Versions	UMCT
Date	9th November 2009

Problem (measurable)

Students' motivation, especially in vocational programs. Low students' employability rate after finishing school. Adapting to the changes – implementing new and renovated programs in a modular way.

Target (measurable)

Reduce dropouts and increase the rate of students finishing school with a diploma. Raise the commitment of teachers engaging themselves in different development projects. Tighten the cooperation between school and companies in the region and improve the quality of the students' practical work in the companies. Engage the companies to cooperate in preparing the educational and practical training.

Background

We want to integrate the MC4VED concept and methodology in the process of implementing new and renovated VET programs in Slovenia.

Milestones / An Evaluation Criteria

Nov 2009–April 2010: Research phase to develop case assessments.
April–June 2010: Test of implementing the cases within the curriculum.
June – August 2010: Development of new methods and case assessments – evaluation.
September 2010–April 2011 – Implement developed case assessments and shape them into the curriculum evaluation – involve the companies.
1. August 2011: final report

Scope

Implementing the MC concept and methodology in programs of Mechatronics, Electrotechnics and Entrepreneurship at the Technical School Centre of Nova Gorica.

Follow ups (Scale)

Adaption of the evaluated methods will be an integrated part of the above mentioned programs. If possible and relevant we will develop the Slovenian program as well.

Project Start/End	November 2009–June 2011

Assumptions

We assume that our students in vocational programs are able to adopt to learning based on the MC concept. We expect that better motivation of the students and commitment of the teachers will provide ideas for effective approaches towards better learning processes (development and implementation of assigned cases).

Communication plan

1. Introduce the project to the management group to get endorsement.
2. Include colleagues in the process and activate their commitment.
3. Contact external partners via network combined with project description.
4. Communicate plans and results through our homepage and through project share point.
5. Publish results in local media.
6. If possible publish results in scientific media.

Risks/Threats

1. Destruction of one part of our workshops due to build new Intercompany Training Centre with new laboratories and workshops (some of the involved teachers will have to move their workshops and so the educational process will be disturbed);
2. Loss of focus due to project members' different assignments as teachers;
3. Lack of support by management and colleagues;
4. External partners' different interests (co-ordination)

Advantages/Benefits

- Developed modules and programs including MC concept and methodology raise the motivation of teachers and students
- Clearer option to recognize students' different skills and competences
- Better cooperation and integration between VET and technical programs, modules and companies needs (preparation of training programs)
- Decrease the dropout rate

Opening and Description of Problem Situation/Case

At our Technical Centre and other VET schools in Slovenia we are trying to change more systematically the traditional teacher-centered teaching and learning with more self-motivated and self-directed approach. MC is just the right concept to achieve those goals. Implementing this concept means more dedicated work of teachers and

mentors as well as students' work – gathering more skills and competences needed for professional and everyday life situations.

There is still a big gap between the market and companies' demands for working skills and competences and the school system of pedagogically based education. There is still a lot of work to do to organize more practical oriented and supported educational processes at school and in company's environment, in order to achieve the educational goal of having more skilled, competent, motivated and effective workers.

Some of the VET programmes and professions within the society seem to lose potential and interest of students to join, but there is a big demand on the market for some of those professions and masters – for example joiners, builders, mechanics, …

To meet this demand it is a challenge for providers of VET programmes to implement the MC concept with the idea of individualized learning on demand – customized learning – in regular and special courses of rare VET programmes and professions.

The project idea was to involve dedicated teachers to prepare quality materials and lessons via project based work to engage and motivate students to prepare their project work and solve individual problem situations.

History and Development of Project

Steps:

- Identify the needs and interest of teachers and students
- Define the field of work – mechatronics, woodworking, entrepreneurship, mechanics and ICT
- Prepare, test and implement cases
- Implement project work activities

Milestones

- Nov 2009–April 2010: Research phase of developing case assessments.
- April–June 2010: Test phase of implementing the cases within the current curriculum.
- June–August 2010: Develop new methods and case assessments.

- September 2010–April 2011 – Implement developed case assessments and shape them into the curriculum evaluation – involve the companies.

Events

- Round Table Association of maintainers of Slovenia, Festo and TSC Nova Gorica 16. 09. 2009 (Mechatronic elements and systems)
- Festo expotainer 14. 10. 2009 – promotion of mechatronics
- SLO skills on TSC Nova Gorica 21-22. 01. 2010 – competition in various different professional fields
- iTime – Enterprise Accelerator (Microsoft and other partners) 18. 05. 2011
- Coaching on demand 06th and 07th of July 2010
- Euro skills (Lisbon Portugal) – 12. 12. 2010 one group of mechatronics and one group of informatics

Results and Prospects

Status Quo

Renovate and adapt curriculums in Mechatronics, Woodworking, Logistics and ICT.
Prepare learning materials for students' project work and supportive material for teachers to prepare learning situations.
Build teacher teams responsible for planning, testing, evaluating and implementing new ideas, projects and materials.
Implement ICT management system for class work (schedule of classes and grading system).
Define a modular system to be implemented and evaluated in the school year of 2011/2012 at three schools: Mechanical and mechatronics, Logistics and Woodworking.

Involvement of Students and Faculty

Within project activities 56 students were involved: 16 from mechatronics, 16 from ICT, 12 from woodworking, and 12 from Higher Vocational School engaged in the elective subject Learning Company

Schools involved:

- Vocational and secondary Technical Mechanical and Mechatronics School
- Vocational and secondary Technical Woodworking School
- Vocational and secondary Electro technical and ICT School

- Higher Vocational School: Mechatronics, Informatics and Management of Countryside and Landscape

Experiences and Lessons Learned

- Our general approach was to combine the variety of national and international projects that are running at our Centre. The MC concept suited our development strategy very well.
- Student and teacher feedback confirmed that.

The results of the evaluation are shown below:

Organization of the Class	strongly	agree	so-so	disagree	strongly
Course sessions were organized to help me learn efficiently.	31	2	6	0	0
Classes were well organized and structured	31	29	3	0	0
Objective of the module/class was discussed with me and were clear.	31	26	6	0	0
Handouts and materials were helpfull and well prepared.	42	20	2	0	0
Teacher and administrative support were available when needed.	45	19	0	0	0
Class was sufficiently equipped concerning material and tools.	23	13	15	0	0
I did like the class.	39	23	2	0	0

Role and functions of the teacher	strongly	agree	so-so	disagree	strongly
The teacher was able to communicate the importance of the topic for the job.	40	19	5	0	0
The teacher was open to other opinions and encouraged alternative approaches for solving the problem.	38	21	5	0	0
The teacher seemed well prepared for classes.	41	18	5	0	0
The teacher adjusted the class to the individual levels of the participants.	37	21	6	0	0

The teachers stimulated my interest in the subject and facilitated self-related learning and problem solving.	35	20	9	0	0
The teacher was able to maintain a positive learning atmosphere and environment during the course.	36	23	5	0	0

Methode – MC – Problem-based Learning	strongly	agree	so-so	disagree	strongly
The class setup required active participation.	39	22	3	0	0
The specific educational approach of the class (customization/ individualization/ problem-based) was discussed with the class	41	23	0	0	0
In this class I had the opportunity to introduce own ideas and work on problems in the framework of the class subject.	34	23	7	0	0
The problem-based practical approach was helpful to develop the relevance of the topic for myself.	34	23	7	0	0
The work atmosphere was positive and encouraging.	42	18	4	0	0
I profited from the self-organized independent work on my own case.	36	20	8	0	0
Teamwork, discussion and reflection of the problem in class added to thorough understanding of the class topic.	39	22	3	0	0
I was able/allowed to make my own mistakes and was able to learn from them and the mistakes of others	38	23	3	0	0
Participating in this class enhanced my soft-skills (team skills, conflict management, communication, etc.)	31	23	10	0	0

Class Topic – case-specific	strongly	agree	so-so	disagree	strongly
The presented cases were practical and authentic.	32	24	8	0	0
The case work was quite time consuming.	42	19	3	0	0
Working on the case was fun.	35	24	5	0	0
The students were actively involved in the evaluation of the results	38	23	3	0	0
I would like to have more classes/modules taught in this way.	46	16	2	0	0

The following students' remarks were, if necessary translated from Slovenian into English:

I LIKED THIS COURSE ...

- because of the idea and the concept.
- because of creating/generating responisbilty for my own education.
- because I like the concept of learning things I want and I'm interested in.
- because of the demanding and challenging cases for individual and cooperative work.
- because this approach motivated me to discover things by myself.

THIS COULD BE IMPROVED BY ...

- using that kind of concept also with other content, subjects and programs.
- more cooperation with companies.

The feedback of the four teachers was generally very positive.

The following teachers' remarks were, if necessary, translated from Slovenian into English:

I LIKED THIS COURSE BECAUSE OF ...

- the enthusiasm and motivation of the students.
- the students' willingness to cooperate.

THIS COURSE COULD BE IMPROVED BY ...

- giving the students even more flexibility
- better synchronization with the curriculum, and cross-curriculum cooperation.

Our Centre intends to play an important role in the field of technical education and training. Therefore well-equipped workshops, dedicated and professional teachers as well as motivated students and adult learners are crucial to achieve this goal. Individualized learning approach and solving particular and specific problems are core elements to be successful, and the MC concept offers efficient ways to achieve this. The integration of the concept into activities within classes will remain our goal also in the future.

Regarding the present economic situation the cooperation between schools and companies should be tighter. By integrating the MC concept we tried to find the best way for the students to get appropriate skills and competences necessary for their profession and life. Our energy will remain focused on activities within the Intercompany Training Centre as a reference point for vocational, technical and professional development of students and learners in the region.

Summary

MC4VED perfectly matched with our timing. We managed to combine and connect the content and activities with other projects that are running at our school: Munus2 (Implementation of new and renovated programs in VET schools), crea-CIT (creative and innovative learning environment). One result is starting to implement the MC concept into the curriculum of Mechatronics and Woodworking.

During some phases of project activities we expected more support and cooperation from the principals, but due to the present situation at the Centre (preparing documentation for new buildings connected with organization of all activities related to this) we had to find our own way.

At the beginning we planned tighter cooperation with companies but due to the present economic and social situation (a large number of people in the region lost their jobs) our actions were not as fruitful as expected. Nevertheless some of our students found their own way to cooperate with the companies in terms of organizing their practical work and doing their project work (improvements or even innovations).

Based on the teachers' and students' feedback we realize that through the MC concept our educational (teaching – learning) efforts are on the right track; so we decide to continue with supportive MC-oriented activities.

Dissemination and Valorization

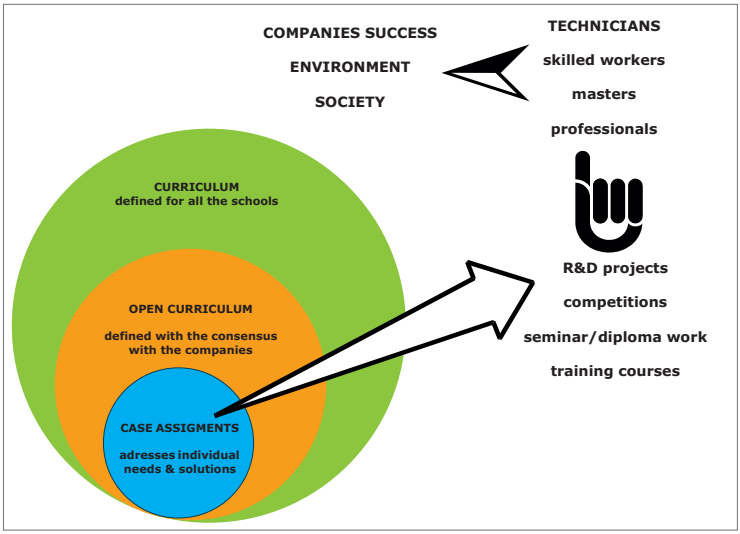
The MC-strategy and methodology was disseminated to the director of the Centre, the head of the Intercompany Training Centre, the principal of the Higher Vocational School, the principal of the Mechanical, Logistic and Woodworking school, 9 teachers together with their classes from the different vocational fields of Mechatronics, Mechanics, ICT, Woodworking, Entrepreneurship, Management of Countryside and Landscape.

Administration was carried out by three secretaries from the involved schools and one from the Intercompany Training Centre responsible for national and international projects.

- People further in further internal activities
  4 teachers of practical training in the workshops at our Centre.

- Communication and Contacts to external interested people
  (other principals, networks for school developments, national agencies)
  Principals from 6 other Vocational Centres in Slovenia
  Slovenian Association of Maintainers
  Centre for Vocational Training in Slovenia
  Cmepius – Centre of the Republic of Slovenia for Mobility and
  European Educational and Training Programmes
- Contacts to political and press agencies

Outlook for your project and the Idea



Our goal was to implement the MC concept to a wide range of programmes at our Centre due to the integration of different professional and general subjects. To achieve this goal, we focused on improving prepared material and lessons on improving motivation and dedication of students to research for the required information to accomplish their individual or group tasks and goals.

The involvement of teachers and students in different promotional actions, research projects and competitions was another way of realizing our project idea.

For the future we plan to implement the MC concept in other curriculum programs and modules as well as involve new teachers by encouraging them to work in their classes and lessons on the bases of the MC concept.

MC4VED: Development, Conclusions and Perspective

In November 2009 the Leonardo-Da-Vinci Transfer of Innovation Project Mass Customization for Vocational Education (MC4VED) started for many of the participants with an informative but also puzzling opening workshop in Esslingen, Germany. Guided by the intention to inquire about new possibilities to solve the diversity-efficiency dilemma for education the partners committed themselves to embark on a quest which questioned many of their traditional beliefs.

Now at the end of the two year project period a significant number of changes and results can be observed even though final results and the future developments can only be predicted.

Starting with the opening conference in November 2009 it seems that the initial insecurity and suspense about the ideas and project plans have transformed into goal-oriented self-administered activities of the involved educators.

The opening workshop was designed to create awareness for the diversity-efficiency dilemma and to introduce the participants to the concept of Mass Customization. After an initial hesitation and uncertainty the partners began to create ideas on how they could transfer the presented industry approach to their own educational context and what kind of obstacles they might face.

As the project itself was designed to facilitate a Mass Customization experience for the participants, they were given the task to define their own projects with goals and objectives within the solution space "finding promising application options of Mass Customization within their regional systems". These ideas were designed around a one-pager project description some of which you have previously seen in the partner cases.

To structure the program and to safeguard a successful project the partners agreed on a milestone plan and further elaborated on the phases and work plan, i.e. define tasks

within each project phase, set the next workshop dates, schedule periodic reporting according to project contracts and decide on the requirements and documents for the interim report.

MC4VED - DE/09/LLP-LdV/TOI/147203

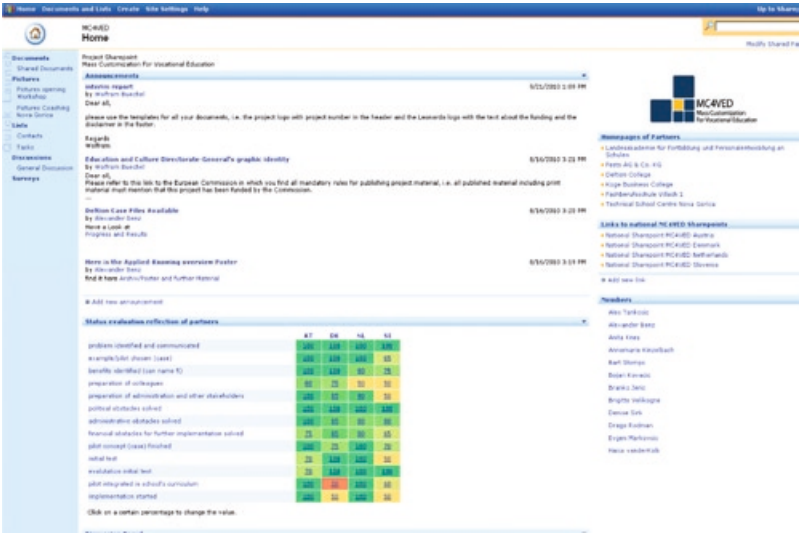
This project has been funded with support from the European Commission.

Project Plan

		days		2009 Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept.	Nov
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	22	17
Phase 1	WP 1	88	WS 1 Kick-off - initialization + scientific consultation + evaluation		03.-06.																							
Phase 2	WP 2	94	Local preparation, Identify cases+ coaching on demand						CoD Zwolle	report																		
Phase 3	WP 3	81	WS 2 Sharing of lessons (Zwolle) + evaluation + coaching on demand										CoD Nova Gorica															
Phase 4	WP 4	157	Local impl.+ eval. + coaching on demand									07.-11.			report		CoD Villa			CoDK ege			09.-10 Laka					
Phase 5	WP 5	75	WS 3, pres. / validation of cases (Villach) + evaluation																				16.-18.					
	WP 6	72	WS 4, Closing Conference + evaluation + prep. Of final report																								22. Laka steering gr.	Closing conf.
	WP 7	49	Management, dissemination & exploitation																									final report
	WP 8	61	Consortium Management																									final report
Total		677			Kick off																							Conference Esslingen, Final report
					Esslingen							Zwolle	Nova Gorica		interim report		Villach			Koge			Villach				

Figure 5: Work Plan for the Leonardo MC4VED Project

Furthermore the communication processes and strategies of the regional partners were discussed and a common collaboration platform for the exchange of ideas and files was presented.



Picture 2: The MC4VED Sharepoint set up to facilitate ongoing exchange of experiences

After the workshop the partner teams returned to their home schools and started their work by spreading the ideas and preparing their cases for implementation. Over 6 months the teams worked on their projects, recruited new team members and multiplied the ideas in their organizations.

When they met again during the second Workshop in Zwolle the partners were eager to present their progress and share the lessons learned. They presented their developed cases and exchanged their experiences with the various activities and interactions they had encountered. They discussed the obstacles that appeared during the process and shared their individual ways of overcoming and tackling them.

All partners reported different surprising and unexpected positive incidents. The regional public authority in charge for teachers' in-service training at the Landesakademie Esslingen e.g. reported that they intended to offer regularly trainings at the academy focusing the method of customized learning in vocational education. The colleagues from Deltion College, Zwolle, told about the unexpected high involvement and inspiration of the fellow teachers after they had overcome "some initial hesitations" during a Festo visit. The Fachberufsschule Villach1 indicated that they received positive and encouraging feedbacks from the University of Education, Linz, from the colleagues of the conference of principals in Villach as well as from their dual partners in the logistics branch. The School Center in Nova Gorica reported that they had been able to reorganize a variety of their internal processes and that they were in contact with the authorities to connect the ideas to a national innovation project. To support communication the school had even produced a video on learning situations.

The colleagues from Køge Business College informed that they were confident that their project of an interdisciplinary program to foster the "pull-approach" will be implemented for a three year project. Corresponding recognition in a number of Danish press media channels would be already on its way.

The hosting partner Deltion College was even able to present a set of material which was prepared for their new mc-fit courses and curriculum. Furthermore they reported that not only almost all teachers in the department were involved in the project but that the head of the department had already ruled that considerable parts of the curricula should be remodeled according to the new ideas.

Most of the partners had at that time stated to communicate and disseminate their project status on their college web page and in local newspaper articles.
To support the regional communication and dissemination tasks and to intensify the feeling of togetherness in the project the MC4VED Logo which had been designed by students of the Danish partner at Køge Business College was introduced.

MC4VED
Mass Customization
For Vocational Education

Picture 3: Logo MC4VED designs in an MC-Logo-contest at Køge Business College

In addition to the MC4VED logo the MC4VED project website (http://www.mc4ved.org/) went live and made information online accessible for the public.

Picture 4: MC4VED Website at www.mc4ved.org

All partners analyzed, discussed and evaluated their current status and visualized their status in a graph.

During the following phase the partners implemented their pilot projects and started an internal evaluation process to follow up on the developments. This critical phase of the project was supported by coaching on-demand offered by the partners Festo and State Academy. All partners which requested the coaching on-demand support at one time in the project emphasized the importance of the interim feedback and one-on-one discussion with an external expert.

The evaluation of the pilots took place after the practical class work via feedback from and interviews with the involved teaching staff and through the students' feedback via a questionnaire.

Figure 6: Example of a MC4VED Dynamic SWOT

The different experiences and findings were presented and consolidated during a last workshop in Villach in May 2011. Experiences were discussed and participating students were heard. Additionally the Slovenian students presented some of their projects and demonstrated the products of their assignments.

In a last session all partners evaluated their own projects and reflected on difficulties and opportunities with a "dynamic SWOT" analysis linking and connecting strength weaknesses with opportunities and threats (see summaries in the annex).

During the following discussions the partners collected their lessons learned and summarized their experiences with the project.

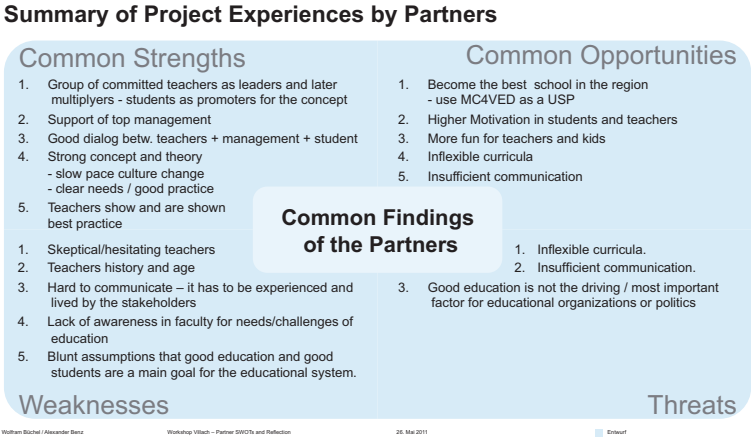


Figure 7: Summary of the final discussions – feedback for the MC4VED project

To disseminate the findings the aggregated results were presented on the final conference at the State Academy in Esslingen in November in which the partners made their experiences with MC4VED available for a wider audience (see posters of the partner in Annex). After an opening keynote by a representative of the Daimler AG the partner presented and discussed their projects with the participants of the conference. In intense discussions and arguments they inquired about the viability of the concept and the differences to existing approaches to individualize learning. Much interest was expressed and a variety of ideas for further MC implementations was generated.

As a closing summary of the project it can be stated that the tested concept of Mass Customization provided for all partners involved a holistic approach to redesign proc-

esses and materials and to foster new mind sets and roles of teachers and learners. However, to apply and transfer the lessons learned in industry and to personalize education without additional financial resources personal commitment and organizational efforts are needed.

The concept has been transferred to the class level of vocational schools in 4 EU countries. The documented lessons learned and resulting classroom material can and should be used for further valorization, dissemination and exploitation.

And even though the project was initiated to test and evaluate the benefits of a mass customized approach for personalized education in a pilot setting much more was created. As you have seen in the summaries of the partners the ideas and concepts will be spread in the organizations and hopefully beyond.

To provide support common attributes of successful projects in mass customizing educational services and case studies and business cases of the four international partners were collected and provide an important resource to successfully mainstream interested organizations.

The Mass Customization approach is much more than a pedagogical tool or method. It is rather the mindset for a reform of the entire educational system including ideas like student orientation, shifting roles of educators or the reorganization of the knowledge flow from push to pull.

To support this more general notion of the "system reform" of departments, schools, a region, a state, or even a country – specific questions on how to influence and manage whole system reforms have to be addressed. Which approach, what is the right starting point, or "are going to get the best results in reasonable time frames" are common obstacles and may find solutions in this process.

This project with its highly diverse partners, educational contexts and starting points provided a unique opportunity to contribute new insight to an educational system reform. Until today an array of interventions within each given contexts has been tested. Taking into account the current status quo, the workshops and final report it seems that with time a set of criteria will become visible.

Nevertheless considering all statements and comments of the participants it is quite clear that all successful projects, until now, are defined by a combinations of motivated and committed leaders/teams managing a small number of critical factors that come together to create the chemistry of an almost viral improvement process.

It might be premature to determine too much at this stage but drawing from recent studies (e.g. McKinsey 2010 – How the world's most improved school systems keep getting better) it can be expected that clusters of interventions can be identified and unique paths in each type of context will be uncovered. That way we will see what it takes to stimulate and maintain system change.

All partners are looking forward to continue the created multilateral cooperation in a less formal manner. They are eager to present and continue their projects even though they will no longer be funded by the EU. The forged community of schools and educators has experienced the power of common goals and open interactions and they all are sure they will find ways and means to continue their efforts and contribute to Mass Customization in education.

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The process of implementing Mass Customization in Vocational Education

Comments from another perspective –
an external evaluator's summary
by Annemarie Kinzelbach

Being the evaluator of the "Leonardo da Vinci Transfer of Innovation Project MC4VED" I participated in three of the project's workshops, followed the project-website and attended the dissemination and final conference of the project.
During the workshops I was able to observe the crucial steps of the process to transfer Mass Customization into vocational education, to see how results were developed and presented and how these results inspired the other partners.

As the external evaluator I remainded a neutral observer. Each partner had to develop a specific design which tackled the particular local problems and fitted into the respective school system and culture. These processes were made transparent through the partners' presentations and through the co-creative exchange of views during the workshops. Only few of the steps and processes could be observed by following the project-website or the newly set specific sharepoint collaboration platform.

During the kick-off meeting in November 2009 it became clear that the structure and success of this opening workshop was crucial to develop the local project goals and to inspire the involved teacher teams of the concepts and benefits connected to the Mass Customization ideas. The schedule which combined workshop phases at the State Academy in Esslingen with the authentic immersion of the teams in mass customized industrial production at the site of Festo in Berkheim, Germany, made the participants aware of how Mass Customization was working in industry, fostered the formation of a common understanding of the concept, and provided ideas how it could be introduced into educational settings.

The extensive but necessary discussions between teams and experts made clear that the partners were coming from very different organizational as well as pedagogical starting positions and that besides the vaguely stated goal to optimize teaching the individual goals and visions were diverging.

The discussions during this first workshop already suggested what later was established: differences are no obstacles; they help to advance the project and broaden the perspectives.

As a result a differentiated (mass-customized) approach to the innovation and transfer-process was necessary. First, creative or better destructive confusion was caused by introducing Mass Customization as an educational methodology, as a tested concept for change in academic education and as a working principle in industry.

In this initial state of uncertainty partners claimed that they had already implemented structures similar to the MC-concept to solve their particular problems; other partners could not see how to transfer the innovative principles into their traditional school systems.

Some even considered their chances to follow the suggested process rather skeptically; it seemed that the mentioned objections tended to stick and were hard to overrule. The group discussion about what MC-terms could mean or could be transfered to in the respective educational environment helped to clarify and transform definitions and concepts. However, many obstacles and limitations within the system were immediately named.

A second (on demand) input session on theory and naming tools for the MC-process combined with the introduction of the idea of case-assignment already tested in academic education enhanced the partners' confidence and understanding of the MC-basics. The first task for the participating partners was to create and present a first draft of a project "one-pager", which helped to identify the outlines for each project by defining fundamentals, such as problems, targets and milestones.

The active collaboration idea of a share-point had been established from the very beginning of the transfer of innovation project with the idea to provide a dedicated platform for communication, collaboration and storage. Between workshops and meetings partners were encouraged to describe the development of their projects, to exchange their views on obstacles encountered and to document problems solved as lessons learned. This approach, however, to provide transparency of "lessons learned" proved to be only partly feasible. Besides the obstacle that a culture of admitting mistakes openly was not fully introduced the problem might also be bound to the age of some of the teachers who, mostly, preferred direct personal communication. A next generation of teachers used to spending much more time online and in clouds might also be better prepared to make use of such means of online-communication; though, perhaps, the means might be different from a project-connected platform.

The second workshop at the Deltion-College in Zwolle, Netherlands, provided an unexpected contrast to the traditional learning with open and flexible architecture of the school-buildings and the accompanying number of ongoing innovative projects at the school.

Analyzing the discussions and communications the advantages of a second workshop only half a year after the kick-off became visible on several levels: 1) Team or project spirit as well as bilateral cooperation and mutual support of the partners was enhanced; 2) Sharing of experiences motivated and inspired the partners to tackle problems encountered; 3) Differences in the understanding of the MC-concept became visible, were discussed and a common understanding of most terms was achieved.

The third and last workshop at the Vocational School of Villach introduced the partners to a different education system, the "Dual System", and to the task on how to implement change in a rather traditional environment.

The presentations of concepts and first results during this workshop revealed to me as the observer that during the rather long interval between the workshops (approx. one year) experiences and lessons-learned had been exchanged on a bilateral team to team level, and by seeking support from the industrial partner and scientific counselor. The rather personal interaction between the partners apparently worked very well. During the workshop the Austrian and the Slovenian teacher-teams were supported by their students – and a presentation of the students' projects and experiences enriched the discussion by a rather personal student-driven evaluation. A general inclusion of the student's view as a further method to measure the success of MC-induced changes in teaching was already designed by the Danish team. Such an evaluation by students was also planned by the Dutch team. The team in Villach obviously felt prepared to start dissemination because they had invited heads of other Vocational schools in Austria to participate in the workshop.

Dissemination and a presentation of ongoing dissemination-processes was the goal of the final conference at the State Academy in Esslingen. The excellent preparation for this conference allowed for a very concise presentation of each project and its specific character and effects. The vivid discussions during the market-place-interval and at the end of the conference made clear that the guests had been actively engaged and had been enabled to grasp the core-qualities of the MC-induced changes in education. Many guests seemed to profit from an interpersonal exchange of experiences and valued the lessons-learned. Such exchange was driven by dedicated stakeholders:

The teachers involved were convinced that the MC-implementation-process had led to sustainable changes in their approach to teaching and that they were able to

persuade and motivate other teachers as well. The heads of the involved vocational schools stated that dissemination to other schools was not just initiated, but that further implementation was already on the way. Students from four nations underlined the success-stories of their teachers.

Considering the diversity of the education-culture in the European states involved in this transfer-project, and observing the divergence of the individual goals of the partners the described success of the implementation-process implies to consider this project as a pilot for further implementation of innovation in education.

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