



MASS CUSTOMIZATION AND PERSONALIZATION IN EDUCATION AND TRAINING

Speaker:

© Robert J. Freund
Finkenweg 6
D-35099 Burgwald
Germany

Tel: ++49 6451 71290

Fax: ++49 6451 71291

E-Mail: info@personalisiertes-lernen.de
www.personalisiertes-lernen.de

Abstract

A decade of industrial experience has shown how mass customization has been used. In this article, some of the factors influencing the use of this business paradigm are discussed and it is argued that mass customization and personalization can help to overcome the efficiency-paradox of developing and delivering education and that the customer is the major limiting factor at the final frontier of mass customization in education market. There is a demand for customized education products in a mass market. With the emerge of mass customization, the added value of customization may now be manufactured with no or only little extra cost. This paper shows, how to gain competitive advantages in education markets. Until now mass customization have mainly been turned towards the product, whereas this paper argues that there might be a need for an increased focus on the fulfilment of customer needs. It makes sense to take personality differences into account when designing an education system. For example Howard Gardner's research has defined 8 or 9 human intelligences and Joyce Martin turned Howard Gardner's theory of multiple intelligences into user-friendly tools. Her work provides a complete system for examining staff needs, matching applicants to jobs, and supervising and training effectively. The author's proposed approach to mass customization in education and training is based on the organisational strategy of Mass Customization and Personalization and Howard Gardner's multiple intelligence theory.

Keywords: Mass Customization, E-Learning, Multiple Intelligence Theory, Intellectual Capital

1. Mass Customization

The idea of mass customization is based on the observation that there is a customer interest in products that are adapted to his/her individual needs and preferences, since the adaptation will increase perceived performance. As the standard of living has increased in the last 50 years, individualization has received increased focus, since customization has come within reach of the average consumer. At the same time there has been a massive development of technologies taking place.

In this environment customers have the power to demand individually tailored products that are specifically designed and manufactured to suit their needs. Recognising the customer as a major factor in the successful exploitation of mass customization is the basis of this paper. Moreover, the increasing competition also puts pressure on other important variables such as costs and services.

An organisational strategy to meet these customers' needs, and therefore gain competitive advantages, is known as mass customization. The concept of mass customization was first identified in "Future shock" by Toffler (1971) and was later described in "Future perfect" by Davis (1987).

Stan Davis, who coined the phrase in 1987, refers to mass customization when "the same large number of customers can be reached as in mass markets of the industrial economy, and simultaneously they can be treated individually as in the customized markets of pre-industrial economies" (Davis 1987). In order to address the implementation issues of mass customization, Tseng and Jiao (2001) provide a working definition of mass customization that is very useful. *The objective of mass customization is "to deliver goods and services that meet individual customers' needs with near mass production efficiency"* (Tseng/Piller 2003).

Doing so, mass customization is performed on four levels (Figure 1). While the differentiation level of mass customization is based on the additional utility (value) customers gain from a product or service that corresponds better to their needs, the cost level demands that this can be done at total costs that will not lead to such a price increase that the customization process implies a switch of market segments (Piller 2003).

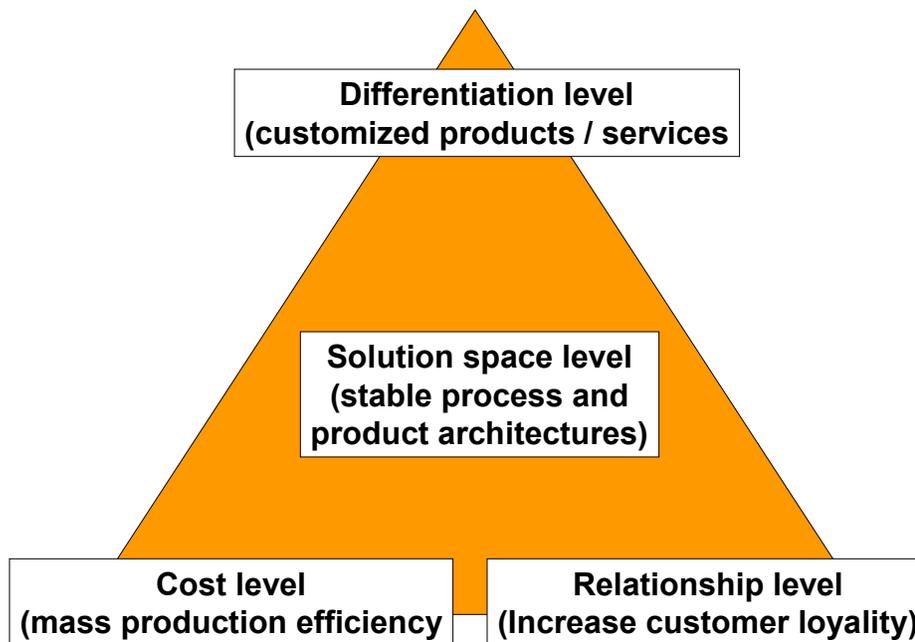


Figure 1: The four levels of mass customization (Piller 2003)

The information collected in the course of individualization serves to build up a lasting individual relationship with each customer and, thus, to increase customer loyalty (relationship level). While the first three levels have a customer centric perspective, a fourth level takes an internal view and relates to the fulfilment system of a mass customizing firm: Mass customization operations are performed in a fixed solution space that represents “the pre-existing capability and degrees of freedom built into a given manufacturer’s production system” (von Hippel 2001).

Every industry is undergoing a fundamental shift. No longer do they focus on producing standardized products or services for homogeneous markets. These firms have thrown away the old paradigm of Mass Production, whose focus was efficiency through stability and control. Their world is no longer stable, cannot be controlled, and therefore their operations cannot be kept efficient in the old way. Through the application of technology and new management methods, they have found their flexibility and quick responsiveness. This is the controlling focus of the new paradigm, mass customization (Pine 1993).

2. Education and Training

The educational model in use today in high schools was actually designed in 1892. To put this another way, while the real world has changed a lot in that last hundred years, the subject matter has not changed at all. Education should be about preparation for living in today's world. That should mean gaining job skills, personal skills, and mental skills. [...] The question is less a matter of subject matter than it is one of method (Shank 2002).

“ ... we transformed education into mass production at around the time we invented mass production of industrial goods. Perhaps at the time, it was sufficient to learn the three “Rs” in order to lead a useful life, perhaps it was just the mass number of people that had to pass through the educational mill. In any case, when we democratized learning, we lost something as well as gained quite a lot. ... The problem is that we now require more than basics in order to function in society. The jobs are more intellectually challenging, and the terrain is shifting too rapidly. You won't work in the same job for a lifetime almost no matter what you do. ... We have the technologies to expedite individuality again. The real question is whether we can transform the teaching environment from factory work to tutoring. That is a complicated social and personal issue.” (Lippman 2002)

In the new paradigm, learning should be individualized, localized, and globalized with aims to create unlimited opportunities for students' life long learning and for development of their contextualized *multiple intelligence* (CMI). *Student is the centre of education*. Students' learning should be facilitated to meet their needs and personal characteristics, and develop their potentials particularly CMI in an optimal way. Students can be self-motivated and self-learning with appropriate guidance and facilitation, and learning is a self-actualizing, discovering, experiencing, and reflecting process (Cheng 2002).

Customization is one of the means by which suppliers of learning products strive to differentiate their products in a world of similarity. Customization is intended to add increased customer perceived value to a product, since the customized learning product – compared with a standard product – fulfils the need of a customer more perfectly.

Technology can humanize the education environment ...bring mass customization to learning ...fine-tune the product to allow students to follow somewhat divergent paths and learn at their own rates. (Gates 1995)

Historically, companies have made strategic decision on “crafted education” or “mass education”. Within these traditional paradigms, a customer may be between a customized product with a high cost or standardised product with a low cost.

“From one size fits all to customized education” (Tapscott 1998). There is a demand for customized education products in a mass market.

As the author (2001), Piller (2002) and Schickedanz (2002) pointed out, Mass Customization and Personalization can help to overcome the efficiency-paradox of developing and delivering (management) education.

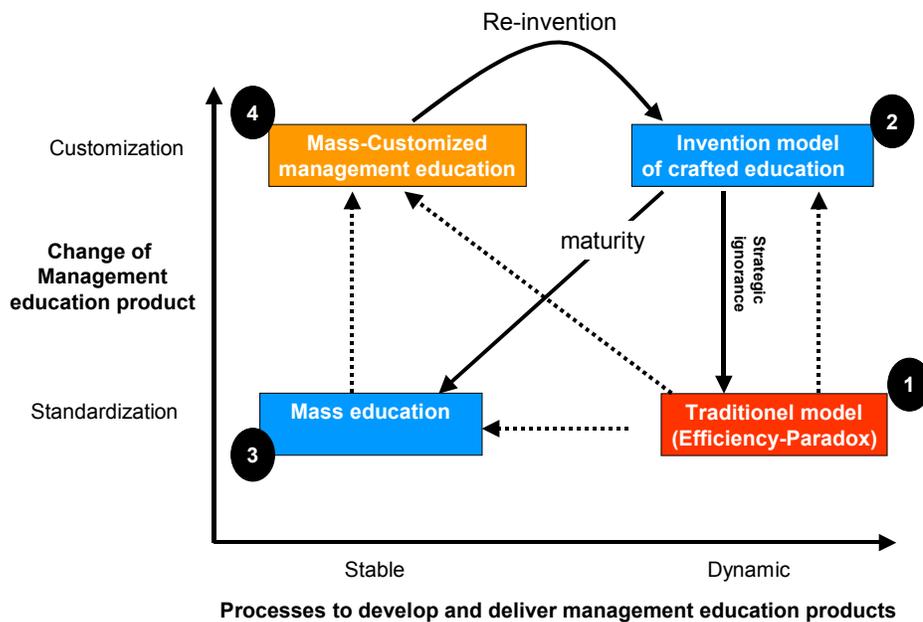


Figure 2: Product-process matrix of supplying management education (Piller 2002)

With the emerge of mass customization, the added value of customization of education products may now be manufactured with no or only little extra cost. The differentiation is, however, only effective, if the customer considers the customization to be of value. Recognising the customer as a major factor in the successful exploitation of mass customization in education market is the basis of this paper.

Education products can either be (Piller 2002)

- standardized products with slow, evolutionary, predictable changes (Field 3 – mass education: Today’s “E-Learning” and virtual education providers are moving towards this model)

- or customized solutions fitting the needs and desires of each single customer resulting in a different product every time one is produced (Field 2 – invention model of crafted education)
- Mass customized management education (Field 4): The concept of mass customization may provide a solution to overcome the efficiencies of the described models and shows an alternative escape from the paradox. It moves one's thinking beyond costly customization on the one hand and pure standardisation of education on the other towards the concept of hybrid competitive strategies

However Piller (2002) did not give an answer to the question, *how* the education market can benefit from this hybrid strategy. Many solutions are technology driven, but from the customers' point of view, education looks different.

Is "technology first" the solution for the education market ?

The American Society for Training and Development conducts an annual survey and in 1998, the survey included eight hundred and one organisations, both profit and non-profit. Among interesting results: firms are spending as much as ten times per employee on information technologies as they are on training (Kwiatkowski 2001) .

- Missing still however is a whole-person understanding of how individuals learn online (more than just how they process, build, and store knowledge). Primarily cognitive solutions originally designed for the classroom solutions (and facilitated by instructors) are often not enough to meet the individual, sophisticated needs of Web learners (Roao 2001).
- Mueller (2001) headlined that "E-Learning initiatives fail in the employees' point of view"
- One important reason mentioned by Mueller (2001) is the lack of personalization
- Further aspects in which E-Learning initiatives fail are collaboration and interactivity (Hutzschenreuter 2002)
- According to a study by the Initiative D21, E-Learning is not learner oriented so far (Initiative D21 2002)

In other words, does it make sense to design a learning experience one way for John and a different for Mary ? Not really. Contrary to common belief, people do not have different learning styles. They do, however, have different personalities. The distinction is important, since we need to be clear that everyone learns the same way [...]. *It makes sense to take personality differences into account when designing a system* (Schank 2002) .

Personalization should be clearly distinguished from customization. Both customization and personalization are based on the assumption that a homogeneous offering is not sufficient in meeting the customers' needs. As defined by the Webster dictionary, *personalize means "to make something personal or individual; specifically: to mark as the property of a particular person"* (Webster dictionary 2003). The definitions of "mass customization" and of "personalization" implies that the goal is to detect customers needs first and then to fulfil these needs with an efficiency that almost equals that of mass production.

The major implication of individualization in education is to maximize motivation, initiative, and creativity of students and teachers in learning, teaching, and research through such measures as implementing individualized educational programs; designing and using individualized learning targets, methods, and progress schedules; encouraging students to be self learning, self actualizing, and self initiating; meeting individual special needs; and developing students' contextualized *multiple intelligences* (Cheng 2003)

It is possible to take personality differences into account by using Gardner's multiple intelligence theory.

3. Howard Gardner's Multiple Intelligence Theory

Intelligence is the biological potential to process information in certain ways that can be activated in a cultural setting to solve problems or make products that are valuable in a culture (Harvard Project Zero 2000). As human beings we have many different ways of representing meaning, many kinds of intelligence. Since the beginning of the last century, psychologists have spoken about a single intelligence that can be measured by an IQ test; Howard Gardner's research however has defined 8 human intelligences: verbal/linguistic, logical/mathematical, musical/rhythmic, bodily/kinesthetic, visual/spatial, intrapersonal, interpersonal and naturalistic.

We all possess these several intelligences, but no two of us - not even identical twins - possess the same profile of intelligences at the same moment. In most countries throughout history, school has focused almost exclusively on language and logic.

Formal education has virtually ignored other forms of mental representation - artistic forms (musical), athletic (bodily), personal (knowledge of others and self), knowledge of natural world, knowledge of big questions. All of these "Frames of Mind" are there to be mobilized; if they are not, one could well call education "half-brained" (Gardner 2001).

Howard Gardner's work in multiple intelligence theory has powerful implications for the workplace. Evaluating Jobs from the MI-Point-of-View is really exciting, because many traditional job-profiles do not characterise the "real" job. The use of multiple intelligence in the workplace will increase creativity and productivity by enabling workers to use their strengths.

The new strategic focus in human-resources management is return-on-employee investment. That goes along with the attitude shift of employers, who now view their workforce as *intellectual capital* – a complex body of individual talents and backgrounds that should be analysed carefully and developed for maximum benefit (Kwiatkowski 2001)

Martin (2001) turned Howard Gardner's theory of multiple intelligence into user-friendly tools. Her work provides a complete system for examining staff needs, matching applicants to jobs, and supervising and training effectively. The results allow the identification of individual skills and uncovering the mosaic of skills needed for multi-skilling, multi-tasking and efficient teamwork.

4. Mass Customization and Personalization in Education and Training

The author's proposed approach to mass customization in education and training is based on the organisational strategy of Mass Customization and Personalization and Howard Gardner's multiple intelligence theory (Figure 3)

If we take personal differences into account first (Personalization) we can use the tools from Martin (2001) to show the individual biological potential (intelligence) and the multiple intelligence job profile. Achieving economies of scale is partly possible by incorporating reusable learning objects (E-Learning and Mass Customization). Information collected during Personalization serves to built up a learning relationship for Lifelong Learning.

- (1) Personal Multiple Intelligence Profile
- (2) Multiple intelligence Job Profile
- (3) E-Learning and Mass Customization and/or adapting Job Profile
- (4) Learning Relationship and Lifelong Learning

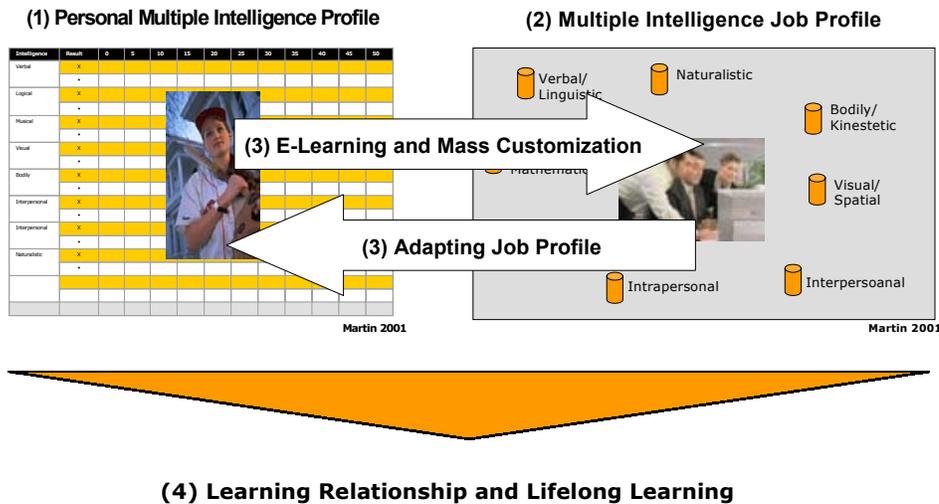


Figure 3: Personalization (Multiple intelligence profiles), E-Learning and Mass Customization, Learning Relationship and Lifelong Learning (Freund 2001)

4.1 Personal Multiple Intelligence Profile (Personalization)

The individual must do a self-assessment to identify their personal “intellectual capital”. This is more than merely writing a work history or resume. It is putting on paper one’s personal likes and dislikes, life style choices, what they actually learned from their experiences at work, school, family, church or any other organised activities. It involves taking a fully inventory of knowledge and technical skills either gained through experience, academic courses, reading, and travel. It involves documentation of one’s personal network of friends, associates, and acquaintances. At the individual level, intellectual capital is more than knowledge – it is a reflection of the individual’s personality, ability to solve problems and life style choices. From this self-assessment, an individual learns not only who they are but what they do not know and what they do not like (Kwiatkowski 2001).

People are very interested in studying their own multiple intelligence profile, however it is necessary to know much about multiple intelligence to make the right interpretation of these results. The most popular tool is MIDAS (Shearer 1995, Moon 2001).

The Multiple Intelligence Development Assessment Scales (MIDAS) was designed to provide an objective measure of the multiple intelligences as reported by the person or by a knowledgeable informant. There are a number of practical reasons why an individual, a parent, a teacher, a counsellor, or a psychologist might desire such an assessment. First, the MIDAS provides information regarding intellectual development, activities, and propensities not generally available from standardized intelligence quotient (IQ) and most aptitude tests. Second, the MIDAS provides information directly from the person's (and/or significant other's) experience that can be used to inform educators to personalize learning, curriculum design and to enhance the counselling process (Morris 2002).

The author prefers tools developed by Martin (2001) because she turned Howard Gardner’s theory of multiple intelligences into user-friendly tools to provide an objective measure of the multiple intelligences as reported by the person *and* her work provides a complete system for examining staff needs, matching applicants to jobs, and supervising and training effectively.

4.2 Multiple-Intelligence-Job-Profile

Educators across the United States, in Europe, Australia, South America, Asia, and Africa have repeatedly demonstrated the benefit of using Gardner's theory to identify and mobilise knowledge. However, industry and the professions have been slower to apply the theory and realise similar benefits. One reason for this has been the lack of demonstrated correlation between the general intelligences identified by Gardner and the specific practices in professions.

Throughout most of his writings, Gardner refers to a series of typical cultural occupations associated with each of his eight intelligences as 'end states.' While such end states serve as instructive examples of ordinary career paths, it is important to realize that all of us represent a blend of each of his eight (8) theorized intelligences [...] and that most occupations in life necessitate a blend of many of his intelligences [...] Almost every occupation [...] consists of a variety of responsibilities that touch on several of Howard Gardner's eight (8) intelligences. In other words, many different talents, skills, or to cite Gardner, intelligences are required for each occupation. What this means is that it is important to develop and nurture all of your various intelligences. Please note that these list only scratch the tip of the much larger MI occupational iceberg (Morris 2000-2002).

Intelligence	Occupation
Verbal / Linguistic	Archivist, attorney, author, call centre operator, comedian , copywriter...
Logical / Mathematical	Accountant, actuary, analyst, astronomer, auditor, banker, biologist, bookkeeper ...
Musical / Rhythmic	audio-video technician, band member, choir or choral director, choreographer, conductor ...
Bodily / Kinesthetic	Acrobat, actor, actress, aerobics instructor, architect, artistic painter, assembler ...
Visual / Spatial	Advertiser, architect, artist, builder, carpenter, cartographer, chess player ...
Interpersonal	Administrator, anthropologist, bartender, businessperson, chess player ...
Intrapersonal	Politician, psychiatrist, receptionist, salesperson, self employed person ...
Naturalistic	Agricultural engineer/worker, astronomer, beachcomber, biologist, botanist ...

Table 1: Lists of just some general occupations that need Gardner's eight Intelligences (Morris 2000-2002)

4.3 E-Learning and Mass Customization

Bridging the gap, we can educate the people or adapt the job profile.

Customization of learning products

The customization of learning products is possible throughout the different steps of the value chain of an education vendor and can address all distinguished dimensions in which learning processes differ (Hutzschenreuter 2002).

8 dimensions along which learning process can differ

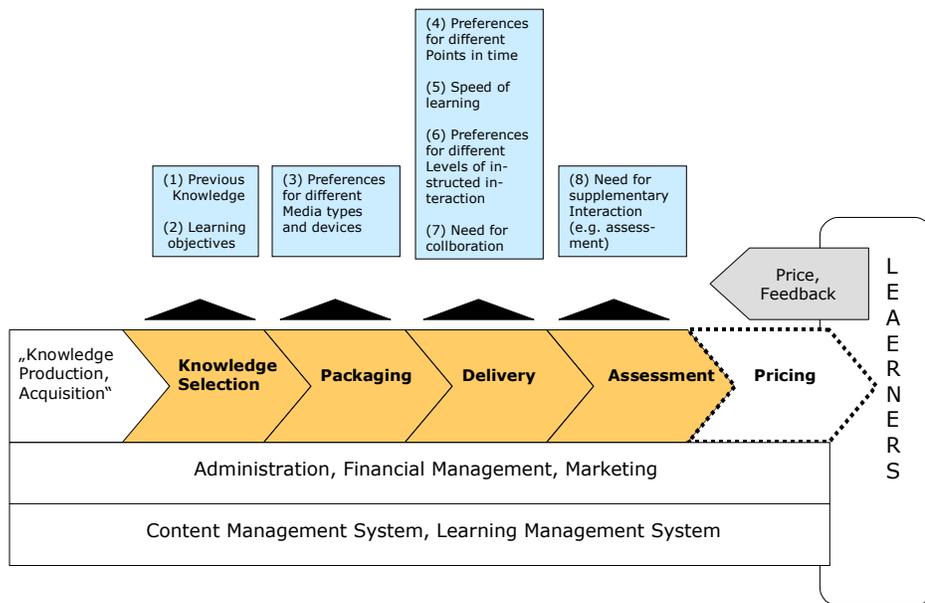


Figure 4: Customization along the “education value chain” (Hutzschenreuter 2002)

E-Learning and Mass Customization:

Achieving economies of scale is partly possible by incorporating reusable learning objects. The IEEE (Institute of Electrical and Electronics Engineers), a non profit, technical professional association of more than 350,000 individual members in 150 countries, has a Learning Technology Standards Committee which has defined learning objects as “any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning.”

These learning objects are self-contained items or may be combined or sequenced to form longer educational interactions. In order to use learning objects, they must be tagged or labelled so that the contents are properly known to all potential users.

Learning objects are reusable. For example, a learning object that defines the basic principles of hydraulics could be used by courses for auto mechanics, construction workers and millwrights. Many countries are researching the use of learning objects, especially in the use in distance education. It is clear to see, how curriculum designed through an outcomes-based process will be able to make use of learning objects (The Commonwealth of Learning 2002, Bannan-Ritland 2000).

Learning objects can be arranged in a fixed order – like at static web page where the place where certain information appears is already predefined. However mass customized learning products will require that the learning objects like text, graphic, diagrams, audio/video, interactive tools, etc. will be put together in real time in order which will depend on the person needs and preferences. Human being would not be able to do this on a large scale, therefore a software (configurator) must be used. The recent progress of information technology makes it possible, however a strong attention must be drawn on methodologies used.



Market segments and relevance of mass customization and low-scale customization (including collaboration)

Organizations	Mass Customization	Customization	Customization
	Mass Customization	Mass Customization	Mass Customization
Demand initiated by			
Individual Learners	Mass Customization	Combination of explicit and tacit knowledge ▼ Customization	Combination of explicit and tacit knowledge ▼ Customization
	Specialized Modules	Basic Programs	Advanced Programs

Figure 5: Market segments and relevance of mass customization and low-scale customization (including collaboration) of management education (Hutzschenreuter 2002)

Moreover one problem can not be solved by technology (Figure 5): Learning products can not be mass customized in regard to collaboration. A decreased level of social interaction and therefore limited flow of tacit knowledge may result. This problem cannot be tackled, because real-life social interaction is unique in its nature (Hutzschenreuter 2002)

Critics of medical education based on computers complain that beside manners are not learned from computers (Mangan 2000). Social isolation is not exactly the way to foster intellectual capital if human interaction helps to associate and assimilate new information (Stowe 2001).

Learning is dependent on the use and application of information – in how information is contextualised to become knowledge. That such a process is socially mediated and is dependent on social interaction is evident.

Learning programmes are broken into smaller component parts and can be reassembled for individuals or groups of learners. The learning objects are materials, together with assessment exercises for each component part. *It seems trite to point out that objects themselves cannot learn. But this lies at the heart of the pedagogic issue. Subject and object are inverted. What are called learning objects are in fact the subject of learning.* So what should be – or could be – a learning object? In our view, this is the outcomes of learning, the knowledge created, at all its different stages and in all its different forms. Learning objects are not created by course or materials developers, or even by learning facilitators but by the learner themselves. The primary role of the computer based learning platform is not in the delivery of the materials but in facilitating the transformation and communication of ideas as knowledge. The reusability of learning objects is in recording and storing that knowledge and in recommunicating and retransforming the experience and practice of learners and participants in both an individual and group context. In other words, the computer or ICT based learning environment is a process tool to support the creation and transformation of knowledge through learning objects (Attwell and Malloch 2002).

Martin Owen, a UK expert, points out [...] ICT becomes a new learning object, on top of other disciplines. This is a failure. There should be a transformation in the way we approach ICT. We should think in terms of "learning processes" and no longer in terms of "learning objects" (European Commission 2002b).

4.4 Learning Relationship and Lifelong Learning

Information collected during Personalization serves to build up a learning relationship for Lifelong Learning.

You can't lick customers, so join them: Enlist their power on your behalf. That means a shift of focus from selling to learning. Customer Relationship Management as it's usually practiced doesn't do that, as C. H. Prahalad observes: "Most CRM strategies view customers as outside, static entities; The goal is to obtain a 360-degree view of each customer – hence, the need to automate and integrate various customer interface touchpoints It's a company-centric view of the customer, with a focus on efficiency gains." [...] A fully developed customer-learning process will have four traits

- First it will emphasize communication over information mining. Without a process of mutual learning – which permits smarter buying and selling – there's little basis for customer loyalty in a low-friction knowledge economy.
- Second, customer learning needs to be integrated across functions – that is, not just confined to marketing, sales, and service but reaching into new-product development and even human resource and finance
- Third, the process should create a kind of relationship capital that is as valuable to the buyer as it is to the seller: Indeed, both sides should be able to quantify the value of relationship. There are a number of well-tested ways for sellers to measure the value of their customers. Flipped around, those tools become measurements of the value of customer capital to the buyer: Switching costs [...] are one token of what loyalty to a seller is worth; [...]
- Finally, the customer learning process should be so visible day to day that you can't imagine running the company without it (Stewart 2001).

Lifelong learning, however, is not just a simple summing-up or integration of traditional education programmes and modern learning opportunities. Instead, the approach to lifelong learning includes fundamental differences in educational content and perspectives: While traditional educational institutions have been (and still are) primarily concerned with transmitting knowledge, modern learning opportunities and the lifelong learning approach put the emphasis on the development of individual capabilities and personal learning competencies. *At the heart of the lifelong learning concept is the idea of enabling and encouraging people "to learn how to learn"* (European Commission 2002a, National Board of Education Finland (2002).

5. Further work

Project's goal is to answer the question: How to overcome the efficiency-paradox of developing and delivering education. The answer may be the use of Mass Customization supplemented with multiple intelligences theory by Howard Gardner. The project will be carried out in a few stages by a consortium of partners spread across Europe.

The initial stage of the project is scheduled on the second half of 2003. At this stage following actions are planned:

- Carry out several questionnaires and data processing works in order to create a personal MI-Profile database. Different groups of people will be encouraged to make a self-assessment to identify their personal "intellectual capital". Already developed and published tools and methodologies will be used for the research (Martin 2001).
- Evaluate jobs from the multiple intelligences point of view. This research will be carried out in the twofold form. Firstly the data obtained from the research mentioned above will be sorted out according to the occupation of participants and analysed accordingly. Secondly people representing management level could be surveyed as for their perception of people personal profiles that are fit for given jobs.
- Compare personal MI-Profiles with Job-Profiles. It will be very interesting to research and analyse the gap between personal profiles (arranged according to the jobs occupied) to the perceptions of management level of what kind of people would be fit for certain positions.

The results obtained from these actions taken in the first stage will be a foundation for further research scheduled on 2004. Its goal is to research the validity of the methodologies and tools already published for such kind of research. If the data obtained from the research was incomplete or incoherent it would be necessary to develop new tools needed to accomplish the main goal of the project.

So far a pilot research, which goal was to collect personal MI-profiles, has been already carried out in Germany. As a result 150 questionnaires were collected. The initial analysis of the data seems promising, however it is necessary to continue this research to draw credible conclusions. Currently because of the highly diverse studied population as for occupied jobs it is impossible to draw final conclusions as for jobs-profile.

In the next months further researches are planned which would concentrate on the following target groups:

- Shopping malls staff – In cooperation with HR managers in such centres a research of staff's personal MI-Profiles is planned. Certain sub-groups like cashiers, physical workers, cleaners, guest service staff, security staff, etc. can be isolated here if we consider job position as a criterion. Since this studied population could be considered as heterogeneous, where certain homogeneous similar sub-groups (stratums) can be isolated, the use of stratified sampling technique will be legitimate. In this sampling technique, the whole population is initially divided into homogenous, exclusive sub-groups and then units are selected from each stratum for study. The research is planned to be carried out in the form of paper questionnaires.
- Students – In cooperation with some polish universities a similar study is planned. It may be interesting to study students' population, because the majority of them is already employed or is going to take up work in the nearest future. Thus not only the scientific aspect, but also a practical application of the results would be interesting (especially for HR managers). Since all students at the chosen university have an access to the Internet at the headquarters or at home electronic format of the questionnaire will be used.

After the data from this research is collected and analysed the prospective stages of the project will be connected with efforts to set up and validate the set of quantitative metrics to assess personal MI-Profiles and job-profiles. Comparing the metrics values will allow assessing the gap between these two dimensions. With the use of e-learning and mass customization concept this will help to make a given person fit for a given job or a given job fit for a given person and to overcome the efficiency paradox in developing and delivering education.

References

Attwell, G., Malloch, M. (2002): Approaching an electronic community from the perspective of mutual learning. Available online at <http://www.uu.nl/content/2002%20ECER.pdf>

Bannan-Ritland, B. , Dabbagh, N. , Murphy, K. (2000): Learning Object Systems as Constructivist Learning Environments: Related Assumptions, Theories and Applications, in: Wiley, D. H.: The Instructional Use of Learning Objects. Available online at <http://reusability.org/read/>

Chen, S. (2001): A Personal View: What Multiple Intelligence Theory is and how to use it, Newsletter of the Center of Teaching and Learning. Available online at <http://web.jccc.net/academic/ctl/PDF/CTLMarch01.pdf>

Cheng, Y.C. (2002): Linkage between Innovative Management and Student-Centred Approach: Platform Theory for Effective Learning Invited Plenary Speech presented at the Second International Forum on Education Reform: Key Factors in Effective Implementation organized by Office of National Education Commission in collaboration with UNESCO and SEAMEO, Bangkok, Thailand, 2-5 September 2002. Available online at <http://www.ied.edu.hk/apcelsq/new/files/cheng2-5sep02.pdf>

Cheng, Y.C (2003): Local Knowledge and Human Development in Globalization of Education. Keynote Speech Presented at The International Conference on Globalization and Challenges for Education organized by National Institute of Educational Policy and Administration (NIEPA) from 19-21 February 2003, New Delhi, India. Available online at <http://www.ied.edu.hk/apcelsq/new/files/cheng19-21feb03.pdf>

Davis, P. (2001): TRANSFINE Transfer Between Formal Non-Formal and Informal Learning. Available online at http://www.transfine.net/Documentation/Project-01-02_en.pdf

Davis, S. M. (1987): Future perfect, MA, Addison-Wesley publishing company, INC.

European Commission (2002a): European Report On Quality Indicators Of Life Long Learning. Available online at http://europa.eu.int/comm/education/policies/lll/life/report/quality/report_en.pdf

European Commission (2002b): What's new in e-learning March 2002. Available online at http://europa.eu.int/comm/education/programmes/elearning/wn2002_03/wat2_en.html

Fernandez, P., McCarthy, I.P., Mena,C., Viesca, C. (2001): Mass Customization in the Digital Age. Presented at the 1. Worldcongress on Mass Customization and Personalization, Hong Kong, China

Freund, R. (1998): Was kann das Bildungsmanagement von der Automobilindustrie lernen ? Vortrag auf dem Europäischen Kongress Kompetenz 1998, Qualitätsmanagement in der beruflichen Weiterbildung, Stuttgart, Germany

Freund, R. (2001): Welche Auswirkungen hat Mass Customization auf das Management der beruflichen Weiterbildung. Vortrag an der Pädagogischen Hochschule, Freiburg, Germany

Gardner, H. (1993): Frames of Mind. The Theory of Multiple Intelligences

Gardner, H. (2001): An Education for the Future. Available online at <http://www.pz.harvard.edu/WhatsNew/Amsterdam.htm>

Gates, Bill (1995): The Road Ahead, Newsweek, November 27, 1995

Harvard Project Zero (2000): Adult Multiple Intelligences MI Basics. Available online at <http://www.pz.harvard.edu/ami/mibasics.htm>

Hutzschenreuter, T. (2002): E-Learning and Mass-Customization, Research Paper No. 92

Initiative D21 (2002): E-Learning: Wahrnehmung und Themenbewertung der Internetweiterbildung, Bonn, Germany

Kwiatkowski, S., Stowe, C. (Editor) (2001): Knowledge café; Intellectual Product and Intellectual Capital, Warszawa, Poland

Lippman, A. (2002): Interview Lippman on Learning: Fundamental Changes. Available online at <http://www.syllabus.com/article.asp?id=6073>

Mangan, K. S. (2000): Medical-School Group Proposes Huge online Library for Students, Chronicle of Higher Education, November 17, p. A65

Martin, J. (2001): Profiting from Multiple Intelligence in Workplace, Burlington USA

Martin, J. (2002): Multiple Intelligences And the Practice of Law: A New Framework. Available online at http://www.abanet.org/lpm/newsletters/articles/newsarticle12305_front.shtml

Mena, J. (1999): Mining E-Customer Behavior, DB2 Magazine, Winter. Available online at http://www.db2mag.com/db_area/archives/1999/q4/mena.shtml

Moon, Yong-Lin (2001): Measuring Multiple Intelligences in Korea. Available online at <http://aped.snu.ac.kr/cyberedu/cyberedu1/eng/eng21-01.html>

Morris, C. (2000-2002): Occupations needing Multiple Intelligences. Available online at http://www.igs.net/~cmorris/smo_comments.html, 2003-06-24

Morris, C. (2002): Howard Gardner's Multiple Intelligences, the MIDAS and Career Development Possibilities. Available online at <http://www.igs.net/~cmorris/ocetf.html>

Mueller, G. (2001): E-Learning-Konzepte fallen bei Mitarbeitern durch, in: Computerwoche Online, 06.12.2001

National Board of Education Finland (2002): Assessing Learning-to-Learn, Helsinki, Finland

Piller, F. (1998): Kundenindividuelle Massenproduktion, München, Germany

Piller, F. (2000): Mass Customization, Wiesbaden, Germany

Piller, F. (2002): Are we practicing what we preach ? – Strategic Perspectives of the Management Education Industry. Available online at <http://www.mass-customization.de/download/pil2002-7.pdf>

Piller, F. (2003). Mass Customization, 3rd edition, Wiesbaden, Germany

Pine, J. P.(1993): Mass Customization, Harvard Business School Press, Boston, MA.

Rao, A.J. (2001): Recognition of Conative and Affective Behaviour in Web Learning using Digital Gestures. Presented at 1. Worldcongress on Mass Customization and Personalization, Hong Kong, China

Schickedanz, C. (2002): Mass Customization und E-Learning: eine lernende Beziehung. Available online at <http://ddi.cs.uni-potsdam.de/GML2003/Workshops/schickentanz/ThesisGesamt.pdf>

Shank, R. C. (2002): Designing World-Class E-Learning, McGraw Hill

Shearer, B. (1995): The MIDAS: A Guide to Assessment and Education for the Multiple Intelligences. Columbus, Ohio: Greydon Press, USA

Stewart, T. A. (2001): The wealth of intellectual capital, Brealey Publishing London, United Kingdom

Stowe, C. R. B. (2001): Foundains for intellectual capital – challenges and opportunities for institutions of higher education in Kwiatkowski, S., Stowe, C. (Editor) (2001): Knowledge café; Intellectual Product and Intellectual Capital, Warszawa, Poland

Svensson, C (2001): The customer at the final frontier of mass customisation. Presented at the 1. Worldcongress on Mass Customization, Hong Kong, China

Tapscott, D. (1998): Growing up digital: the rise of the net generation. New York: McGraw-Hill, USA

Toffler, A. (1971): Future shock, Bantam, New York

The Commonwealth of Learning (2002): Skills Development through Distance Education, Vancouver, Canada

Tseng, M.M. and Jiao, J. (2001): Mass Customization, in G. Salvendy (Ed.) Handbook of Industrial Engineering, 3rd edition, New York: Wiley, 2001, pp. 684-709.

Tseng, M. M., Piller, F. (2003): Upcoming book “The customer centric enterprise: Advances in mass customization and personalization” (to be published at Springer in June 2003).

Von Hippel, E. (2001): Perspective: User Toolkits for Innovation, The Journal of Product Innovation Management, 18 , pp. 247-257.

Webster Online (2003): <http://www.webster.com/cgi-bin/dictionary?book=Dictionary&va=personalize>