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**E-Learning and Mass
Customization**

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E-Learning and Mass Customization

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Abstract

Within the e-learning industry, demand and supply factors jointly determine a need for mass customization of e-learning products. This paper asks whether e-learning products can be mass-customized, and if so, how this can be done. Firstly, the paper characterizes e-learning and e-learning technologies. Secondly, a learning model is developed in order to enhance the understanding of how learning processes differ across individuals. Based on this, the paper argues that e-learning products in general can be mass-customized. However, mass customization is only possible for some e-learning technologies and some types of communication, namely instruction and supplementary interaction, while it cannot support collaboration. In this context, solutions for the most common problems of mass customization are discussed. The results are then applied to the market for higher management education. It is shown that mass customization has a limited relevance for degree programs that are demanded by individuals, while it is crucial for programs that are either demanded by organizations or offered in specialized modules.

Key words: e-learning, mass customization, e-learning technologies

1 Introduction

One important objective of each scientific paper should be that the reader learns something. To learn something means that the reader's knowledge base after reading is richer than before. In order to ensure that this happens, the author would have to know the reader's knowledge base right in the moment of reading. As each reader is an individual one can assume that different readers have different knowledge bases. This implies that the author would have to know the individual reader's knowledge base in order to assure a learning experience. By fulfilling this condition and by using electronic formats, the author could potentially provide a customized article for each reader. In most cases, an electronic format is necessary because customization without incorporating electronic media typically implies communication costs that are prohibitively high [Hutzschenreuter, 2002a]. Due to technological restrictions of the chosen format, here it is impossible to efficiently identify each reader's individual knowledge base. Therefore, I implicitly assume a shared knowledge base. Based on this I deliver (only) a standardized learning product.

This little reflection on learning and media formats gives an idea of the relevance of the relationship between learning and customization. It shows that learners are demanding customized learning products. By assuming a large audience, it also shows that customization would require incorporating electronic media. As e-learning is "a prime candidate for becoming the ultimate electronic commerce application" [Hämäläinen *et al.*, 1996] it should therefore address learners' individual needs through customization. The major characteristic of the Internet [McKnight/Bailey, 1997; Angehrn, 1997; Haged III/Armstrong, 1997] is its ability to virtually centralize distributed information that exists in different formats on a unique multimedia platform. This characteristic qualifies the Internet as an appropriate instrument to support learning processes [Shapiro/Varian, 1998]. However, this instrument is not yet used to its full potential. On the one hand, recent studies support the requirement of personalization/customization of electronic learning processes. On the other hand, they show that today's e-learning initiatives suffer to fulfill this demand. This is why e-learning initiatives are currently of limited success. Mueller headlined that "e-learning initiatives fail in the employees' point of view" [Mueller, 2001]. One important reason mentioned by Mueller is the lack of personalization. Further aspects in which e-learning initiatives fail are collaboration and interactivity. According to a study by the Initiative D21, e-learning is not learner oriented so far [Initiative D21, 2002]. Consequently, universities as well as commercial and non-commercial organizations that have heavily invested in e-learning and that have planned further e-learning investments are thinking of cutting back on these investments. Therefore, the e-learning industry that maintains a market of approximately US\$ 20 billion [Aberdeen Group, 2002] must better meet customers' needs in order to regain confidence and willingness to further invest in e-learning [Porter, 2000].

The e-learning industry can be modeled as containing vendors along two value chain functions: software vendors and education vendors. Software vendors deliver software that can be used to produce and market learning products. Education vendors produce and/or market learning products. The market of software vendors is highly fragmented. The few large players invest heavily while niche players are trying to survive. For this in-

dustry segment, the success of e-learning initiatives is of importance, and therefore personalization/customization is crucial. In the market of education vendors there is a need for high scale in order to amortize high development costs. This is also true for organizations that are offering e-learning products that are developed in-house. They are only able to reduce training costs significantly (up to 30%) if e-learning is used organization-wide. Universities and other education vendors that are already offering e-learning have to attract students on a high scale. Due to these reasons, "e-learning" education vendors are interested in a large customer base. This entails a need for mass customization of e-learning products rather than customization to the individual. In other words: demand and supply factors jointly determine a need for mass customization of e-learning. This raises the question whether it is possible to mass-customize learning products. If so, how can it be done?

Previous research has investigated e-learning and mass customization separately. Mass customization is a research topic in marketing and strategy, operations management and e-business [e.g. Pine, 1993]. Researchers have investigated characteristics, opportunities and limitations of mass customization. The focus of this previous research has mainly been on physical products and industrial as well as consumer services. So far, e-learning has not been discussed with regard to mass customization. E-learning is a topic in communication science [e.g. Kerres, 1998], cognitive science [e.g. Twigg, 1994] and computer science [e.g. Astleitner/Leutner, 1998]. Furthermore, e-learning has been identified as an important topic in knowledge management [e.g. Hutzschenreuter, 2002c]. Previous research has not yet looked at the economic implications of the customization of e-learning products. This paper tries to close that research gap.

The paper is organized as follows. Firstly, the paper discusses the relevance and characteristics of e-learning and mass customization. The second part examines opportunities to customize learning products. Finally, opportunities and limits of mass customization of learning products will be shown. This section includes a discussion of the implications for the market of higher management education and implications for market segments that most business schools serve.

2 Learning and E-Learning

Learning takes place when an individual's knowledge base at a certain point in time (t_0) is transformed into a richer knowledge base at a later point in time (t_1) [see for a summary Gldenbergl, 2001]. Two general modes for learning can be distinguished. First, an individual can learn independently through *self-study*. Second, learning can also be directly or indirectly supported by another person. This is the case of *instruction*. In both cases, the individual's learning process is embedded in a social environment and in other individuals' learning processes (*collaboration*) [Simon, 1991; Dodgson, 1993; Miller, 1996].

E-learning can be distinguished from other learning formats by using two dimensions: on the one hand the local distribution of instructor and participants, and on the other hand the temporal dimension of information flow [Hutzschenreuter, 2000]. The instructor and

the participants can be locally dispersed or centralized. The flow of information between instructor and participants can be either synchronous or asynchronous. The case in which the information flow between sender and receiver is synchronous and instructor and participants are locally centralized is labeled classroom teaching. If the parties are locally centralized but the information flow is asynchronous we call this on-campus self study (see Figure 1).

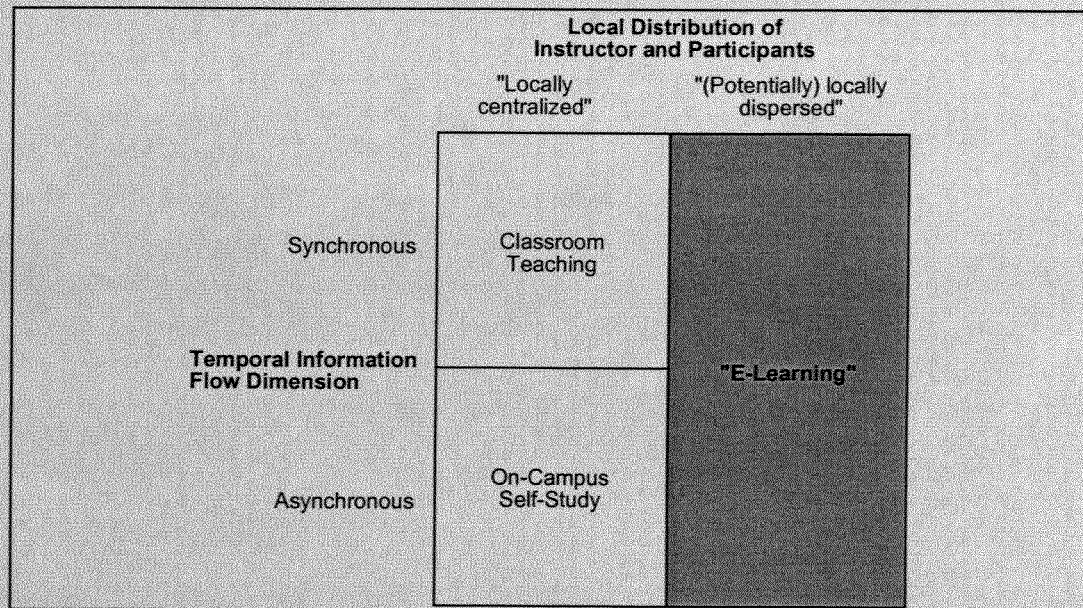


Figure 1: E-learning among other learning formats

E-learning takes place, when networked multimedia technologies (e-learning technologies) support the learning process (self study, instruction and collaboration). Thus, e-learning permits learning processes when participants and the instructor are locally dispersed. In this case, learning processes could not efficiently be encouraged without networked multimedia technologies. E-learning does not take place if such technologies are used to support classroom teaching and self-study, because in these case e-learning technologies are not crucial for enabling learning processes.

After having differentiated e-learning from other forms of learning we are now interested in different types of e-learning that are characterized by the types of technologies in use [Hutzschenreuter, 2002b]. E-learning technologies vary along two dimensions. The mode of communication can either be one-way, when information is only sent out without interaction, or two-/multiple-way, when two or more people interchange information during the learning process. The second differentiating factor is the temporal dimension: usage is either synchronous or asynchronous. Thus, there are four types of e-learning technologies (see Figure 2).

		Temporal Dimension	
		Synchronous	Asynchronous
Mode of Communication	One-way	Live-Video Lecture	<ul style="list-style-type: none"> . Screen Cams . Streaming Audio/Video . Drawing Boards . Hypertext Documents (incl. other files)
	Two-/multiple way	<ul style="list-style-type: none"> . Virtual Classrooms . Internet Relay Chat incl. ICQ-Software . Application Sharing/Workflow Collaboration . Shared Whiteboards . Interactive Websites 	<ul style="list-style-type: none"> . Electronic Bulletin Boards (including News Function) . E-Mail/Mailing Lists . Assessment Tools

Figure 2: E-learning technologies

(1) Asynchronous one-way communication is enabled by a number of technologies. For example, Real Audio enables the recording and playing of audio files through the Internet. Streaming Video permits to play video recordings with sound, while they are downloaded from the Internet. Screen Cams allow the instructor to record the work of different software applications while she is working on it (e.g. Excel[©] Spreadsheets). In addition, it is possible to record spoken explanations. Participants can then access and work with those recorded presentations as often as they like. Drawing Boards, which are similar to the chalkboard in a traditional seminar room, allow instructors to develop and record a drawing on an electronic screen together with spoken comments. Participants can work with drawing boards as they do with screen cams. Hypertext documents provide the possibility to insert electronic links in linearly structured documents. These links point from predefined terms to other documents (e.g. related exercises or definitions of specific terms) and can also connect to documents that are located on the Internet and can therefore be updated quickly and easily.

(2) Synchronous, one-way communication takes place primarily through Live-Video lectures. This makes it possible for an instructor to broadcast a lecture live through the Internet without providing any means for interaction between students and professors.

(3) Asynchronous, two-/multiple-way communication is also enabled by multiple technologies. Electronic Bulletin Boards present discussion platforms for specific topics, such as answers to practice exams or homework assignments, which are made publicly available through the Internet. E-mail messages provide the possibility to distribute messages and documents to one or many people.

(4) Synchronous, two-/multiple-way communication can be achieved in numerous ways. Virtual classrooms make it possible to broadcast a live discussion between seminar participants and the instructor through the Internet. By using web cams it is possible to record the participants during the discussion. It should be pointed out that the usage of this type of technology still requires considerable bandwidth and is therefore not suitable for learning environments with slow network connectivity. Consequently, the penetration of this technology is currently very low. Internet Relay Chat (IRC) facilitates the exchange of written messages between two or more people in real time. For example, IRC can be the basis for an online office hour. ICQ (I-see-you)-Software allows members of a group to find out instantly which other members are currently online. Application Sharing Software provides the possibility to work on a software application, e.g., an Excel Spreadsheet or a Word document, simultaneously from different locations. Other technologies belonging to this category are shared whiteboards and interactive websites.

3 Customization of Learning Products

In the following, a learning model is used in order to identify opportunities to customize learning products. This learning model is based on learning theories, namely the behavioral theory, the cognitive learning theory and the social learning theory. The behavioral theory explains learning as a reaction to positive or negative stimuli [Watson, 1913]. As a result, learning products should focus on instruction and supplementary interaction between the instructor and the learner. Cognitive theory looks at processes in the brain of an individual learner [Sadler-Smith/Riding, 1999; Wickens/Sandry/Vidulich, 1983]. When put into practice, cognitive theory demands differing learning styles across individuals. Finally, social learning theory explains learning as a process in which an individual is not only influenced by an instructor, but also by other members of a learning community [e.g. Mandel/Gruber/Renkl, 1997]. Therefore, a learning product should address collaboration and an appropriate learning context.

Based on these theories, learning can be seen as a multidimensional process that takes place through different communication processes.¹ Communication occurs (1) as instruction and supplementary interaction between the individual learner and an instructor, (2) as collaboration between the individual learner and a learning group of which the individual learner is a part and (3) as instruction and supplementary interaction between the instructor and the learning group as a whole. Furthermore, learning processes differ across individuals and are embedded in a learning context (see Figure 3).

¹ The paper abstracts from pure self-study.

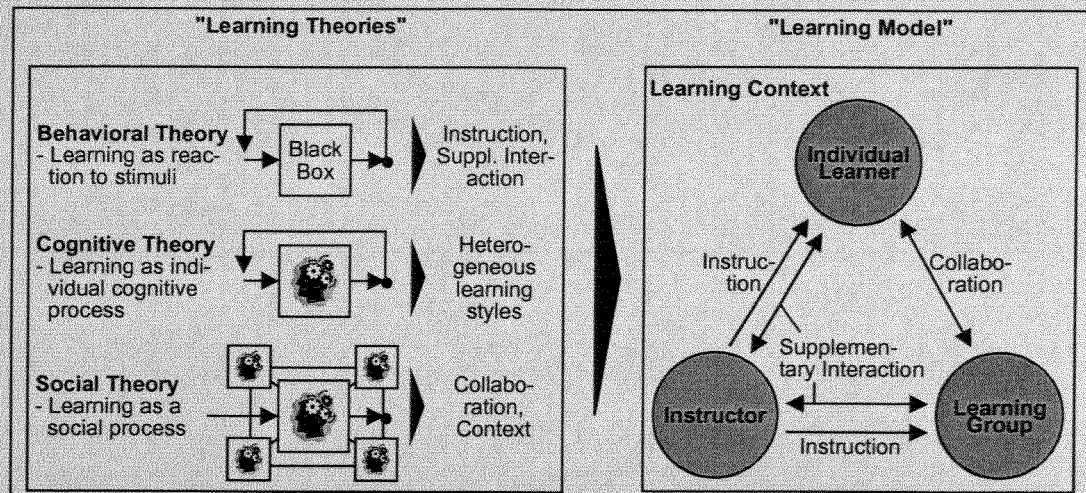


Figure 3: Learning theories and learning model

In order to assess the possibilities for the customization of learning products, we have to evaluate the different e-learning technologies with respect to their ability to sustain the three communication processes of instruction, collaboration and supplementary interaction. Instruction, supplementary interaction and collaboration are "produced" through the processes in an "education value chain". The education value chain consists of primary functions such as knowledge production and acquisition, knowledge selection, packaging, delivery, assessment as well as pricing (see figure 4).²

A learning product can be personalized along each of the primary functions of this value chain, depending on the learner's needs and preferences. Figure 4 reveals at least eight dimension along which learning processes can differ. Knowledge selection can vary by subject, focus and depth, depending on the learner's previous knowledge and her learning objectives. The packaging function is personalized by taking the learner's preferences for media types into account. The previously selected knowledge can be packaged into the desired media types, such as text, audio, video, graphics and combinations of these, and into different devices, such as wired-line and wireless. The delivery can be customized in different dimensions as the learner might want to chose the right point of time for learning, the speed of learning and the desired intensity of interaction. In addition, the delivery function can also vary by the intensity of collaboration within the learning group as well as by the intensity of supplementary interaction. The assessment function can address differing needs for feedback by incorporating different types of assignments and exams in different intensity.

² Furthermore the value chain contains secondary functions such as a Content Management System and a Learning Management Systems as well as Administration, Financial Management and Marketing.

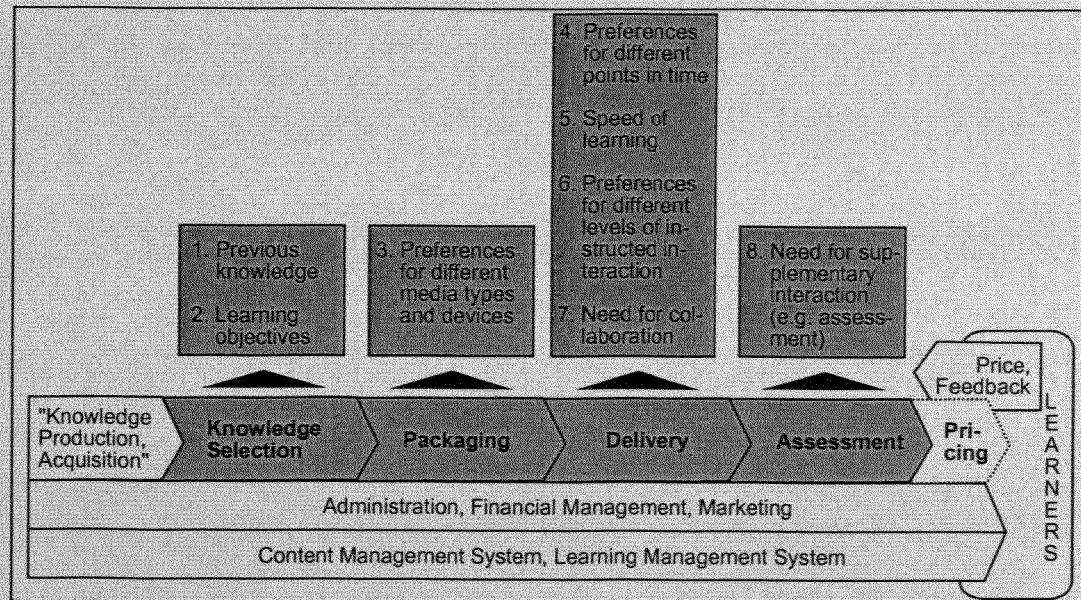


Figure 4: Customization along the "education value chain"

In summary, learning processes differ across individuals and therefore demand customization. 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.

4 Mass Customization of E-Learning

In comparison to low-scale customization, mass customization is not only a means to personalize a learning product, but also to do so on a high scale [Agrawal/Kumaresh/Mercer, 2001]. Therefore, mass customization requires scalability [Piller, 2000]. This raises two questions. (1) To what extent is it possible to mass-customize e-learning products? And, if learning products can be mass-customized, (2) which problems have to be solved in order to ensure learning success?

To answer the first question, the different types of technologies that were differentiated in part 2 of this paper are evaluated with regard to two questions: Are they able to support the three types of communication processes from the learning model? Can e-learning vendors standardize, low-scale customize or mass-customize their products for those types of communication processes? These aspects are discussed for each type of e-learning technology (see figure 5).

Technologies based on a one-way mode of communication cannot perform supplementary interaction and collaboration, because these types of communication require a two-way mode of communication per definition. Therefore, e-learning technologies that are based on a one-way mode of communication can only support instruction. Instruction that

is based on those technologies and that is based on a synchronous mode of communication is standardized by definition. E-learning vendors are able to standardize, but also to low-scale customize and mass-customize instruction that is supported by e-learning technologies that incorporate a one-way, asynchronous mode of communication. Here, instruction can be automated based on the learners' needs.

E-learning technologies that use a two-way, synchronous mode of communication support all three types of communication processes. Furthermore, all three types can be low-scale customized. Because collaboration is not scalable, learning products cannot be mass-customized in regard to collaboration. The lack of scalability for collaboration goes back to factors, such as bounded rationality, that occur in collaboration processes among individuals. Instruction and supplementary interaction can partly be mass-customized, if the communication can be automated. An instructor's involvement that is not supported by electronic media would prevent mass customization.

Mass customization is also possible in the case of instruction and supplementary interaction based on technologies that use an asynchronous, two-way mode of communication (collaboration is not supported by those technologies). The reason why mass customization is possible in this case is that these technologies allow an automation of communication or allow a replication of communication capacity, which is not possible in the case of technologies that use synchronous communication, such as a virtual classroom.

		Temporal Dimension							
		Synchronous			Asynchronous				
Mode of Communication	One-way	S C MC			S C MC				
		Instruction	■	□	□	Instruction	■	■	■
		Collaboration	□	□	□	Collaboration	□	□	□
	Suppl. Interaction	□	□	□	Suppl. Interaction	□	□	□	
Two-/multiple way	S C MC			S C MC					
	Instruction	□	■	▣	Instruction	□	■	■	
	Collaboration	□	■	□	Collaboration	□	□	□	
Suppl. Interaction	□	■	▣	Suppl. Interaction	□	■	■		

Legend

S Standardization
C Customization
MC Mass Customization

□ not possible
■ fully possible
▣ partly possible

* Assumption: Initial communication between provider and participant had already taken place.

Figure 5: Mass customization and e-learning technologies

Generally, low-scale customization of learning products is possible by employing a wide range of e-learning technologies. E-Learning technologies usually also allow to mass-customize learning products. However, they do not sustain mass customization of collaboration and are only partly able to mass-customize a synchronous, two-way communi-

cation process. The highest degree of mass customization can be achieved for technologies that support instruction based on a synchronous, one-way mode of communication. Mass customization of learning products faces four major problems. All of these are related to the fact that communication has to be automated in order to ensure scalability. The first two problems concern the individual learner, while the third and fourth problem treat his interaction with the instructor and the learning group, respectively (see figure 6).

Problems	Possible Solutions	Approaches ¹
Self-externalization of previous knowledge and learning objectives can be difficult.	Questionnaires, quizzes, recommendations instead of self customization	Filter and recommendation systems, learning accounts
Self-externalization of preferences for media types and levels of interaction can be difficult.	Tracking of use of media, assessment of media by participants, tracking of participation	Software agents (learning relationship between instructor and participants)
Instructor loses control over learning process.	Tracking of product use and motivating participants, support of self-control, assessment of product by participants	Assessment managers, software agents, reminder and news functions, personalized learning aids (notes, highlights, exports)
Decreased level of social interaction and of flow of tacit knowledge	- ²	- ²

¹ Examples for software vendors (products): Click2Learn (Aspen), SAP (Learning Solutions as part of mySAP.com/hr), IMC (CLIX Campus), IBM (Mindspan Solutions/Learning Space).

² Real life social interaction and flow of tacit knowledge is unique in nature.

Figure 6: Problems related to mass customization of learning products and possible solutions

- The first problem is that it can be difficult for the learner to identify and to make available her previous knowledge and her learning objectives ("self-externalization"). A reason is that individuals do not exhaustively know what they know and what they want to know. Possible solutions to handle this problem are questionnaires and quizzes as a basis for recommendations. Therefore, software products can make use of filter and recommendation systems as well as learning accounts.
- A second point is that self-externalization of preferences for media types and levels of interaction can be difficult. Possible solutions for this problem are that vendors track the use of media and let assess the media by participants. Furthermore, vendors can track participation. A possible approach to incorporate these solutions is the usage of software agents that allow creating a learning relationship between the instructor and the participants.
- The third problem occurs when the instructor loses control over the learning process. Here, the tracking of product use, the motivation of participants and the assessment of the product by participants are solutions. Vendors cover this problem by using as-

assessment managers, software agents as well as reminder and news functions. Some vendors also offer personalized learning aids, such as capturing notes and highlights.

- A fourth problem is that only a decreased level of social interaction and therefore a limited flow of tacit knowledge is possible. This problem cannot be tackled, because real-life social interaction is unique in its nature.

5 Market Implications: The case of management education

The characteristics, opportunities and limits of personalization and mass customization determine their fit to the needs of certain market segments [Zerdick et al., 2001]. In this paragraph, we will shortly describe the possibilities of customized e-learning for the market of management education. This market can be segmented with regard to the initiators of demand and with regard to the content (see figure 7). Demand for management education can be initiated either by individual learners or by organizational entities that are demanding e-learning programs for their employees. The content can be packaged as specialized modules (e.g. for marketing or finance), basic programs (e.g. a Bachelor-degree course) or advanced programs (e.g. MBA or EMBA courses).

		Customization	Customization
Organi- zations	Mass Customization	Mass Customization	Mass Customization
Demand ini- tiated by		Combination of explicit and tacit knowledge	Combination of explicit and tacit knowledge
Individual Learners	Mass Customization	Customization	Customization
	Specialized Modules ¹	Basic Programs	Advanced Programs
	Content		
	¹ in case of a high amount of explicit knowledge		

Figure 7: Market segments and relevance of mass customization and low-scale customization (including collaboration)

Within these different dimensions, mass customization has a high relevance for the special modules' segment. As these programs are usually add-ons to previous education they do not necessarily require collaboration within a group as a type of communication. In the case of an individual learner's demand for a basic or advanced program, mass customiza-

tion is of low relevance, because these segments require a sufficient level of collaboration. Here low-scale customized products are more appropriate. When the employees of an organization demand for such programs, mass customization has a higher relevance, because employees are by definition a part of a group. Therefore, the combination of a learning group by the education vendor adds less value. Thus, mass customization can be applied.

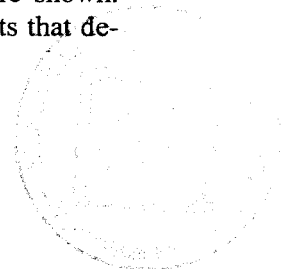
Comparing this picture with the characterization of supply factors of the learning industry from the introduction, one might ask how education vendors that are active in segments with lower relevance for mass customization can achieve economies of scale in order to quickly amortize high development costs. Achieving economies of scale is partly possible by incorporating reusable learning objects from others or by selling reusable learning objects. Reusability is based on specifications, such as SCORM (Sharable Content Object Reference Model), that are worked out by e-learning vendors [Ostyn, 2001]. This forces the formation of alliances between vendors active in these market segments.

Summary

Within the e-learning industry, both demand and supply factors determine a need for mass customization of e-learning products. This raises the questions whether mass customization of e-learning products is possible and if so, how it can be done. In order to find an answer to these questions, the paper characterizes e-learning in the context of other learning formats and differentiates e-learning technologies. E-learning uses a wide range of different technologies that are based on a one- or two-way mode of communication as well as on a synchronous or asynchronous mode of communication. The second part of the paper develops a learning model that is based on behavioral, cognitive and social learning theories. According to the model effective learning processes require a combination of instruction, supplementary interaction and collaboration. Furthermore, the paper identifies along which dimensions learning processes differ across individuals and how education vendors are able to customize learning products throughout their value chain.

Based on this, the paper shows how education vendors can mass-customize learning products. Firstly it is shown how e-learning technologies support instruction, collaboration and supplementary interaction. Secondly, standardization, low-scale customization and mass customization are discussed for each of these types of communication processes. The paper concludes that e-learning technologies do not allow mass customization of collaboration and they are only partly able to mass-customize a synchronous, two-way mode of communication. The highest degree of mass customization can be achieved by incorporating technologies that support instruction based on asynchronous, one-way mode of communication. Furthermore, there are various viable ways to tackle the constraints of mass-customized e-learning products.

In addition, implications for the market for higher management education are shown. Mass-customized e-learning products are of high relevance for market segments that de-



liver special modules. In contrast, mass customization of e-learning products is less important for basic and advanced degree programs that are demanded by individuals. Mass customization is more relevant for such programs that are demanded by organizations.

References

- Aberdeen Group (2002): *The Infrastructure for Education: SAP Provides Keystone for Managing the Learning Process*, Boston 2002.
- Agrawal, M., Kumaresh, T. V., Mercer, G. A. (2001): The false promise of mass customization, in: *McKinsey Quarterly*, pp. 62-71.
- Angehrn, A. (1997): Designing Mature Internet Business Strategies. *European Management Journal*, Vol. 15, pp. 361-369.
- Dodgson, M. (1993): Organizational Learning : A Review of some literatures, in: *Organization Studies*, Vol. 14, 1993, pp. 375-394.
- Hagel III, J., Armstrong, A. G. (1997): *Net Gain, Expanding Markets Through Virtual Communities*, Boston 1997.
- Hämäläinen, M., Whinston, A., Vishik, S. (1996): Electronic Markets for Learning: Education Brokerage on the Internet, in: *Communication of the ACM*, Vol. 39, No. 6, 1996, pp.51-58.
- Hutzschenreuter, T. (2000): *Electronic Competition*, Wiesbaden 2000.
- Hutzschenreuter, T. (2002a): How do E-Business-Based Mass-customized Products Effect Revenues and Costs of Established Enterprises, in: *The E-Business Review*, Vol. 2, 2002, pp. 110-113.
- Hutzschenreuter, T. (2002b): Using E-Learning Technologies and E-Learning Programs to Support Knowledge Management, in: *The E-Business Review*, Vol. 2, 2002, pp. 114-117.
- Initiative D21 (2002): *E-Learning: Wahrnehmung und Themenbewertung der Internet-Weiterbildung*, Bonn 2002.
- McKnight, L. W., Bailey, J. P. (1997): An Introduction to Internet Economics, in: *Internet Economics*, ed. L. W. McKnight, J. P. Bailey, Cambridge/Mass. 1997, pp. 3-24.
- Miller, D. (1996): A Preliminary Typology of Organizational Learning: Synthesizing the Literature, in: *Journal of Management*, Vol. 22, 1996, pp. 485-505.
- Mueller, G. (2001): E-Learning-Konzepte fallen bei Mitarbeitern durch, in: *Computerwoche Online*, 06.12.2001.
- Ostyn, C. (2001): E-Learning Standards, in: *Click2learn Briefing*, Boston 2001, pp. 1-25.
- Piller, F. (2000): *Mass Customization*, Wiesbaden 2000.
- Porter, M.E. (2000): Strategy and the Internet, in: *Harvard Business Review*, Vol. 78, March 2000, pp. 63-78.
- Shapiro, C., Varian, H. (1998): *Information Rules: A Strategic Guide to the Network Economy*, Boston 1998.
- Simon, H. A. (1991): Bounded Rationality and Organizational Learning, in: *Organization Science*, Vol. 2, 1991, pp. 125-134.
- Zerdick, A. et. al. (2001): *Internet Economics (European Communication Council Report)*, Berlin 2001.
- Pine, B. J. (1993): *Mass Customization*, Boston/Mass. 1993

- Astleitner, H., Leutner, D. (1998): Fernunterricht und neue Informationstechnologien: Aktuelle Entwicklungen, in: *Zeitschrift für Pädagogik*, Vol. 44, 1998, pp. 105-123.
- Twigg, C. (1994): The Changing Definition of Learning, in: *Educom Review*, Vol. 29, No. 4, 1999, pp. 1-4.
- Kerres, M. (1998): *Multimediale und telemediale Lernumgebungen*, Munich 1998.
- Sadler-Smith, E., Riding, R. (1999): Cognitive Style and Instructional Preferences, in: *Instructional Science*, 1999, pp. 355-371.
- Wickens, C. D., Sandry, D. L., Vidulich, M. (1983): Compatibility and Resource Competition between Modalities of Input and Output, in: *Human Factors*, Vol. 25, No. 2, 1983, pp. 227-248.
- Mandel, H., Gruber, H., Renkl, A. (1997): Situiertes Lernen in multimedialen Lernumgebungen, in: *Information und Lernen mit Multimedia*, ed. by L. Issing, P. Klimsa, 2nd ed. Weinheim 1997, pp. 167-177.

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