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DIFFUSION OF E-LEARNING AS AN INNOVATION AND ECONOMIC ASPECTS OF E-LEARNING SUPPORT STRUCTURES

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Abstract

Meanwhile, many universities and educational institutions have implemented an e-learning center or some similar, often smaller institutional units in order to support the usage of new media in teaching and learning processes [1]. This paper addresses questions around the installation of such e-learning support structures at different levels of an institution and also looks at the diffusion of e-learning as an innovation in educational institutions.

Keywords: e-learning, innovation, support structure, institutionalisation

1 INTRODUCTION AND OVERVIEW

2005, the University of Frankfurt was confronted with the question on how to use a certain amount of financial resources made available through public funding by the federal ministry for education and research and additional funds by the university itself in order to foster the distribution of e-learning at the university as a whole. The questions which came up in this regard addressed issues such as

- Should resources be allocated centrally or peripherally?
- If a combination of central and decentralized allocation of resources is chosen, how much is invested where and for which purposes?
- Are there any conditions linked to the provision of financial resources, if yes, which ones?
- Should financial and other resources be invested at once or step-by-step?
- Which measures and, most of all, which combination of measures is most successful?

First of all, the university decided not to invest all the financial resources at once, but to apply a gradual process which involved the different departments step-by-step. The main intention behind this decision was to allow for a learning process in which one department could learn from the others, positive examples could be repeated while negative experiences could be avoided in the next step.

The second decision concerned the distribution of the financial resources. It seemed to be appropriate to choose a combination of central and decentralised allocation of resources. Since it seemed to be inefficient to have every department choosing and running their own learning management system or other services, these types of support services where allocated at a central institutional center. At the same time, certain support functions seemed to be more appropriate within the departmental structure since this leads to a higher degree of acceptance within the learning and teaching cultures in different disciplines [2] [3] [4] [5] [6]. At the end, a combination of a central support structure and decentralised allocation of human resources was chosen which was implemented through a gradual process.

2 IMPLEMENTATION

2.1 Stepwise process

As mentioned above, a gradual process was chosen for the introduction of e-learning at the University of Frankfurt. In reference to Rogers we can differentiate certain stages of innovators [7]. Also Hagner and Schneebeck offer categories to differentiate attidudes towards an innovation as they differentiate a risk-aversive, reward-seeking, or reluctant behaviour [8]. The different attitudes show themselves at the level of individual teachers as they choose to integrate e-learning as an innovation into their teaching. Concerning the diffusion of e-learning in institutions, Seufert and Bremer showed in studies and projects that these types also can be applied not only to people but also at the level of institutions, departments, and teams [9] [10].

In order to take those different stages into account, we offered a stepwise integration of departments into the whole integration process (see figure 1). Besides the time to get more familiar with 'e-learning' as an innovation, the departments had enough time to develop their own organisational path of development and could learn from those which already had gone through the process before [11].

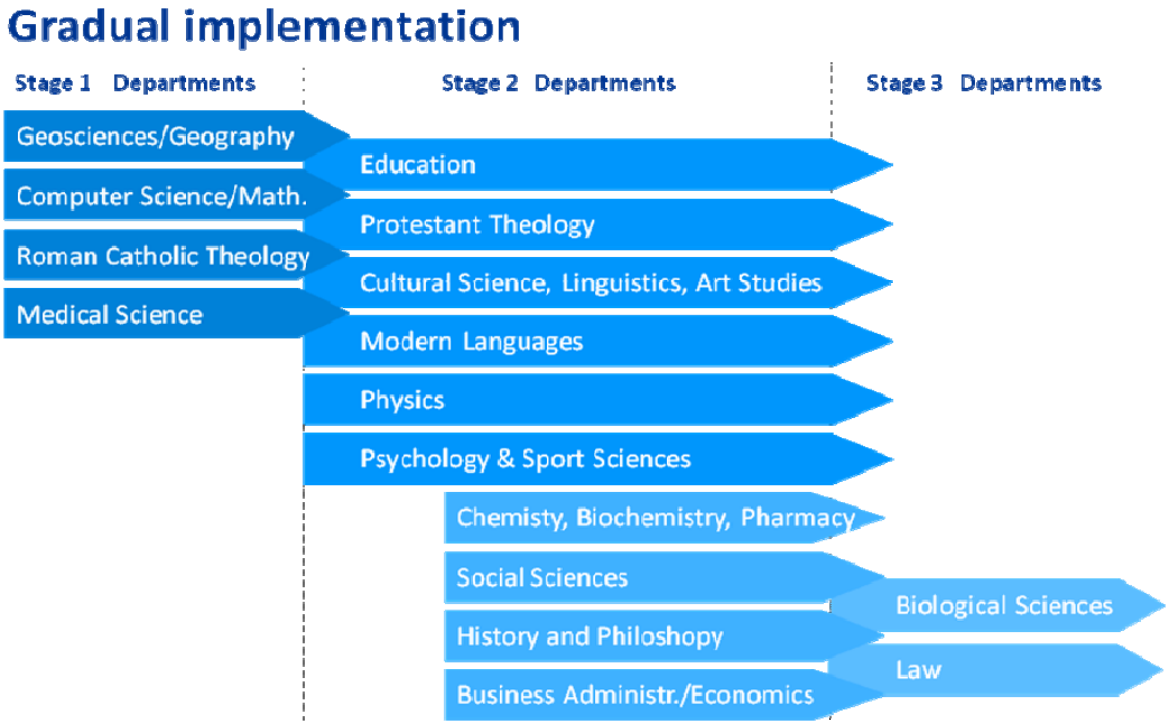

Figure 1: Gradual integration of departments into the organisational development process

The 'stage one departments' were chosen by their previous e-learning experiences (e.g. through major e-learning projects), interest and motivation, availability of appropriate competencies, and willingness. In exchange, they could participate in the process of strategic planning and had influence on the direction of the development. Additionally, they received a longer funding for their departmental e-learning structure than the departments which entered the process at a later stage. With intention, the selection of the 'stage one departments' ranged from natural science up to humanities, so each field of discipline was represented to ensure enough reference projects for the two latter stages.

The 'stage two departments' had one year time to develop their own organisational concept how to implement and distribute e-learning throughout their institutes. This planning process was mainly executed by the heads of the departments or certain stakeholders accompanied by the central e-learning division which also was responsible for the organisational development project in general. In accordance with the project coordination the 'stage one departments' counselled the 'stage two ones' concerning the allocation of financial ressources, and shared their experiences with the diffusion and innovation process. Already at this stage, various network meetings were conducted in order to foster the exchange between the departments – a fact that advanced the latter creation of the ongoing e-learning community.

Along this project, we tried to develop a deeper understanding on what circumstances and factors had an impact on different paths of development and the effects of these paths on further outcomes. For example, one interesting effect was that departments which spread their financial resources into several staff positions secured that the adequate competencies became available in different institutes. Later, these departments became more successful in acquiring additional financial resources from the university e-learning funds that the ones who had chosen more centralized settings (see chapter 2.2.2 and [10]). On the other hand, these departments had to invest more effort to align the departmental e-learning strategy in comparison to those departments where this function was assigned to only one person. Often this one person was even located close to the head of the department, for example in the dean's office, so coordination efforts were lower than in the other ones.

2.2 Bottom-up/top-down

Along with the stepwise process of developing and implementing e-learning strategies in the departments, an accompanying support structure was build up in order to provide the necessary preconditions for successful e-learning implementation (see figure 2).

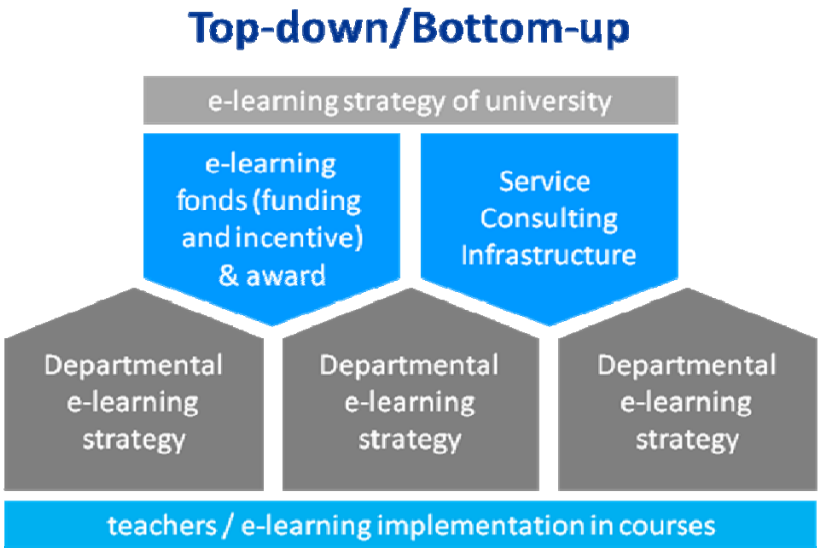

Figure 2: Top-down/bottom-up implementation of e-learning at the University of Frankfurt

2.2.1 Support structure

The objective of the e-learning infrastructure was to support teachers who want to use new media in classroom teachings and for self study phases. This infrastructure includes the provision of a learning management system and other systems, consulting and support services around e-learning concepts and media production (here, a standardized procedure model is applied, see [12] [13]), lecture recording, provision of software, and practical hands-on support in technical questions. This support system also helps to ensure quality and efficiency in media production processes [12].

Institutes and teachers who want to produce digital learning material can ‘rent’ qualified students, so called student consultants’, for low rates who are supported and advised by the e-learning center of the university as their back office [3]. The advantages of this concept lies in the flexibility and qualification of those student consultants: while teachers often have difficulties to find qualified students for media production projects within their own disciplines, they now can book students for exactly the amount of time and the competencies they have demand for in their projects – just as in commercial projects. Nevertheless, the student’s wages are far below market prices and in addition, the students are supported by the team members of the central e-learning unit. While some universities offer this kind of services for free, Frankfurt decided to charge some minimum prices in order to raise cost awareness and efficiency in e-learning projects. Although the provision of such special services is charged, the provision of general services and any consulting are provided for free.

2.2.2 Funding and incentive system

A mentioned above, the university provides additional funding for e-learning projects – a measurement also chosen by other universities [14] [15] [16]. This funding is part of the financial resources for e-learning projects and e.g. often the source for the payment of the student consultants. The idea behind this additional funding is, that teachers should be politically independent from departmental politics and structures and have enough resources for e-learning. Although their e-learning projects have to fit into the departmental e-learning strategies, some ideas are beyond current mainstream and too innovative to be understood by the heads or decision makers in the departments. Therefore, and also to bypass potential e-learning-aversive departmental structures and to give additional incentives for the use of new media, additional funding is provided for the development and implementation of innovative e-learning projects [17]. The funded projects are selected by an evaluation procedure which is comparable to the ones of scientific conferences: each project is evaluated by two to three independent e-learning experts, one out of each status group of the university. The final decision upon funding

is made based on the results of these evaluations in a commission under the guidance of one of the vice president of the university, mostly the one responsible for teaching and learning. By now, more than 1 million Euros have been invested since 2006: nearly 900,000 Euros for teachers' projects and 300,000 Euros for students' projects. Table 1 shows the funding per department/cluster since 2005:

Table 1: Number of funded projects and funding in euro by department (FB) and clusters[1]

Cluster	Departments	(Number of funded projects in department) Amount of funding in euro					
		2005	2007	2009	2010	2011	Sum
Cluster I Business, Law, Social Science, and Psychology and Sports	FB 1 – Law				(1) 12.288		(1) 12.288
	FB 2 – Business and Economics	(1) 23.000	(2) 13.500	(1) 21.375		(1) 14.900	(5) 72.775
	FB 3 – Social Sciences	(1) 5.000	(3) 24.300	(2) 31.949	(1) 15.000	(.5) 7.000	(7.5) 83.249
	FB 4 - Education	(2) 18.000	(2) 13.500	(1) 17.000	(1) 5.000		(6) 53.500
	FB 5 - Psychology and Sports	(2) 20.000					(2) 20.000
	Sum Cluster I	**(6) 66.000**	**(7) 51.300**	**(4) 70.324**	**(3) 32.288**	**(1.5) 21.900**	**(21.5) 241.812**
Cluster II Theology, History and Philosophy, Cultural Science, and Modern Languages	FB 6 – Protestant Theology	(1) 12.000					(1) 12.000
	FB 7 – Catholic Theology		(1) 11.000	(1) 15.535			(2) 26.535
	FB 8 – History and Philosophy	(1) 10.000		(1) 18.000	(1) 20.000	(1) 10.000	(4) 58.000
	FB 9 – Cultural Science	(7) 30.510	(6) 41.000	(1) 11.960	(2.5) 39.250	(4) 15.908	(20.5) 138.628
	FB 10 – Modern Languages	(2) 20.000	(3) 29.000		(2) 23.800		(9) 72.800
	Sum Cluster II	**(11) 72.510**	**(10) 81.000**	**(3) 45.495**	**(5.5) 83.050**	**(7) 25.908**	**(36.5) 307.963**
Cluster III Natural Science, mathematics, Computer Science, and Medical Science	FB 11 - Geoscience/ Geography	(3) 36.000	(1) 3.400	(1) 17.900	(1) 17.320	(1) 11.500	(7) 86.120
	FB 12 – Mathematics/ Computer Sc.	(1) 13.000	(1) 12.000			(1.5) 14.600	(3.5) 39.600
	FB 13 – Physics	(1) 5.000	(.5) 1.850				(1.5) 6.850
	FB 14 – Chemisty, Biochemistry		(.5) 5.550	(1) 25.730			(1.5) 31.280
	FB 15 – Biological Science	(2) 17.000	(1) 12.000		(2) 27.250	(1) 12.000	(6) 68.250
	FB 16 – Medical Science	(1) 5.000	(1) 8.200	(1) 22.500	(1.5) 19.000	(1) 15.000	(5.5) 6.700
	Sum Cluster III	**(8) 76.000**	**(5) 43.000**	**(3) 66.130**	**(4.5) 63.570**	**(4.5) 53.100**	**(25) 301.800**
Centers						(1) 13.500	(1) 13.500
Sum		**(25) 214.510**	**(22) 175.300**	**(10) 181.949**	**(13) 178.908**	**(13) 114.408**	**(84) 865.075**
Included: Projects by more than one department			(1) 3.700		(2) 36.500	(1) 14.000	(4) 54.200

Quite often the assumption was stated that natural science departments and the departments of computer science and mathematics might be more willing start e-learning projects that humanities or social science - a phenomenon that has proven to be true in Frankfurt. Maybe due to the gradual involvement of all departments, no single department was left behind. Especially, the department of cultural science managed to acquire more funding than any other department due to its wide spread allocation of e-learning competencies through various staff members in many institutes. In this context, it is quite interesting to take a look at the figures 3 to 6: although cluster 2, the humanities, managed to receive a high amount of funding in the year 2010 (figure 3), and also had the highest funding rate per depart-

[1] The overall decline of funding can be explained by the introduction of an additional fund for students' projects.

ment in that year (figure 4), the amount per project was much closer to the average, since the funding was spread over many small projects (figure 5). In the humanities cluster, where this department is located, overall more projects were funded than in any other cluster (figure 5), but mostly they applied for smaller budgets than the natural science projects which seem to need more financial resources per project (figure 6).

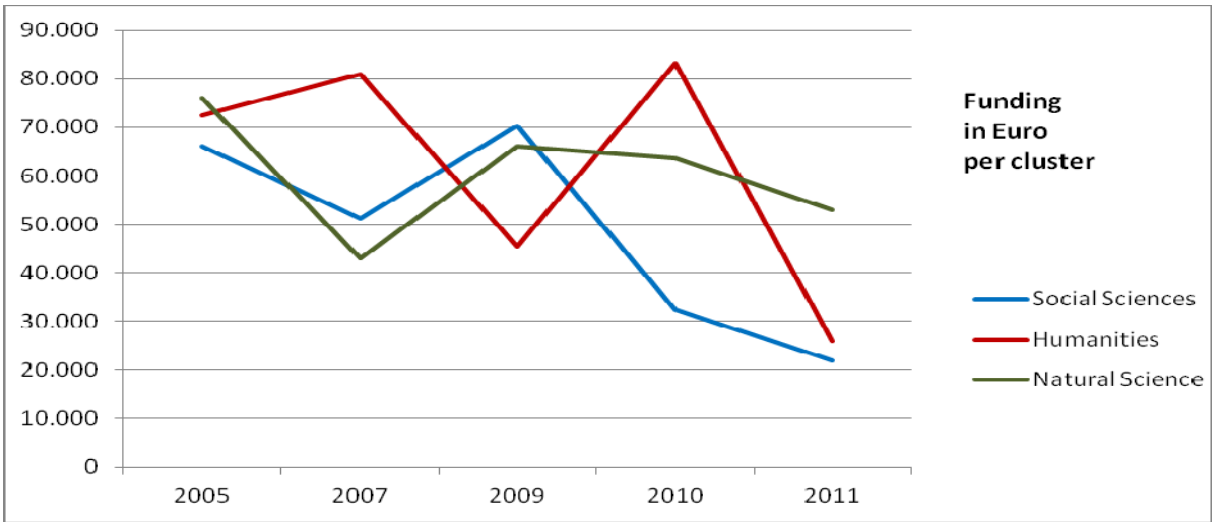

Figure 3: Funding in Euro in total per cluster

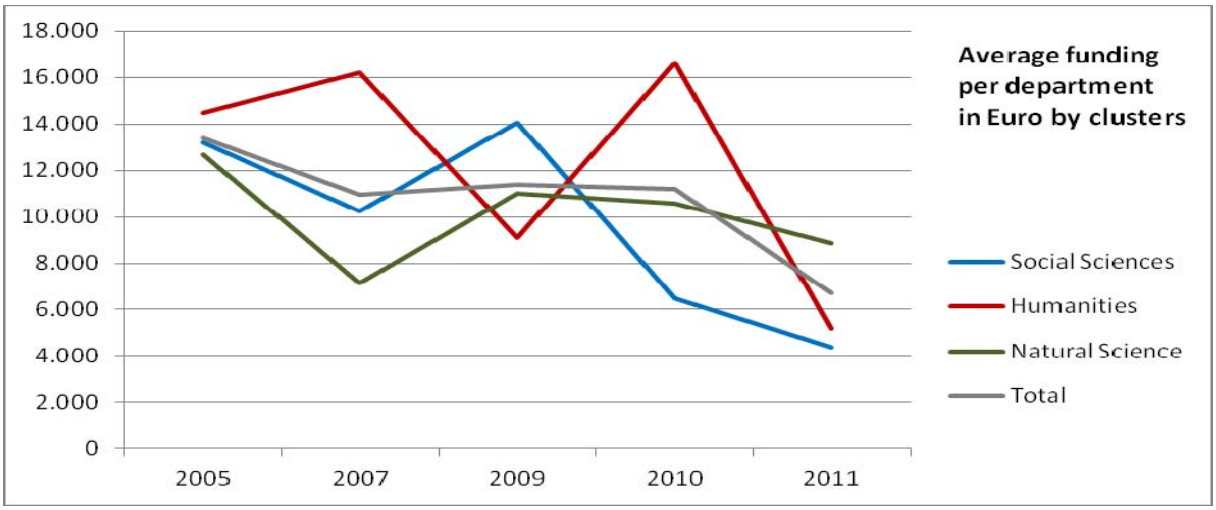

Figure 4: Average funding per department in Euro by clusters

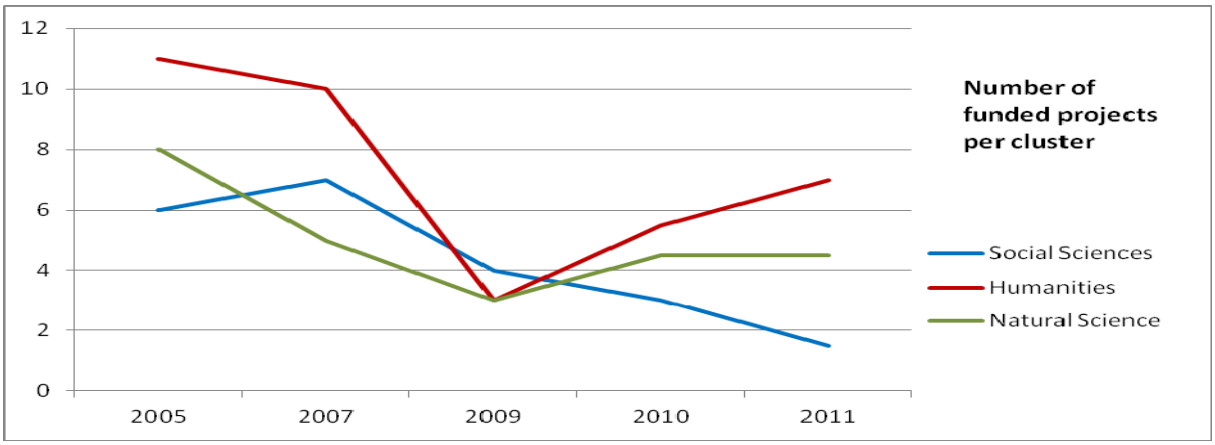

Figure 5: Number of funded projects by clusters

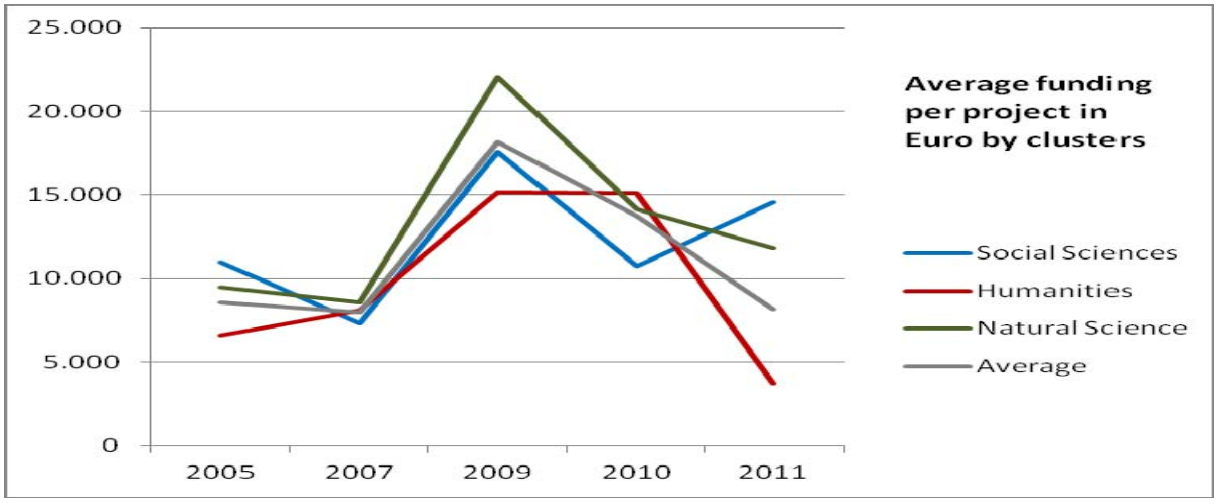

Figure 6: Average funding per project in Euro by clusters

During implementation, all the projects were accompanied by the central e-learning unit, studiumdigitale, well documented and evaluated[2]. In monthly meetings and annual conferences the projects present their results and share their experiences to other stakeholders and digital contents were made available publically (e.g. in [3]). In order to provide an additional incentive and make results available to the university's public, an e-learning award was promoted along with some public announcement of the winners on the e-learning networking day of the University of Frankfurt in 2008.

2.2.3 Qualification

As part of the central support structure, a qualification program on using new media in teaching and learning is provided. Besides 30 single workshops[4] which can be attended separately, a structured qualification program is offered, leading to the e-learning certificate of the University of Frankfurt [18]. The qualification program is divided into three main areas (see figure 7):

Figure 7: Structure of the e-learning qualification program

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2 http://www.studiumdigitale.uni-frankfurt.de/elf/index.html

3 Portal for LernBar-content at the University of Frankfurt: http://lernbar.uni-frankfurt.de/

4 http://www.studiumdigitale.uni-frankfurt.de/workshopreihe/index.html

By now, nearly 160 certificates were given to university staff members since 2008, mainly to young professionals who are interested in making their additional qualification visible as well as to external school teachers (see table 2).

Table 2: Bookings and participants in the e-learning qualification program at the University of Frankfurt

Term	Number of workshops	Bookings	Participants	External participants	e-Learning Certificates
Winter term 2006/2007	24	226	62	9	12
Sommer term 2007	29	141	76	6	8
Winter term 2007/2008	27	207	50	5	10
Sommer term 2008	24	232	59	17	19
Winter term 2008/2009	29	234	55	8	14
Sommer term 2009	25	222	69	10	14
Winter term 2009/2010	32	312	74	15	13
Sommer term 2010	34	399	76	12	18
Winter term 2010/2011	35	351	76	20	23
Sommer term 2011	32	273	81	44	11
Winter term 2011/2012	28	264	68	31	17
Sum	**319**	**2,861**	**746**	**177**	**159**

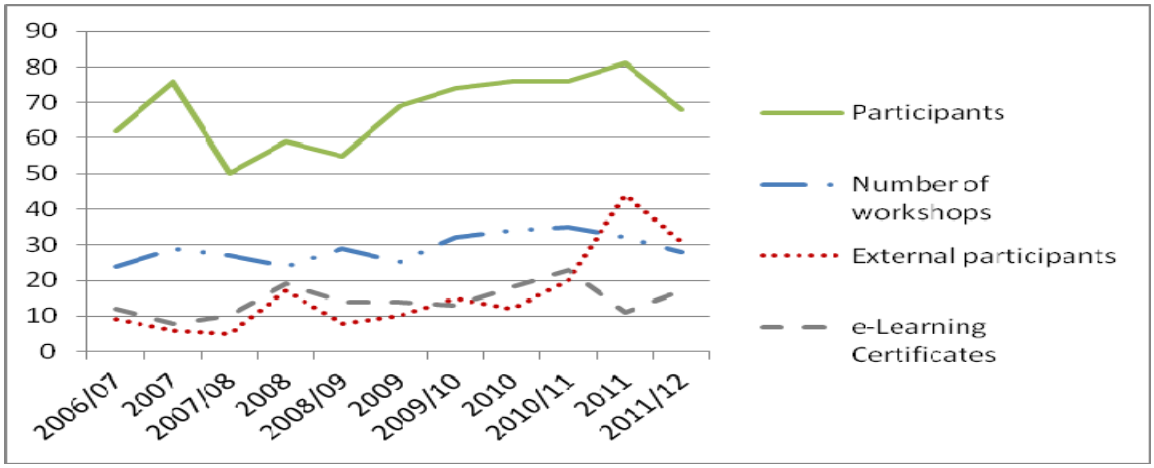

Figure 8: Development of the e-learning qualification program

While the numbers of participants, workshops, and certificates grew over the years, the decrease of external participants and participants in total can be explained by an increasing number of in-house workshops in schools and educational institutions in the last years which are not included in the table.

The workshops addressing the university staff members are closely linked to the funding program since the items which have to be described in the application forms for the funding correspond directly with the topics covered in the qualification program. Consequently, especially around the deadlines of the e-learning funding program the demand for workshops and one-to-one consultation rise significantly. At an university of the size of the University of Frankfurt (2,800 teaching staff members, 16 departments at 5 different locations) it is more than difficult to identify staff members potentially interested in the use of new media in teaching and subsequently to get in touch with them. Therefore, an incentive program as the e-learning funding and the qualification program help to make e-learning more visible and get teachers and support units in touch with each other. Additionally, teaching 12 participants in one workshop saves a significant amount of time and effort in comparison to one-to-one consultations, which are offered additionally. Also, the workshop program gives a good overview over potential topics and options for one-to-one consultation sessions because it helps teachers to get some insight into the range of potential e-learning settings. Going jointly through the certificate program helps teachers to understand the specific conditions in their departments even more, because they get to know the prerequisites in other departments. By this, they become more aware of their own teaching cultures and potential obstacles and challenges in their own departments.

2.2.4 Community and change management

In addition to the programs and measurements described above, the process was intensively accompanied by networking and community building activities. Each year, the departments of the current stage presented their progress and experiences to the next stage departments. Funded projects are obligated to make results and digital content available to the university's public. Their results are presented at the annual e-learning networking day and additionally, project descripttions are made available on the university's e-learning website and progress is documented in a blog[5]. Figure 9 presents the different measurements for the diverse target groups and on different institutional levels:

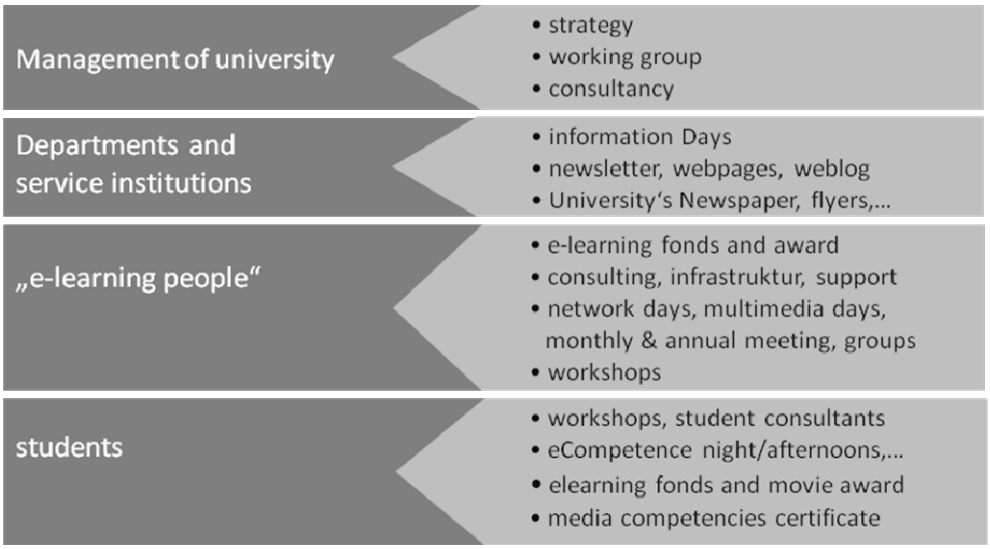

Figure 9: Combination of measurements on different levels of the university

Until now, networking and community building is fostered by a set of meetings and conferences: once the month, all the e-learning activists of the departments and centers are invited into one of the departments where this host presents its current e-learning activities, new plans, current obstacles, and requests for support or exchange. Besides these topics, any other topic brought up by any participant can be discussed. The e-learning unit organises the meetings in cooperation with the departments. Other participating centers are the center for student teacher training, the university library, the center for staff development, the student consultancy office, and the university computing center (figure 10).

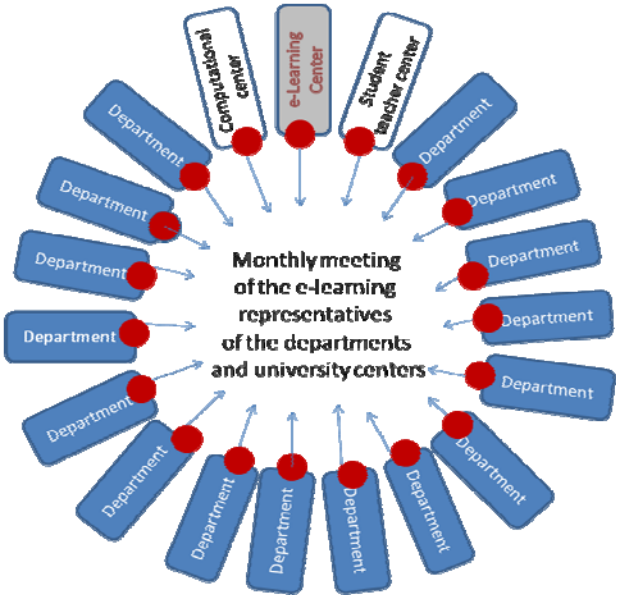

Figure 10: Monthly meeting of e-learning representatives of the departments and university centers

[5] http://www.studiumdigitale.uni-frankfurt.de/elf/index.html

Other monthly networking events are the 'open multimedia studio', a two hour session in which new technological or educational trends are presented and discussed. Recent topics covered aspects such as mobile learning, usage of apps, voting systems, and so on. Anybody can suggest topics for the next term or can present new applications. After the multimedia studio, the monthly informal e-learning meeting takes place in a bar near the central campus. Annual e-learning events cover the 'fall impulses', a conference in cooperation with an industrial partner, and the e-learning networking day in December, where all the funded projects present their result, as well as several smaller conferences covering special topics such as e-portfolios, wikis in e-learning, gesture based learning, and so on. These conferences also serve the objective to bring new knowledge into the university while making results of the university's e-learning projects available to a broader community beyond the institution.

3 SUMMARY AND CONCLUSION

For the above described program in 2007, the University of Frankfurt won one of the most important European awards on organisational development in educational institutions, the MedidaPrix[6]. Mainly, the combination of the described measurements allowed the university wide diffusion of e-learning as an innovation in teaching and learning. Instead of top-down pressure, incentive systems were installed and enough support provided for those teachers who were interested in applying new media in their teaching but were looking for support and advice. The installation of a qualification program made the e-learning center more visible and the development of competencies more time efficient, while one-to-one consultancy also was always available – especially for specific projects and requirements. The workshop program, monthly meetings, and regular conferences helped to build up an e-learning community were teachers also help each other as peers. Meanwhile they even conduct joint projects (even across departments and disciplines) as the current applications for the e-learning funds show.

After the four years of an organisational development process from 2006 to 2008 which aimed at the diffusion of e-learning in the university as a whole, a center for e-learning was founded officially in 2009. This center still offers all the described services and coordinates the networking activities.

Today, the center is divided into three service areas:

- instructional design (qualification, consultation) and evaluation/quality assurance
- media production (support and services)
- technological infrastructure (learning management systems, special applications)

The work division between departments, institutes, and the central e-learning unit differs depending on the competencies and resources available in the peripheral institutional units. If they have enough resources and competencies to produce digital content on their own, this activity is located fully at the department or institute. If they want to have access to the central support, they can assign tasks to the central e-learning unit. In most cases, this work division shifts from the central unit towards the institutes due to their growing competencies: while in early media production projects the institute often relies on intensive support and consulting, latter projects are often conducted independently. A standardized procedure model for the instructional design concept, the raw and detail concepts and for scripts for media production helped to raise and hold up high quality levels for e-learning [12] [13].

In terms of efficiency, services such as the provision of the e-learning infrastructure (i.e. learning management systems and other systems) are provided on a central level, so resources and competencies are allocated efficiently at a central place. Especially the decision of the university, to have the e-learning center managing the funding program helped to raise its transparency concerning the allocation of financial resources and the projects' results as well as their quality. Additionally, the network activities help to distribute experiences and new knowledge from outside into the organisation.

In the next step, the university plans to develop a content strategy, extend the lecture recording due to growing demand, and intensify its research program around e-learning.

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