EVALUATION OF AN INTERNATIONAL BLENDED LEARNING COOPERATION PROJECT IN BIOLOGY TEACHER EDUCATION

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ABSTRACT
At the beginning of the 21st century, virtual learning was thought to have the potential to revolutionize learning arrangements. This enthusiastic notion has given way to a kind of disillusionment, which has, however, led to a more realistic assessment of the potential of e-learning, the development of new conceptions, new methodical approaches, and opportunities for cooperation and collaboration. The didactic value of these emerging concepts is now under scrutiny.

The project presented in this article included the development, implementation and evaluation of a cross-national blended learning seminar on the didactics of biology. The class included three focus topics dealing with different aspects of biology education. The sample comprised students training to be biology teachers at the University of Technology Dortmund and Hacettepe University in Ankara. All students attended a class called "Teaching Biology" during the winter term 2008/09. The open source e-learning platform Claroline (www.claroline.net) was chosen as the learning environment. Participants had the opportunity to exchange ideas and information, to reflect on the learning process and to complete assignments in international teams. After completing the class, the students evaluated the concept based on their experience. In-class sessions, individual learning, exercises and application ranked higher than online phases, group work, discussions and information exchange. Items evaluating the overall concept received relatively high ratings. Despite the cautious ratings some items received, the positive overall results support efforts to further develop such international teaching concepts.
KEYWORDS: Blended-Learning, Biology Education, Biology Education Students, Evaluation,

INTRODUCTION

Over the past few years, developments in university education have been characterized by a growing trend towards internationalization. Course grades are being converted to a standardized credit point system (European Credit Transfer System) and many countries have switched to a common system of Bachelor's and Master's degrees. European exchange programmes (e.g. ERASMUS, Leonardo da Vinci) offer transborder mobility, where students are given the opportunity to spend one or two semesters at a foreign university, or to complete an internship abroad. However, the internationalization of the education system is not limited to such developments, but also encompasses information and communication technologies, which have great potential. They offer educational opportunities which seemed unimaginable only a few years ago. Take, for example, international MBA programmes (Master of Business Administration), which are transnational courses that pose an alternative to traditional university education (Schenker, Wicki & Demont, 2006).

According to the e-learning action plan, information and communication technologies provide a virtual extension of the students' geographic mobility (Kommission der europäischen Gemeinschaften, 2001). Their integration into university curricula will be a political priority over the next few years (Knierzinger & Weigner, 2008).
The internationalization of the education system raises expectations of increasing student mobility. Nevertheless, many students will not be able to benefit from this development, due to high student numbers and limited financial resources. Thus, information technology is expected to play a key role in internationalizing the education system. It may not be able to replace geographic mobility, but it can create a tight network among cooperating universities and enable virtual cooperation among students and teachers at different universities, both nationally and internationally.

From E-learning to Blended Learning

The term e-learning can be applied to all those forms of teaching and learning based on the use of information and communication technology (Clark & Mayer, 2003). Computer-Based Training, Web-Based Training, online learning, distance learning, tele-tutoring, distributed learning – these are just a few examples from a broad

variety of e-learning offerings. E-learning is often used as a generic term for all such forms of learning (Reinmann-Rothmeier, 2002).

Today, e-learning has become immensely popular at many national and international educational facilities and is turning into a common method of teaching. It is present at different levels of education, from schools to universities and vocational training. As technology is quickly improving, a growing number of e-learning concepts are finding their way into the education system. Compared to traditional forms of learning, e-learning offers numerous advantages: increased flexibility during the learning process, self-organized learning, different formats and ways of coding, and virtual communication. But in spite of its benefits and its increasing presence in the education system, e-learning has some disadvantages as well. Frequent points of criticism include: content cannot be directly imparted, social aspects are lacking, and the learners' needs cannot be catered to individually. Given that these problems can usually be avoided during in-class sessions, a new learning concept called Blended Learning was developed (Allen & Seaman, 2003; Gallenstein, 2001; Sauter, Sauter & Bender, 2002).

Blended learning is a hybrid learning concept integrating traditional in-class sessions and e-learning elements (Reay, 2001; Rooney, 2003) in an attempt to combine the benefits of both learning forms. Elements from e-learning or in-class sessions should not be included arbitrarily, nor should one form of learning simply accompany the other . There is no rule of thumb determining the percentage of online and in-class phases in the concept (Reimer, 2004). Some fields are better suited for in-class methods, others clearly benefit from the use of the new media (Lang, 2002). The emphasis placed on each phase depends on the learning goals, content, learning group, available online resources and didactical design (Ostguthorpe & Graham 2003). The decisive factor in developing blended learning concepts is to combine the methods of in-class learning and e-learning in a way that is appropriate to both pedagogy and current concepts of learning (Lang, 2002).

As opposed to classic e-learning concepts, in-class sessions offer opportunities for social communication. However, students can still benefit from the advantages of e-learning: learners can easily access material used during in-class sessions in a virtual learning environment. The instructors can quickly implement content changes and additions without additional costs, e.g. for photocopying. In this way, learning materials are always of the highest quality, but can also easily be adapted to changes in the learning/teaching scenario. Instructors thus have the ability to flexibly respond to the learning situation and the learners' needs by modifying content or teaching methods. Learners are given the opportunity to undertake research and communicate according to their personal preferences, irrespective of time and location (Cunningham & Billingsley, 2003; Reinmann, 2005). In theory, there are many possible combinations of different methods such as individual work, group work, discussions, project work, etc. These different assignments are completed using an online learning platform, which facilitates cooperative work by offering different tools, such as chat, email, whiteboard, forums and wikis.

Today, rapid developments in society, the economy and technology are changing educational goals. Currently, education policies are directed towards greater compatibility in university programmes, an increased internationalization of education, and more national and international cooperative activities. In addition to the advantages mentioned above, the blended learning approach has the potential to contribute to current educational goals, especially the internationalization of educational programmes. For example, universities in different countries might offer joint blended learning classes including local in-class sessions and an e-learning platform for communication and cooperation among students and lecturers.

These high hopes and expectations give rise to many questions, which must be answered by empirical research: how exactly will blended learning be implemented at universities? How will the aforementioned characteristics and advantages play out in real life situations? How well can these learning concepts be implemented through international cooperation? How will students and teachers evaluate their experience with this learning concept? Even though blended learning is a relatively new concept, it has already received attention from researchers in many different fields of study. Most research in this field was published by experts in media didactics (Akkoyunlu & Yılmaz-Soylu, 2008; Derntl & Motschnig-Pitrik, 2005; So & Brush, 2008, Kerres & De Witt 2003), business disciplines (see Godfrey, Johnson, Pollack, Niendorf & Wresch, 2009) and foreign language didactics (Harker & Koutsantoni 2005; Kupetz und Ziegenmayer 2005, Sharma & Barrett, 2007), but there are also publications from other disciplines (Barnard, Lan, To, Paton & Lai, 2009; Bauer & Graf, 2003; Ginns & Ellis, 2007). However, much remains to be done. Most of the research was conducted on a national scale. So far, the internationalisation of lectures and the evaluation of such classes has not been the focus of empirical research. The publication at hand aims to contribute to this specific field of research.

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The blended learning class provided the opportunity to have student teachers from two different countries (Germany and Turkey), with different cultural backgrounds and different ideas about teaching, undertake a joint project and share both thoughts and information. For this purpose, we developed, implemented and evaluated a cross-national blended learning seminar on the didactics of biology. This article presents the students' evaluation of the concept.

METHOD

Sample

The study sample comprised students training to be biology teachers at the University of Technology Dortmund and Hacettepe University in Ankara. All students attended a class called "Teaching Biology" during the winter term 2008/09.

Class design: The class dealt with current topics of biology education and generally outlined the field of didactics. For international cooperation, three focus topics were chosen: 'What is Biology Didactics?', 'Epistemological Aspects' and 'Objectives of Biology Education'. The class was held in German. This was possible because Hacettepe University features a biology programme with German as the second language of instruction.

The open source e-learning platform Claroline (www.claroline.net) was chosen as the learning environment. At the University of Technology Dortmund, the learning platform had already proven to be a valuable tool. It stands out due to its easy installation process, its speed and its ability to adapt to user requirements. Claroline offers a broad range of tools which can be upgraded by using extensions: class description, calendar management, documents/files uploaded by lecturers, exams for participants, upload area for students, forums, participant groups, users, chat, wiki, and access statistics for instructors. The instructors can activate or deactivate any feature according to their current requirements. This avoids confusion due to unutilized features.

As a typical blended learning scenario, the course included phases of both online work and class attendance. During in-class sessions, lecturers in Dortmund and Ankara gave basic factual information on the topic. All content was closely coordinated beforehand. The content discussed during class sessions was also made available online. Using the learning platform, participants were given the opportunity to broaden their knowledge on certain topics, as well as communicate and cooperate with classmates. For these purposes, the learning platform provided the following features:

- Fixed dates/events: Special events were posted
- Announcements: Assignments and news were posted
- Documents/files: The content discussed during class time was made available online to the participants as PowerPoint presentations, Word and PDF files, as well as specifically edited videos featuring the didactic material used in class. This gave participants who did not attend class the opportunity to catch up online.
- Upload area: Everyone involved in the class could upload their own files to share information with the other participants. This feature also facilitated group activities.
- Email: Participants had the opportunity to get in touch with instructors and classmates via email.
- Forums: The forum gave participants the opportunity to share news with everyone.
- Groups: This space was reserved for groups formed for class activities. Information could be shared among group members only, making it invisible to members of other groups.
- Users: Contained a list of participants including their email addresses.

Over the duration of the class, students were given three assignments which they were to complete both individually and in international group work. The assignments were to be completed outside class time.

The first assignment was to be done individually. The task was to evaluate statements. Each participant had to choose five statements, assess whether these statements were scientific or not, and give a detailed explanation of his or her assessment. Students were expected to work with the information given during the lecture, but also include their own considerations. By using the learning platform, students had the opportunity to learn about the other participants' opinions and comment on them, which would have been impossible during class time, mostly due to time constraints. The participants were given one week to complete the assignment.

The second assignment was to be completed in international groups. The task was to undertake an empirical study to answer the following research question: does smoking in teenagers affect body height? The groups were

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put together by the instructors. Group allocation was randomized; however, each group had to contain students from both countries. Each group had 6 to 7 members. The participants' task was to derive hypotheses from the research question and draw up a research design to test them. Each group was expected to survey at least a hundred people in each of their cities. After analyzing the results, the group was to write a short research paper (approx. 2 pages). These papers were accessible to all participants on the learning platform. Students were given three weeks to complete the assignment.

The third assignment targeted learning objectives. For this, a new forum with 39 sub-forums was set up. Their respective titles provided a broad learning objective or a skill to be acquired. The participants' task was to derive testable, highly specific learning objectives from three broad objectives they had picked out themselves. The participants were given one week to complete the assignment.

Class procedure: During the summer term of 2008, a pilot study was conducted, assessing how students dealt with the learning platform and whether technical problems would arise. As no problems occurred, the platform was used in the "Teaching Biology" class during the 2008/09 winter term. Since lecture periods were different for Turkey and Germany, the class content was restricted to three focus topics, and the duration of the class was limited to two months.

The first two topics were discussed in two successive two-hour seminars, which required attendance and were held on a weekly basis. After the second seminar, students were presented with the first assignment. The following week, the results were discussed in class in each country. After the discussion, the second assignment was set, and the participants were asked to submit it in three weeks' time. The third focus topic was discussed in week 7. This was when participants were given their third assignment. During the final seminar, the results for both assignments were discussed.

Evaluation: Since the participants' previous knowledge about computer use and teaching methods was important to complete the class successfully, a pre-class questionnaire was handed out assessing computer access, frequency and reasons for computer and internet use, as well as previous experience with certain methods of teaching.
To help develop high-quality blended learning activities in the future, the learning environment was subjected to a summative evaluation at the end of the class. This was also done using a questionnaire. The survey contained items regarding personal information and the assessment of online material (Reinhardt, 2008a), online tools (Reinhardt, 2008b), the overall concept (Reinhardt, 2008c), work periods and the international group activities from a participant's perspective. For evaluation, a five-point Likert scale was used (depending on the question - 5: strongly agree / very satisfied / very useful; 1: strongly disagree / very dissatisfied / not useful at all).

RESULTS

Personal information

99 students participated in the survey, with 41.4%% (n=41) being from Dortmund and 58.6 (n=56) being from Ankara. All of the Turkish participants were training to be biology teachers; students from Germany were also training to be teachers, with biology as either their major or minor. In our sample, women were over-represented: 83.2% of the students were female, while only 16.8% were male. Age ranged from 20 to 32 years (M=22.6, SD=2.04).

Computer access and computer/internet use

The majority of participants (77.9%) own either a desktop PC or a notebook. 65.3% of the participants said they use a computer at home, 35.8% use it at university. None of the participants had no computer access at all.

87.3%/85.5% use the computer/the internet on a daily or almost daily basis. 10.7%/12,2% use the computer/the internet several times a week. Only 2% of the participants said they use their computer/the internet only sporadically. There were no participants who never use the computer or the internet.

The computer is often used for internet access (83.2%), word processing (55%), listening to music (52.6%), electronic reference works (42.1%), and watching videos or looking at photos (48.4%). However, 72.5% never do programming, and 45.2% never use drawing or graphical programmes.

Frequency of experiencing certain teaching methods

Table 1 shows that all participants regularly experience classroom lectures. 89.9% do group activities, 52.5% have project classes and 33.3% practice e-learning on a regular basis. 69.7% have never experienced blended

learning, 30.3% have only experienced it once. Since some of the participants were involved in the pilot class, most of those choosing "once" probably had their first experience of blended learning during this very class.

Table 1. Frequency of experiencing certain methods of teaching

	Frequently / occasionally		once		never	
methods of teaching	n	%	n	%	n	%
Classroom lectures	99	100	-	-	-	-
Distance learning	13	13.1	26	26.3	60	60.6
E-learning	33	33.3	28	28.3	38	38.4
Project classes	52	52.5	29	29.3	18	18.2
Group activities	89	89.9	10	10.1	-	-
Blended learning	-	-	30	30.3	69	69.7

3.4 Evaluation of class phases and working methods

Table 2 summarizes the mean values and standard deviations for student satisfaction with class stages and teaching methods. The mean values are around the middle of the scale. However, there are notable differences. In-class phases scored the highest, followed by exercises and application, individual learning (using online material) and online phases. Discussions and exchange of information scored a 3.1. Compared to other phases and work methods, group activities achieved a relatively low score of 2.8.

Table 2. Evaluation of class phases and working methods

	Mean	SD
In-class phases	3.7	.87
Online phases	3.3	.95
Individual learning (using online material and assignments)	3.6	1.11
Group activities	2.8	1.17
Exercise and application	3.5	.91
Discussion and exchange of information	3.14	1.06

3.5 Evaluation of available online material

Table 3 summarizes the results of the online class material evaluation. Two different scales were used for this evaluation. For the first 3 items, the scale ranged from "very useful" (5) to "not useful at all" (1), for the following 3 items the scale ranged from "strongly agree" to "strongly disagree" (1).

The table shows that the participants gave the online class material a relatively high rating. All values ranged around 4. The video material ($x = 3.8$) and the lecture notes ($x = 3.9$) were regarded as less useful. However, these ratings are just slightly below 4. It is also important to note that participants mostly reported no technical difficulties downloading the materials.

Table 3. Evaluation of online class material

	Mean	SD
The online learning material (lecture notes etc.) available for this class was…	3.90	.76
The PowerPoint slides available for this class were…	4.06	.76
The video material available for this class was…	3.78	1.03
Overall, I found it very useful that the teaching and learning material used during this class was available online.	4.13	.88
I would like future classes of this kind to make stronger use of digital teaching and learning material.	4.05	.91
No problems occurred when downloading and/or opening the files containing digital teaching and learning material.	4.10	1.08

3.6 Evaluation of online communication tools

Table 4 shows that participants tended to agree that the use of online communication tools in class was linked to clear tasks and objectives ($x = 3.94$), and that tasks to be completed using online communication tools were suited for this medium ($x = 3.8$). However, participants only partially agreed that the use of online

communication tools in class helped them keep in touch with their classmates (x = 2.96) and that the overall learning gain was improved by using online communication tools (x = 3.2).

Table 4. Evaluation of online communication tools during this class

	Mean	SD
The use of online communication tools (email, forums) in this class was linked to clear tasks and objectives.	3.94	.74
The assignments completed with the support of online communication tools were suited for this medium.	3.88	.75
Overall, the use of online communication tools in this class improved mentoring by lecturers.	3.38	.94
Overall, the use of online communication tools improved relations with my classmates.	2.96	1.05
Overall, I learnt more in this class due to the use of online communication tools.	3.02	.94
Overall, the effort required for using online communication tools was appropriate in relation to the learning gain achieved during this class.	3.43	.95
I would like future classes of this kind to make stronger use of online communication tools.	3.36	1.07

3.7 Evaluation of group activities

Table 5 shows the evaluation of communication and teamwork from the participants' point of view. Communication concerning personal matters scored the lowest. Participants usually did not talk about private matters (x = 1.98). Communication with the lecturer ranked highest. The participants agreed that it was easy for them to communicate with their lecturers via the learning platform. All other statements scored around the middle of the scale, which means that the participants expressed only partial agreement.

Table 5. Evaluation of communication and group activities during class

	Mean	SD
We not only discussed the class assignments but also talked about private matters.	1.98	.94
It was easy for me to communicate with lecturers and class assistants via the e-learning platform.	3.65	.99
My group and I discussed intensively the work done on our assignment.	2.97	.97
We developed strategies to complete the assignments together.	3.24	.96
I received responses to my messages.	3.31	.98
Over time, my online communication skills improved.	3.07	1.07
We developed questions and ideas concerning the assignment as a group.	3.03	.97
Over time, cooperation with my classmates improved.	3.01	.96
I feel that I benefited from the use of online elements.	3.17	1.00
I had the impression that my classmates participated actively.	3.08	1.03
For the completion of the assignments, we set common goals and succeeded in realizing them.	3.05	.98
I compared the results of our assignments to others' and evaluated my own work.	3.14	1.13

Evaluation of the overall concept

Table 6 represents the evaluation of the overall concept. All values are in the positive range. The participants tend to agree that, for example, the instructors did a good job explaining the class concept and that the online activities were linked to clear tasks and objectives. The assignments given in class score between 3.6 and 3.8 regarding their organization, their content and their suitability for online completion. However, with a mean value of 3.1, the learning gain achieved by combining in-class lectures and online activities scored the lowest.

Table 6. Evaluation of the overall concept

	Mean	SD
The lecturer did a good job explaining the overall concept before the start of the class.	4.13	.78
The organization of online assignments was sufficiently prepared.	3.60	.92
The content of the online assignments was sufficiently prepared.	3.73	.91
The online activities in this class were linked to clear tasks and objectives.	3.82	.92

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The class assignments were suited for online media use.	3.79	.82
While doing online activities, I felt well mentored.	3.67	1.09
Overall, I learnt more through the combination of in-class lectures and online activities.	3.13	.97
I would like future classes of this kind to focus more strongly on complementing in-class lectures with online activities.	3.52	.91

4. DISCUSSION AND OUTLOOK

Globalization is increasingly affecting the internationalization of university research and education. Partner universities cooperate on a national and international scale to conduct projects in virtual classrooms (Lenz & Machado, 2006). The blended learning concepts which are currently being developed have great potential to contribute to modern teaching scenarios. Since most research has so far been conducted on a national scale, internationalization requires some adjustments to the concept. In the scope of this study, an international blended learning concept was developed and evaluated. Two universities located in Turkey and Germany cooperated on the project. The class was designed for students training to be teachers at the University of Technology Dortmund and Hacettepe University in Ankara. Participants were given the opportunity to exchange ideas and information, to reflect on the learning process, and to complete assignments in international teams. After completing the class, the students evaluated the concept based on their experience.

As computer skills are an important asset for successful participation in a blended learning class, the participants' experience was evaluated prior to the start of a class using a questionnaire. Results showed that more than 85% use a computer/the internet on a daily or almost daily basis. For them, the computer represents an everyday study tool. Most participants said they use the computer for word processing, and they use the internet to check their email, research information, and communicate. Given these results, it is safe to assume that participants have sufficient computer skills to complete the class without encountering technical difficulties. Similarly, a lack of computer skills will not affect the evaluation of the class.

Concerning "class phases and methods", students rated in-class sessions, individual learning and practice and application the highest. Online phases, discussions and information exchange received moderate ratings. Before discussing the above results in detail, however, it seems reasonable to elaborate on the participants' experience with teaching methods. Unsurprisingly, all participants have considerable experience with in-class sessions. However, few had participated in e-learning (33.7%) or distance learning (13.7%) on a regular basis. The percentages for blended learning are even lower. Just 32.6% had participated in blended learning beforehand. Lower ratings for online phases might thus be due to learning habits formed by in-class 'chalk and talk' teaching. Presumably, students prefer teaching methods catering to the learning habits they have developed over the years, and these preferences will in turn affect the evaluation of new learning methods. This might also apply to the results for individual learning, discussion, and exchange of information. As most participants have little e-learning experience, they will be unfamiliar with discussion and information exchange via learning platforms; individual learning, however, should be a familiar process. According to Da Rinn (2005), the integration of new forms of learning has proven to be a slow, almost cumbersome process, as learning habits change over long periods of time.

On the other hand, research shows that new methods, material and work routines integrated into the teaching process are highly popular with the students ("novelty effect", Clark & Sugrue, 1988) and positively affect motivation, interest, evaluation, learning gains, etc. (Blömeke, 2003; Kerres, 2001). Why did this effect not kick in during the online phases of this study? Considering some oral statements students gave during class, one possible explanation might be that despite the advantages of the concept, changes to the learning routine cause an additional workload (see Kroop & Magler 2005). This strain might have affected the students' rating.

Online group work scored the lowest of all "class phases and methods". Students were asked to undertake their own empirical research in international groups, and to write up a joint research report. Even though 90% of the participants regularly work in groups, virtual teamwork via learning platform constituted a way of working students had never before experienced, either in school or at university. Cultural differences and language barriers might also be confounding variables. In particular, during the planning stages and the preparation of the research report, the virtual group work required a high degree of communication among the group members. Some authors point out that a lack of informal signals such as gestures, facial expressions and intonation might hamper virtual communication and cooperation (Hinds & Bailey, 2003; Weinkauf & Woywode, 2004). Furthermore, international cooperation lacks one feature of blended learning: meeting one's classmates in person. Comparing the evaluation of group work as a "class phase and method" to the set of items dealing with

"communication and group work", which included more detailed questions, it becomes evident that more specific items received better ratings than group work in general. Students most liked communicating with their lecturers via the learning platform. Other features that received positive ratings were developing joint group strategies to complete assignments, getting feedback on messages, and being able to compare their own assignments to the work of other groups (thus facilitating self-evaluation). A qualitative data analysis will supply the exact reasons for the low group work ratings.

The students approved of online access to the class material via the learning platform. All items in this field scored values around four on a five-point scale. Items related to available online communication tools also received positive ratings, with just one exception. For example, students tended to agree that the use of online communication tools during the class was related to clearly defined tasks and objectives, and that tasks to be completed with the help of online communication tools were suited to this medium. However, students only partially agreed that they learned more due to the use of online communication tools.

Items concerning the evaluation of the overall concept generally scored positively. Concerning learning gains, the results parallel the evaluation of online communication tools. Students only partially agree that they learned more due to the combination of in-class sessions and online activities. Even though higher learning efficiencies are worth striving for, this result is by no means a setback. The focus of this study was on international cooperation and information exchange rather than on maximizing learning gains. All other items in this set of questions scored between 3.5 and 4. Despite the cautious ratings some items received, the positive overall results support efforts to further develop such international teaching concepts.

When interpreting the ambiguous ratings some items received, one should always keep in mind that the students had to deal with two completely new experiences: a novel learning concept and international cooperation. Also, the limited duration of the project might have had negative effects.

Organizers are likely to encounter lot of obstacles when developing such concepts. However, many of those obstacles can be overcome by the commitment and dedication of the lecturers involved in the cooperating countries. Difficulties include differences in public holiday schedules and examination regulations, cultural and organizational obstacles, inexperienced participants, and curricular differences and obligations.

The present study has yielded many insights concerning current difficulties and problem areas, but also opportunities and the potential for cross-border online projects. Based on these results, further research is needed to optimize concepts, improve evaluation tools and facilitate a systematic development of these learning concepts.

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