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How Can Medical Students Be Prepared Effectively for Current Challenges in the Field of Expert-Guided Online-Counselling on Preventive Interventions? - A Randomised, Prospective Trial Exemplified by a Case Study of Mammography-Screening

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Für meine Familie

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(See "8 Publications", p. 88. for Fig. 6, Fig. 16, Fig. 17, and Fig. 18 in publications of the project)

List of Abbreviations

X = test cases

O = training cases

Y = yes

N = no

SW = weeks of the semester

G1 = self-directed group of students

G2 = trainer-directed group of students

O_1 = first point of data observation (pre)

O_2 = second point of data observation (post)

X = educational intervention, divided into X_a and X_b

X_a = provided to G1 and G2 at the beginning of the course

X_b = provided to G2 before O_2, to G1 after O_2

AS = Analysis sample

PT = learning objectives already been regarded in previous training programs throughout the curriculum

NT = learning objectives as new aspects throughout the topical course

P1 = pretest

P2 = independent training

P3 = posttest

Group X = group of students with even continuous numbers in individual codes

Group Y = group of students with uneven continuous numbers in individual codes

SP = standardised patient

VP = virtual patient

1   Introduction

1.1   Approach to preventive medical care

Global health landscape has been transformed over the last two decades, particularly in western societies: The purpose of medical care has changed its focus from reducing premature mortality to minimise disability (Institute for Health Metrics and Evaluation Seattle 2013). An estimated two third of worldwide deaths today is caused by non-communicable and chronic diseases, including chronic cardiovascular and lung diseases, as well as cancer (Lim, Vos et al. 2012, World Health Organization 2014). Thus a major proportion of death and disability in western societies is preventable by increasing health-awareness and changing aspects of the population's daily routine (Mokdad, Marks et al. 2004). Therefore western medical systems are increasingly geared towards preventing rather than treating as a form of medical care. Programs for educating public in habits, such as smoking, physical activity and nutrition, are being established (Donnelly, Greene et al. 2009, Lubans, Morgan et al. 2009, West, May et al. 2013) and further preventive methods are being increasingly implemented into medical systems. They include regular health check-ups, vaccination and screening programs (Tota, Chevarie-Davis et al. 2011, Bijlsma, Rendering et al. 2014). The aim is to provide preventive medical procedures on three levels: firstly, for avoiding occurrence of disease (e.g. education and vaccination programs), secondly, for detecting and addressing existing diseases to prevent occurrence of symptoms and disability (e.g. cancer screening programs and treatment of hypertension) and thirdly, for reducing negative impact, such as disability or death, of symptomatic disease (e.g. treatment and rehabilitation) (Cohen, Chavez et al. 2007).

The success of these actions depends on specific factors: It is not only influenced by patients' health literacy and the impact of the Internet on it, but also by the arising demand for online-communication between doctors and patients and the resulting challenges for doctors in this field.

1.2 Impact of population's health literacy and the Internet

Adequate health literacy amongst the population fosters effectiveness of today's medical care, since it is associated with better understanding and hence more coherent participation in preventive medical procedures (Scott, Gazmararian et al. 2002, Kobayashi, Wardle et al. 2014). Therefore the movement towards a preventive medical approach has been fostered in those groups of the population that show a high level in health literacy (Bijlsma, Rendering et al. 2014). However, there is still a lack of patients' average participation in preventive procedures in those groups of the population that show a low level in health literacy (Bijlsma, Rendering et al. 2014). Thus it needs to be promoted, in order to reach a high level in effectiveness of medical treatment. Therefore the problem of how to promote and optimise health literacy amongst patients arises; the recent establishment of the Internet presents an opportunity to meet this problem.

The impact of the Internet is "changing the landscape of clinical practice and health care" (Wicks, Stamford et al. 2014). The development of the Internet is a dynamic process and its impact on western societies is going to constantly increase in the coming years (Eysenbach 2001). This development brings unavoidable challenges for medical care with them that need to be addressed, in order to sustain effective health care in the future (Donnelly, Shaw et al. 2008, Stadtler, Bromme et al. 2009, Calvillo, Roman et al. 2013).

The proliferation of Internet-related media is increasing the access to information through a variety of medical sources to patients (Bromme and Jucks 2014). Current medical topics are not only present in public media and on various websites. They are also discussed online, via online-forums and social networks (McCracken 2012, Teufel, Hofer et al. 2013). According to the "eHealth Action Plan 2012–2020", the currently most popular websites, are those containing medical information (European Commission 2012). Even more so, a recent study from the Netherlands indicates that the Internet is the number

one source for health-related information (82.7%) (Van de Belt, Engelen et al. 2013).

A study from the United States also states that approximately 60 % of the American population searches the Internet for health information and 35 % indicate that they have even tried to find a diagnosis on their own via online-research (Fox and Duggan 2013). Hereby, the relationship between patients and doctors is changing. Due to the patients' increased access to medical information and opportunity to discuss medical problems in online-facilities, their medical experience and health literacy is increasing, as well as their responsibility and demand on autonomy in medical decisions (Russ, Giveon et al. 2011, Hewitt-Taylor and Bond 2012). This in turn, can benefit the effectiveness of medical care, for instance by increasing patients' participation in preventive medical procedures (Stadtler, Bromme et al. 2009, Dedding, van Doorn et al. 2011, Calvillo, Roman et al. 2013, Pirillo 2014).

At the same time it can threaten effectiveness of medical care: Health-related information is accessible on all kinds of websites and platforms, while quality control measures are missing. Thus scientific consistency and reliability of these sources differs (Eysenbach 2002). In addition, pharmacy firms and publishing companies own certain websites for medical information, which can bias content and quality of the provided sources. Even though official seals have been established, in order to rate medical websites on their consistency, these are still not well enough established amongst the population (Stadtler, Bromme et al. 2009). Patients usually lack medical expertise and are thus not able to evaluate and classify the quality of particular medical information. This can be described as "asymmetry of expert knowledge" between patients and doctors (Bromme and Jucks 2014). Nevertheless, a study by "The international Society of Dermatology" illustrates that about 70 % of patients that search the Internet for health-related information rate the resulting information as beneficial (AlGhamdi and Almohideb 2011). The study further states that the Internet is reported as the most popular source for health-related information (82.7%),

compared to information provided by health care professionals (71.1%) (Van de Belt, Engelen et al. 2013).

Furthermore only 40 % of patients in an American study that tried to find a diagnosis on the Internet had the same confirmed by a doctor (Fox and Duggan 2013). Therefore independently developed medical decisions by patients run the risk of being based on inconsistent information sources. Hereby health of that particular patient is threatened. (AlGhamdi and Almohideb 2011, Wong, Yuen et al. 2014) In light of these developments, the significance of patients' guidance through these various sources by medical experts (doctors) becomes apparent.

1.3   Arising demand for online-counselling

The Internet also opens up new communication media in fields of medical topics (Bromme and Jucks 2014). This is driven by a rising technical potential (Pirillo 2014) as well as by a high demand for online-communication by patients, due to the Internet's easy access, concise information and anonymity (Reips 2006). Results from the study "Online Communication Between Doctors and Patients in Europe: Status and Perspectives" (Santana, Lausen et al. 2010) indicate the interest in Internet associated health-services among the population that is likely to increase in the coming years. Furthermore, a recent study from the Netherlands presents that approximately one-quarter of the Dutch population would like to communicate with a doctor via the Internet (Van de Belt, Engelen et al. 2013). Results from the Cisco (International IT Company) and MSL (German communication consultancy) health study indicate that 74 % of German citizen are interested in online-communication with their doctor and 28 % claim to already contact their doctor online (MSL 2012, CISCO 2013). While the scientific value of these two studies can be questioned, they illustrate the recent trend towards online-communication in the medical sector.

In addition to the intellectual debate about online-counselling, the topic has reached a political level. The recent promotion of the "e-Health Action Plan

2012-2020" (European Commission 2012) directs concrete implementation of online-communication within European health care systems.

The advantages of this transformation are clear; as for instance described in an article "BIG MED" in "THE NEW YORKER" that states "Reinventing medical care could produce hundreds of innovations. Some may be as simple as giving patients greater e-mail and online support from their clinicians, which would enable timelier advice and reduce the need for emergency-room visits" (Gawande 2012). The relevance of online-counselling by medical experts (doctors) particularly arises in fields of preventive medical procedures. Momentarily, patients discuss their medical issues in online-forums that claim to offer "expert-guided counselling". At the same time it is not always clear whether the counselling is guided by an expert or by a layperson. In light of these facts, doctors need to present themselves online to offer patients professional and expert-guided counselling; complementarily, patients can be invited for personal medical examination, if needed (Eysenbach 2001).

1.4   Arising challenges for doctors

The impact of the Internet on Western medical care, introduced above as (1) expanded information environment of patients and (2) online-communication, creates two main challenges for today's doctors:

1. Guidance of patients on medical information sources from the Internet
2. Online presence in order to provide patients professional and expert-guided counselling on medical concerns

As soon as doctors are present on the Internet and practise in fields of online-counselling patients, the communication setting changes from being face-to-face to Internet-based. This in turn causes new challenges for doctors' communication competencies (Bromme, Jucks et al. 2004, Hasebrink, Schulz et al. 2013). This context is illustrated by Fig. 1.
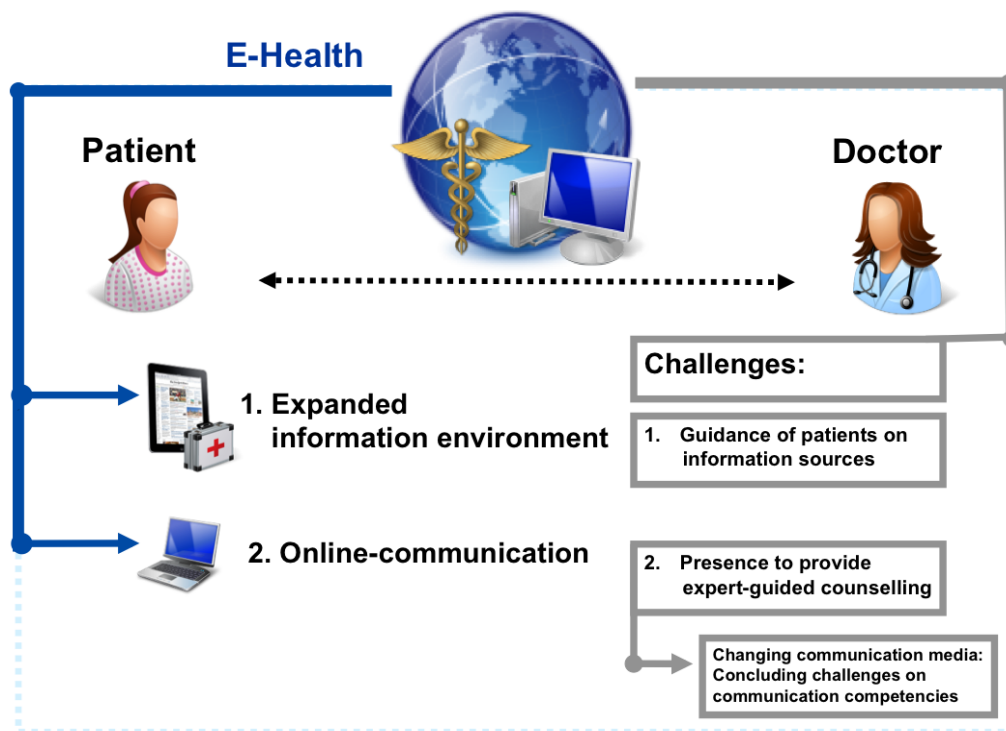
Fig. 1 Impact of the Internet on medical care. The arising challenges for doctors.

In order to specify these resulting challenges, factors of online-communication and the resulting impact of the new communication medium on doctor-patient communication is elaborated below.

Impact of changing communication media. The definition "internet-based communication" (Reips 2006) describes the exchange of information between people via internet-networks and is described by the term "online-communication" throughout the proceedings of this project. The relevant types of communication media for this project ("Face-to-face, chat and e-mail") are characterised below. Following this order a "reduction of channels" (Döring 2000) can be described, referring to a loss of communicated information. "Richness" (Daft 1984) is at its highest level, if the respective medium reduces ambiguity and uncertainty and "Synchronicity" defines the relation between people and the point of time at which they work on a task (Dennis and Valacich 1999). The "Grounding" process supports the establishment of a "common ground" between communication partners on eight levels (Clark 1991). For further details, see Table 1.

Table 1 Application of several theories on communication media (Boos and Jonas 2008) Medium: The three relevant types for this project are characterised. **Channels:** For example face-to-face communication contains all channels (audio, video, text), compared to e-mail communication only containing text (not counting attachments). Information, once transferred through the visible and audible channels, (such as facial expression, language and subject of voice) is entirely absent. **Richness:** It is reached by providing information via multiple channels and immediate feedback options and is therefore it has its highest level in face-to-face communication. **Synchronicity:** It adds the aspects of information-mediation (collecting facts) and information-concentration (operating information into a context). **Grounding** (Level 1-8): Physical presence (1), visibility (2), audibility (3), synchronicity (4), simultaneity (5), sequence maintenance (6), editability (7) and reusability (8).

Medium	Channels	Richness	Synchronicity	Grounding
Face-to-face	All of them	Very high	Very High	1-6
Chat	Text	Low	Medium	4,7
E-Mail	Text, (audio, graphic, video in attachment)	Low	Very Low	7,8

Online-communication can sometimes limit the interaction and information exchange through the reduction of channels (in for e.g. e-mails), which may lead to misinterpretation. Furthermore, it can be received as impersonal and distant and thereby reduce social desirability.

On the other hand, it can benefit development of an emotional relationship through a communication process between counterparts. For instance, anonymity within communication can foster relatedness, due to estimated similarity with the communication partner (Reicher, Spears et al. 1995). In addition, the transmitter of the message has the chance to control its impression and influencing factors, due to the low grade in the channels' synchronicity and thus the chance of message-editability and coordination of the message's purpose. Also no subconscious channels (e.g. body language) are used. All these aspects support the controllability of self-exposure by the transmitter, thus increasing the quality of relation between the communication partners.

This is supported furthermore, since the deficit of information can lead to an idealisation of the counterpart by the receiver and as long as the receiver's impression of the transmitter is positive, options for feedback promote and deepen the development of the relationship (Boos and Jonas 2008, Dennis and Valacich 1999).

Resulting challenges for doctors' communication competencies. The description of the challenges is focussed on effects by e-mail as communication medium online-counselling (asynchronous, written online-communication), due to its current predominance in fields of online-counselling in the medical sector (Kummervold, Chronaki et al. 2008). First of all, doctors need to be competent in use of new communication-media (McGowan, Passiment et al. 2007) and understand the arising legal issues about patient and data security (Pirillo 2014). In addition, the lack of information through the new medium needs to be addressed (Bromme, Jucks et al. 2004). It is important that relevant and missing information about the patient is noticed and asked for (Bromme and Jucks 2014), thus mutual communication and feedback gains significance (Daft 1984, Clark 1991). Adapting the message to the individual patient is now focused on the text and can be realised by implementation of specific key words (Bientzle, Cress et al. 2013). Also the advantages of online-communication should be used, involving purposeful expression for developing a relationship with the patient and efficient formulation of messages (Boos and Jonas 2008).

In contrast to the actuality and significance of this transition with its associated challenges, medical students and doctors are not prepared. First of all there is a lack in training options in medical curricula concerning the arising challenges, which leads to uncertainty on the topic amongst medical students and doctors (Stadtler, Bromme et al. 2009, Bromme and Jucks 2014, Ahmad, Hudak et al. 2006, AlGhamdi and Almohideb 2011). Additionally, understanding of the significant impact of the Internet on medical care and the need for online-presence among medical students and doctors is lacking (European Commission 2012).

1.5 Purpose of the research project

Purpose of the topical project is to close the gap between the arising challenges for today's doctors due to the impact of the Internet on medical care and the lacking training options in medical curricula and lacking awareness among doctors and medical students in this field. The aim is to establish an adequate training program to prepare medical students: First of all, to raise awareness for the need to be accessible for a professional and expert-guided online-counselling for patients searching the Internet and secondly, to provide training on the resulting challenges for doctors' communication competencies. Since e-mail is currently the most common medium for online-counselling, training should focus on corresponding challenges. Students should be required to counsel patient requests via asynchronous, written online-communication in a private and professional environment.

As training instrument a constructed online-forum was chosen, since it was suited to simulate the topical challenges (online-counselling via asynchronous, written online-communication in a private and professional environment) in a realistic way. It involved the option to develop simulated patients in the forum to be counselled by the students (in the role of a doctor). It also provided flexibility in content and features, which were technically easy to expand and exchange and allowed the implementation of research instruments.

In order to provide comparability of the simulated patient cases, their requests were focussed on one overall topic: "Mammography-Screening". This program has been established in western societies over the last years (Spadea, Bellini et al. 2010). Aim is to detect early stages of breast cancer through regular health check-ups in order to intervene timely to prevent disease's late stages that are associated death and disability (Bock, Heywang-Köbrunner et al. 2014). This topic was chosen as an example for preventive interventions in fields of online-counselling patients, due to its topicality in fields of preventive medical care today (Bock, Heywang-Köbrunner et al. 2014).

Training with the online-forum was integrated into a course in a blended-learning format. Blended-learning is described as an educational approach that involves lectures in small groups and in a face-to-face situation away from home with supervision and instruction (present sessions) expanded by periods in which students learn through an internet-based training-instrument (independent training sessions). Within this constitution, the ratio between present sessions and independent training sessions can vary (Bains, Reynolds et al. 2011, Staker and Horn 2012). Throughout the project, the aim was to investigate which approach of course concept was most effective and which factors are relevant for an adequate training outcome and acceptance by the students. Therefore two different didactical approaches (self-directed, trainer-directed) were constructed, to be compared concerning the students' learning outcome and course evaluation.

The topical research project was carried out in connection with the study "The impact of patients' Internet use on the doctor-patient relationship, which is carried out in cooperation between the Knowledge Research Centre in Tuebingen (KMRC) (sub-project 1, 2: patients' acquisition of health-related knowledge on the Internet and its consequences for doctor-patient relationships) and the Competence Centre for University Teaching in Baden-Wuerttemberg, Faculty of Medicine of the University of Tuebingen (sub-project 3: "Preparing medical students and doctors for dealing with web-informed patients"). The topical experiment was placed in the early stages of sub-project 3: Requirement analysis with clinical physicians and practising gynaecologists had already been completed. Stating data had been collected through focus group interviews and an online survey. Evaluation provided an information basis about physician's attitude towards the Internet in their professional life and the requirement of an adequate training. Therefore meaning of the topical experiment is to offer foundation and navigation for further development of training devices in this field, such as realising module 3 (face-to-face interaction), deepening of main aspects (e.g. web-informed patient) and expansion to different places in curriculum and further professions.

For this purpose, course concepts and instruments were developed and implemented into medical curriculum and their effect on the students was scientifically evaluated. Implementation of course was realised in cooperation with Dr. Christian Gall (Department of Gynaecology, University Hospital Tuebingen) as trainer for the present sessions.

The following research question, with two involved sub-question, arises:
How can medical students be prepared effectively for current challenges in the field of expert-guided online-counselling on preventive interventions?
- A randomised, prospective trial exemplified by a case study of Mammography-Screening

1. How does an online-forum need to be designed, in order to provide an adequate training instrument simulating the arising challenges with a high level in closeness to reality?
2. Which didactical blended-learning approach (trainer-directed or self-directed) is most appropriate to prepare students effectively?

The alternative hypothesis and sub-hypotheses are described as:
Medical students can be prepared effectively for current challenges in the field of expert-guided online-counselling on preventive interventions.

1. A designed online-forum provides a training-instrument that simulates the arising challenges with a high level in closeness to reality.
2. Either a trainer-directed or self-directed approach of a blended-learning format is more appropriate to prepare students effectively.

The null hypothesis and sub-hypotheses are described as:
Medical students cannot be prepared effectively for current challenges in the field of expert-guided online-counselling on preventive interventions.

1. A designed online-forum does not provide an adequate training-instrument that simulates the arising challenges with a high level in closeness to reality.
2. There is no difference between a trainer-directed and a self-directed approach of a blended-learning format in preparing students effectively.

2   Methods

First of all the development of the training instrument is described. Secondly, a description of the course concept's development and implementation as well as the associated study design with its setting and circumstances is given. Finally, methods for evaluation of the training program and data analysis are presented.

2.1   Online-forum development

2.1.1 Concept of reviewed online-forums

The review of common online-forums' design and features was carried out by research via the search engine "www.google.com" using the key words "health", "information" and "forum". The resulting German websites that contained reliable health information and were the three most commonly used on the Internet and therefore appeared at the top of the research result lists, were chosen as models for design and features of the topical online-forum; these were: www.vitanet.de, www.gesundheitsinformation.de, www.onmeda.de. The concept of the topical online-forum was designed while taking into account common designs and constitutions of the reviewed online-forums. Hereby aim was to reach a high level in closeness to reality of content (e.g. patient cases) and features (e.g. communication processes) of the training-instrument.

2.1.2 Content and features

Simulated (virtual) patients. A basic pool of 40 simulated patients was designed and adapted to currently common patient cases, as main content for the forum. Development of these patient cases was realised along a standardised scheme (see Fig. 2). This allowed constitution of an evenly arranged variety in individual attributes of the simulated patients: their attitude (such as health conceptions[1] (Egger 2005, Bientzle, Cress et al. 2013), clinical history, information background and age. For each simulated patient a first request was pre-designed according to the combined criteria.

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[1] The two concepts impact the individual processing of information. Patients that follow the "biopsychosocial" conception perceive health information on an individual and personal level. Patients with the "biomedical" concept perceive it on a rather technical and scientifically level.

Topics of requests were reduced on questions concerning one topic: Mammography-Screening. Thereby, comparability of participants' work on requests was supported. Clinical content of requests was adapted to realistic and common patient concerns through expert knowledge from the local Gynaecology Department (Dr. Christian Gall).

Information about the patient's medical and personal background, the first request as well as a pre-designed text block for further communication was designed in form of vignettes. These were optimised throughout the development process, since level of the cases' difficulty should be raised by leaving out relevant information during the patients' first appearance; thus differing vignettes with the same set of attributes resulted (see Fig. 2). Study assistants pre-selected vignettes, which were most optimised throughout the development process and representative for the even range of attributes in the pool of developed vignettes. Those vignettes were adapted to an equal level of difficulty along the following central aspects:

1. Relevant information (personal and medical background and information source) about the simulated patient: provided or missing?
2. Extent of the vignette's theoretical content
3. Formal complexity of the involved patient requests

Challenge to value and involve relevant information, notice relevant lacks of information about patients' background, sources and case should be evoked. Three medical experts (gynaecologists) all practicing in the field of Mammography diagnostics at the University Hospital in Tuebingen also rated the difficulty of the vignettes at medium level. Eight of these vignettes were implemented during the pre- and posttest of the project ("test cases"). Students were asked to reflect and assess their skills before and after the course after having completed the test cases. Four vignettes were selected for the independent training ("training cases"). Since resulting communication texts from this period were not used for the students' self-assessment, these simulated patient requests were expanded in their variety of concerns, thus deviated from the standardised pattern. By this diversified setting, the students'

motivation to counsel the simulated patients throughout the independent training period to reach a greater learning effect was raised. A pool of "reserve cases" remained to be optionally applied throughout the project.

Total.: 40

| Health conception | biopsychosocial: 20 | biomedical: 20 |

| Age | 20-49 y.: 10 | 50-70 y.: 10 | 20-49 y.: 10 | 50-70 y.: 10 |

| Source: Internet | y: 6 | n: 4 | y: 3 | n: 7 | y: 7 | n: 3 | y: 3 | n: 7 |

| + Clinical history | y: 3 | y: 4 | n: 3 | y: 3 | y: 3 | y: 3 | n: 3 | y: 4 |
| | n: 3 | | | n: 4 | n: 4 | | | n: 3 |

Maike1
Frida8
X Blinky

Gaby K.
Jenny S.
X Mona F.

Sina92
Ida92
Lili92
O Fipsi92

F Bernd
F Müller
X F Lani
F Frenzel
F Schlüter
F Bauer
O F Feldkamp

Birthe B.
Annika L.
O F Brinker

F Stadler
F Fritsch
Laura L.
X F Kipp

Sandra R.
Antonia D
X Lara M

Frau Pohl
F Hagedorn
X F Pape

healthy_girl
lady_little
lady_betty
O Maria H.

F Reiter
F Steinhoff
X Charlotte R.

F Westermann
F Köhlhofer
X F Gümmer

CAPTION
No missing information
Missing information
X = Test case
O = Training case

Fig. 2 Standardised scheme for development of the simulated patients' vignettes.
To the left: criteria for allocation of particular attributes; to the right: allocation, y= yes, n = no; below: user names of developed patient cases, colour indicates the difficulty level (missing information: yes, no) and the cases implementation as "test case" (X) during pre/post-test for research and "training case" (O) during the independent training period.

Table 2 illustrates the development of patient cases. Name of patients and whether relevant information is missing is listed as well as the pre-selected vignettes, the rating on a medium-grade level of difficulty and final implementation of the simulated patient in fields of the research project (as "Test", "Training" or "Reserve" case).

Table 2 Pool of 40 simulated patients. Development of "Test" cases with comparable level through "Expert rating", "Training" cases and the "Reserve" vignettes.

No.	Name of patient	Missing information	Preselection	Expert rating	Reserve	Test	Training
1	Maike1	no			X		
2	Frida8	yes			X		
3	Blinky	yes	X	X		**X**	
4	Gaby K.	no			X		
5	Jenny S.	yes			X		
6	Mona F.	yes	X	X		**X**	
7	Sina92	no			X		
8	Ida92	yes			X		
9	Lili92	yes	X		X		
10	Fipsi92	yes	X				**O**
11	Frau Bernd	no			X		
12	Frau Müller	yes			X		
13	Frau Lani	yes	X	X		**X**	
14	Frau Frenzel	no			X		
15	Frau Schlüter	yes			X		
16	Frau Bauer	yes	X				
17	Frau Feldkamp	yes	X				**O**
18	Frau Westermann	no			X		
19	Frau Köhlhofer	yes			X		
20	Frau Gümmer	yes	X	X		**X**	
21	Maria H.	yes	X				**O**
22	lady_betty	yes	X		X		
23	lady_little	yes			X		
24	healthy_girl	no			X		
25	Lara M	yes	X	X		**X**	
26	Antonia D	yes			X		
27	Sandra R.	no			X		
28	Birthe B.	no			X		
29	Annika L.	yes	X		X		
30	Frau Brinker	yes	X				**O**
31	Frau Stadler	no			X		
32	Frau Fritsch	yes			X		
33	Laura L.	yes			X		
34	Frau Kipp	yes	X	X		**X**	
35	Frau Pohl	no			X		
36	Frau Hagedorn	yes			X		
37	Frau Pape	yes	X	X		**X**	
38	Frau Reiter	no			X		
39	Frau Steinhoff	yes			X		
40	Charlotte R.	yes	X	X		**X**	

Users. For the online-forum four different types of users were created:

1. The vignettes were integrated into the online-forum in form of the user type "patient". This provided the pool of simulated patients, whose requests were to be counselled by students through the online-forum; a standardised password allowed study assistants to log into the "patients'" accounts providing the option for further communication between patients and students.

2. The user type "doctor" was created, by which participants could log into an individual forum section. Hereby they got access to the patient requests that were allocated to their section. For reaching the required private and expert guided setting, individual logins and passwords were developed leading the students to an individual section in the forum. Generating process contained the criteria: semester, week of participation, group of participants, continuous number and the word "doctor" (e.g.: "WS_13_14_4_Arzt"). The passwords equalled these codes with a prefix ("secure4").

3. The user "moderator" got the option to administrate sections in the forum.

4. The user "phpbbconnector" got the option to administrate all features, content and sections. Hereby it was also possible to access and extract data (e.g. written texts) from the forum. A manual about handling of the forum's features for was developed for the students (Attachment No. 1).

2.1.3 Technical realisation

Technical development of the forum was carried out in cooperation with the Knowledge Research Centre in Tuebingen, whereas concept of features and content was designed at the Competence Centre for University Teaching in Medicine Baden-Wuerttemberg. It was established with an open source program for development of optional online-forums ("phpBB"), due to its practicability and cost-effective way of implementation. The software was connected to a database ("MySQL"), for storing the data being produced in the forum. Features of the open source program needed to be expanded, in order to create additional options and content for adequate training and research. "Python" was used as programming language for adding all necessary

configurations to the database. Hereby required content, such as the creation of the user types and the individual sections, was integrated into the training-instrument. In the same way, the written vignettes for the particular pre-designed patients were integrated and individual logins and passwords for the students and standardised ones for the patients were created. Developed python scripts also enabled automating processes, such as creation of users and passwords, as well as the process of posting requests that was organised along a developed standardised scheme. Thus overall comparability of processes and efficiency of their coordination (reductions of needed triggers on one command) was supported. A manual was written for easily creating and adapting these "Python" scripts, thus a high level in flexibility of the forum's content and features was supported. University Hospital of Tuebingen provided a web server for software and database. Accessing the website through search engines was prevented, hereby the online-forum was only accessible to the participants of the course (via the provided URL).

2.1.4 Piloting the online-forum

Two pilot groups were confronted with design and concept of the online-forum. Evaluation by the participants of the first pilot group, consisted of six voluntary medical students, who did not take part in the study, was used for testing and adapting the online-forum's general usability and coherence of its features as well as technical functionality of communication between participants and allocated patients and adequate controllability by study assistants; comments of participants were collected via a semi structured interview with key questions on the forum's technical functionality, content and noticeable abnormalities. The second pilot group consisted of students (n=29) that were allocated to participate in the training program during the first three weeks of semester (see Fig.4). Their feedback on implementation of the forum into the training program and flow of processes throughout the course was collected and saved in the course protocol. This information, as well as the study assistant and trainer's experience with the flow of processes was used for optimising implementation of the forum into the training program's flow of processes.

2.2 Study design

2.2.1 Structure of the study

The study was a prospective, parallel group, randomised trial with pre/post analysis comparing two educational intervention strategies (Mad 2008). Independent variable was the intervention: Implementation of course (concept and online-forum). Dependent variable was the impact on participants' competencies and evaluation of the training program. Information on participants' competencies in online-counselling patients (self-assessment and test through the forum) was collected at the beginning of the 2 present sessions (thus before and after the intervention, see Fig. 3 "O_1 and O_2") via equal instruments and under standardised conditions. In addition information on participants' sociodemographic data and their attitudes was collected before the intervention as well as evaluation of the training program was collected after the intervention. The group of participants was randomised into two groups: G1 and G2 (see Fig. 3). The educational intervention (X_a and X_b) is described in 2.4.

$$G1: O_1 - - - X_a \quad - - - O_2 - - - X_b$$
$$R, n=135$$
$$G2: O_1 - - - X_{a+b} - - - O_2$$
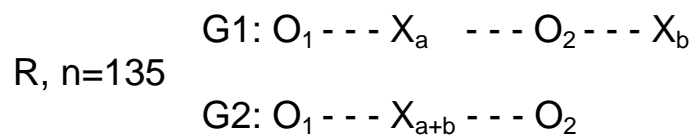
**Fig. 3 Study design regarding assessment of differences between G1 and G2.**

R = number of participants that were randomised into G1 and G2. Allocation of participants into cohort and analysis sample is shown in Fig.4; O_1 = first point of data observation; O_2 = second observation; X = educational intervention, devided into part a and b: X_a and X_b, which was provided to G2 before O_2, to G1 after O_2 (see 2.4)

2.2.2 Study group and ethics

The course concept was implemented into the curriculum of 9th semester medical students (see 2.4). The total number of participants (n=135) consisted of all 14 groups of 8 to 11 medical students that each participated for one week throughout the semester (see Fig. 4 "SW"). First three weeks of semester were necessary for piloting course and training instrument; therefore the cohort was set from 4th week of semester until the 14th. In three groups (SW 8, 10 and 12) deviations in workflow of course implementation occurred (disturbance of course process due to technical problems). They were thus excluded from analysis (n missing = 28), leaving a number of participants (n = 78) described as analysis sample. Sociodemographic data was tested on whether differences between cohort and analysis samples occurred.
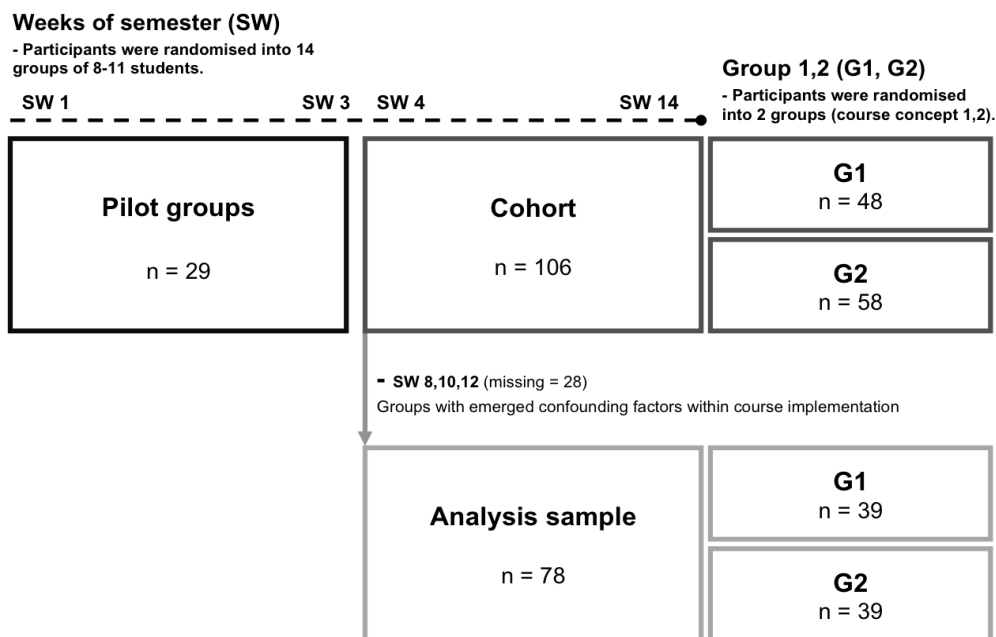
Fig. 4 Constitution of cohort and analysis sample. Allocation of students to the groups G1 and G2, as well as the weeks of the semester "SW".

Formation of the analysis sample was furthermore outlined by means of the "Consort 2010 Flow Diagram" (see Fig. 5) (Schulz, Altman et al. 2010).
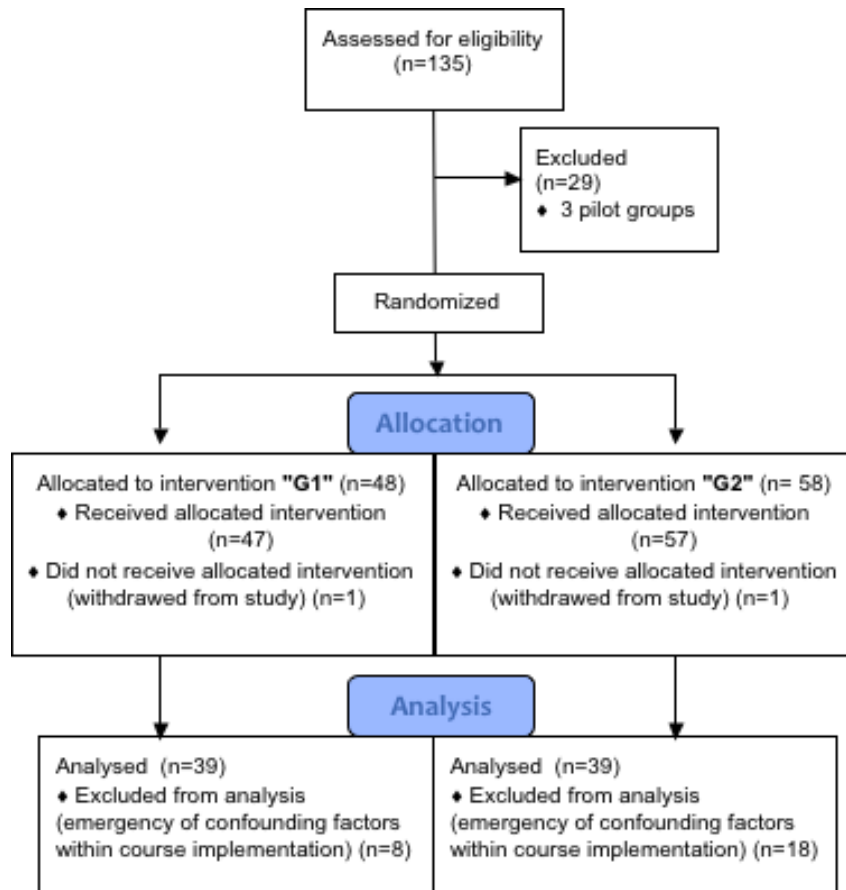
Fig. 5 CONSORT 2010 Flow Diagram (Schulz, Altman et al. 2010). Illustration of the analysis sample's constitution.

Participants were randomised into groups of 8-11 students (Fig. 4 "SW"), due to their allocation in "SIMED-groups", which are encoded by serial numbers. This process is organised by the Dean's office and the only information that persons carrying out topical project got was which numbers of "SIMED-groups" were scheduled to participate gynaecology internship in which weeks of semester. Thus they were neither able to influence nor reproduce allocation process; conditions of "allocation concealment" were therefore given (Mad 2008). Each randomised group of 8-11 students was again randomised in group 1 and 2 throughout the weeks of semester (see Table 3.).

Required time of the trainer's presence differed between time tables of the two course concepts. Thus allocation ratio into G1 and G2 was determined by organisational circumstances. In order to ensure statistical comparability of data, G1 and G2 were tested on significant differences regarding sociodemographic data.

Due to educational context blinding of operator (trainer) and study assistants was not possible: While implementing one course strategy they automatically were aware of it. Students were not aware of which group they were allocated to. However, it could not be excluded whether they noticed differences between the course concepts.

Table 3 Allocation record of G1 and G2. Participants of group 1 and 2, allocated to particular weeks of semester (SW), in which they participated the training program.

		Weeks of semester (SW)								Total
		4	5	6	7	9	11	13	14	
Analysis sample	Group 1	10	9	0	10	10	0	0	0	39
	Group 2	0	0	10	0	0	10	10	9	39
Total		10	9	10	10	10	10	10	9	78

Ethics. The different sessions of the course were integrated into the compulsory curriculum of the gynaecology internship. Thus participation in the seminars was as obligatory as participation of gynaecological sessions. Surveys for research were integrated und qualitative data from the online-forum was collected. For this, individual codes were provided to participants and students gave written consent and could withdraw without giving any reasons (Consent form, see Attachment No. 2). Thus participation in the study was voluntary and anonymous and the Ethics Committee approved the study protocol.

2.2.3 Research instruments

Research instruments of the project are illustrated by Table 4, divided into acquisition before the course (pre: O1, see Fig. 3) and after the course (post: O2, see Fig. 3) and are described by the following. For the pre/post online-survey, see Attachments No. 3 and No. 4.

Evaluation of the course. Quantitative evaluation of the training program was integrated into the post online-survey in order to gain information about effective application of resources and the participants' satisfaction with implementation of the course and the online-forum. Participants were asked to rate the three aspects "External organisational circumstances", "Performance and moderation of the course" and "Application of the online-forum" on ordinal scales, in which a minimum value (1) indicated the lowest grade of satisfaction in this field and a maximum value (5) the highest grade of satisfaction. Furthermore they were asked to rate the "profit" they felt to have realised throughout the training program on the same type of scale. For qualitative evaluation a field was integrated into the post online-survey, in which participants were requested to type in any comments concerning the training program. In addition, study assistants collected oral feedback by students in the study protocol.

Pre/post test and self-assessment. In order to elaborate the students' learning progress in fields of "expert-guided online-counselling" throughout the training program, information was acquired through the pre/posttest and the following self-assessment. For both groups the first present session started with a "pretest" (see Table 4) in the forum: Students counselled a simulated patient request that had been allocated to their individual forum section before they got any information on the topic through the course; they were asked to complete the task on their own and in a time frame of 15 minutes. Participants were furthermore divided into 2 equal groups (X and Y), which were seated in an altering order and got to counsel differing cases during pretest and posttest; thus individual work on test cases by students was maintained. They were then required to reflect challenges in this specific situation of counselling patient via

the Internet and in how far they felt prepared for it while completing this "test case" (status quo). Furthermore the emerging data (written texts) was stored to be available for further assessment of students' learning progress throughout a following research project (OSCE evaluation). The following self-assessment (see Table 4) was implemented via global rating scales (ordinal scales; min. 1 max. 11), students were asked to specify their competencies in view of the learning objectives, which were explained and illustrated to them at the beginning of the present session (see Table 7,8), regarding two aspects: "doctor-patient communication" and "online-communication". The self-assessment was integrated into the pre/post online-survey and was illustrated by sliders, visual analogue scales that did not show the values of the scales to the students (Funke and Reips 2012). The same procedure was implemented during the last present session: The "posttest" in the forum, was followed by the self-assessment. Students were now asked to reflect how they now, after the training program, felt prepared regarding the learning objectives of the course.

Further data acquisition. Pre survey (Tuesday) also involved acquisition of sociodemographic data: The variables gender, nationality and previous education were acquired on nominal scales, age and university semester on ordinal scales. Respondents were divided into 2 gender groups (Male, Female), 4 age categories (19–22, 23–26, 27–30 and ≥ 30), 2 groups of nationality (German, Other than German), 2 groups of educational background (Previous education: Yes and No) and 5 categories of university semester (≤ 8, 9, 10, 11 and ≥ 12). Furthermore holdings and use of Internet related media and attitude towards the Internet, related media and online-communication were collected on nominal scales. Post survey also involved acquisition of participants' activity during independent training: Therefore the sources they used for completing the tasks (information from present session or independent online-research) were collected from the post survey, the number of training cases participants completed was collected through analysis of web protocols and indicated on ordinal scales (sources: min. 1 and max. 5; training cases: min. 0 and max. 4) (Wirtz and Nachtigall 2008).

O$_1$		O$_2$	
Instrument	**Goal**	**Instrument**	**Goal**
Pretest (test case in the online-forum)	Assessing the status quo competencies in fields of online-counselling patients and self-reflection	Posttest (test case in the online-forum)	Assessing the competencies in fields of online-counselling patients after the course and self-reflection
Pre self-assessment (online-survey)	Requiring self-assessment in fields of online-counselling patients	Post self-assessment (online-survey)	Requiring self-assessment in fields of online-counselling patients
Survey on sociodemographic data, attitudes and habits (online-survey)	Gaining information on participants' attitudes and habits regarding Internet and communication	Survey on activity and course evaluation (online-survey)	Gaining information on students' individual research during independent training and evaluation of the training program

Table 4 Research instruments. Data acquisition point (O1, O2) divided into instrument (pre/posttest, pre/post self-assessment, pre/post online-survey) and the particular goal.

2.3   Statistical analysis

First of all a power analysis was implemented to calculate the needed sample size. Statistical analysis was performed using the SPSS system (IBM statistics, version 20). A *P* value of <0.05 was considered significant. Data was not normally distributed, since Kolmogorow-Smirnow test (KS) was below 5 % (<0.05) for all variables; thus qui square (χ^2) test was used for analysis of significant differences between sociodemographic data of cohort and analysis sample as well as between G1 and G2. For self-assessment, quantitative evaluation, number of completed training cases and use of sources data was not normally distributed either (KS <0.05). It was therefore analysed using Wilcoxon test for pre/post analysis of self-assessment and Man-Whitney U test for comparison between the two groups (G1, G2) and spearman's rank correlation coefficient was applied (Nachtigall and Wirtz 2006). In order to provide adequate illustration, mean (parametric method) was used for development of graphs (Nachtigall and Wirtz 2006).

2.3.1 Organisation of data

Online-surveys. Pre and post survey were developed and integrated into an open source program "Soscisurvey" (https://www.soscisurvey.de) for conducting surveys via internet and coordinating data acquisition. Since each participant had access to a computer during present sessions, they were provided the particular web link to the survey via an html document on the desktop and participants were requested to enter their individual code before taking the survey. Due to the fact that completing survey and pre/post-test was optional and participants could skip separate questions in surveys, total number of participants within collected data for particular analyses could differ.

Excel file ("database"). Organising data for analysis was structured by individual codes for each participant, connecting data from the online-survey and the pre/posttest in the online-forum: "Soscisurvey" was automatically connected to SPSS, where data from pre and post online-survey was gathered and sorted by individual codes of participants. An excel file was created as database, in which the quantitative and qualitative data from "SPSS" and the qualitative data from the online-forum (via hyperlinks) as well as the course protocol was collected, sorted by individual codes of participants. Qualitative data from pre and post-test in the online-forum (written texts by participants) were derived from the forum as "SQL" data scripts and encoded, involving pre/post in one letter, related patient request in a number and continuous number of participant, which could be tracked to individual code of participant (e.g.: a_1_205). Qualitative feedback from the post online-survey was divided into positive and negative comments and sorted by issues that were commonly raised; it was encoded on basis of an established codebook (Attachment No. 5) and concluding tendencies described. These were matched with tendencies, resulting from protocol of qualitative feedback during present sessions. The concluding codification was assigned to the excel database.

2.4   Course development

2.4.1 Course concept

Two educational interventions in a blended-learning format were designed: A more self-directed strategy (group 1 "G1"), which was focused on the students' individual training period and a more trainer-directed strategy (group 2 "G2"), which was focused on the training during present sessions. For a detailed description of the two course concepts, see 2.4.4.

The course concept was developed using Kern's six step curriculum development model (Kern, Thomas et al. 2010): (1) problem identification and general needs assessment, (2) assessment of targeted learners, (3) definition of goals and objectives, (4) implementing educational strategies, (5) implementation into curriculum and finally (6) evaluation and feedback.

2.4.2 Assessment of targeted learners

Possible differences between needs of students and doctors concerning a training program on topical problem were to be considered, since general needs were assessed regarding both and the training program was simply conducted with medical students. Thus targeted learners were assessed on their preconditions regarding online communication-media on basis of two pilot groups, to adapt the training program adequately to their needs.

Also the medical students' previous knowledge on the subject matter "expert-guided counselling via online-communication" was analysed: The first aspect "expert-guided counselling" is a basic aspect in fields of doctor-patient communication. The students were already prepared for this aspect due to previous training programs in fields of doctor-patient communication throughout the medical curriculum at the University of Tuebingen. Thus the topical course aimed at recalling and expanding these competencies (see "PT" Table 6.). The second aspect "counselling via online-communication" is a new aspect in fields of medical education; therefore the students were not prepared for this before the course (see "NT" Table 6.).

2.4.3 Goals and objectives

Purpose of the topical project was divided into two aspects: arising awareness of medical students regarding the need to be accessible to patients searching the Internet for providing expertise and neutral based counselling (1) and to develop training options for the resulting challenges for doctors' communication competencies (2). Therefore the subject matter of the training program was derived from these aspects. The associated learning objectives (see Table 6) were derived from the assessed general needs. These were based on the challenges for doctors' communication competencies in an online setting (elaborated in 1.4). These challenges (10-14) are summarised in Table 5 and are added to the general set of challenges for doctors' communication competencies, for reaching effective communication (challenge 1-9) (Reviewed literature: (Bensing 2000, Watzlawick, Beavin et al. 2000, Bekker 2010))

Table 5 Challenges for doctor's communication competencies in fields of expert-guided online-counselling. Challenge 1-9: general set of challenges for doctors' communication competencies; 10-14: doctors' communication competencies in an online setting

|	
1.	Adequate formal language: content, spelling and use of terms
2.	Revelation of relevant personal and medical background
3.	Detection of patients' individualities (information status, perceptions, demands)
4.	Adaptation of the message to challenge 2,3
5.	Adequate assessment and explanation of expert information
6.	Support of mutual communication process
7.	Use of adequate channels for the particular message
8.	Self-reflection within relationship and influencing factors on message
9.	Application of metacommunication
10.	Focus on text as the channel (notice relevant information; purposeful, efficient expression)
11.	Discovering lack of information (see 1. + 2.)
12.	Fostering feedback and mutual communication
13.	Considering aspects of legacy
14.	Competency in online communication-media

The resulting learning objectives (Table 6), divided into those that have already been regarded throughout the curriculum and those that are new aspects throughout the topical course, were developed on basis of the elements "Who will do how much / how well of what by when?" (Kern, Thomas et al. 2010).

Table 6 Learning objectives of the training program. "PT" = learning objectives already been regarded in previous training programs throughout the curriculum; "NT" = learning objectives as new aspects throughout the topical course.

By the end of the training program, the student will:	PT	NT
1. Incorporate adequate formal language (content, spelling and use of terms) into performance of online-communication and rank it as important for this process.	X	
2. Examine personal and medical background of the individual patient, as well as patients´ individual information status, perceptions, demands and situation.	X	
3. Differentiate between relevant and irrelevant information (from 2.)	X	
4. Identify lack of relevant information (from 2.)	X	
5. Implement resulting information (from 2.) into construction of a message that is suited to the individual patient.	X	
6. Define impact on text as the communication-channel on communication process (1.-5.)		X
7. Identify information contained in the text and incorporate purposeful and efficient expression (focus on demand of the patient, reaction on missing or insufficient information, length of reply) into writing a message.		X
8. Rank aspects of legacy in fields of online counselling patients as important.		X
9. Develop competency in handling online communication-media		X
10. Develop mutual communication process, foster feedback in fields of online-communication.		X
11. Verify medical information sources in its quality; administer and relate it to the patients' individual situation.	X	
12. Show adequate explanation of expert information to a layperson/patient.	X	
13. Rank self-reflection and metacommunication within relationship and influencing factors on message as important, incorporate it into communication process.	X	

2.4.4 Educational strategies

The course concept was a blended-learning format with an Internet based and hands-on approach using simulated patients with the online-forum as training instrument. The course involved one present session at the start and one present session at the end of the week; an independent training period was set in between these present sessions (see Fig.6). Students of G1 (more self-directed strategy) got a short introduction to the topic's relevance and the learning objectives during first present session (see Fig. 3 "X_a"). Instead of a more extensive seminar during present session, they got instruction to further information on the topic, which they could access independently on ILIAS (online learning-platform) or via independent online-research. Students of G2 (more trainer-directed strategy) got an extensive seminar with introduction to the topic, training and discussion during the first present session (see Fig. 3 "X_{a+b}"). During independent training all participants were asked to apply the information they either got through their extensive seminar (G2) or their independent research on the topic (G1) while counselling at least two out of four simulated patient requests independently. At the end of the course both groups got feedback on their independent training. G1 also got a session, to ensure that content that was provided to G2 was not denied to them (Fig. 3 "X_b").
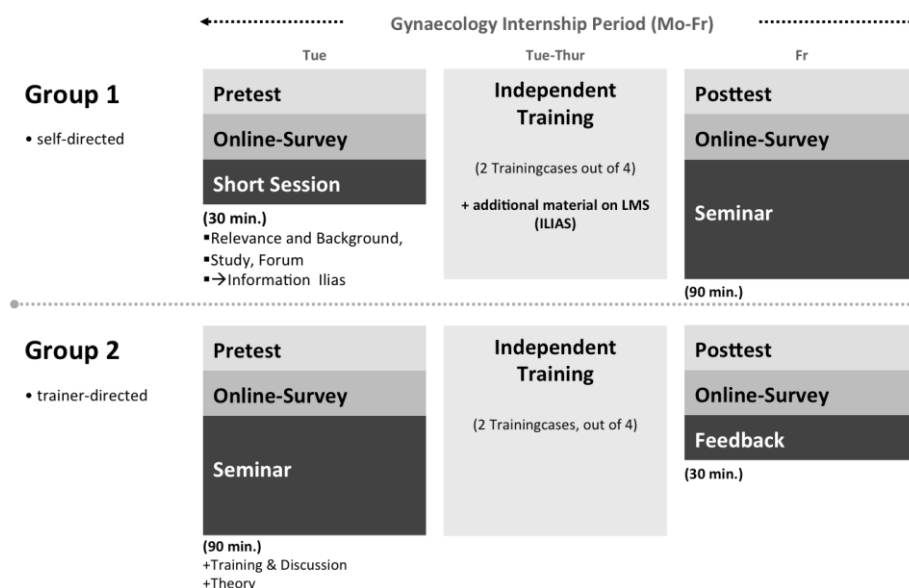
Fig. 6 Course concept of the two educational approaches. The Flow of processes throughout course concept of group 1 (G1) and group 2 (G2).

Implementation of educational methods and didactical reasoning throughout the training program for G1 and G2 is described by Table 7 and 8.

Table 7 Didactical reasoning of concept G1. Differences to G2 are highlighted in grey.

Point of time	Min.	Content	Goal	Method	Material
MO	--	Announcement of the topic and the project	Preparing for the project and arising awareness	Information material	Flyer
TUE start: 2 pm	30	X_a: Presentation of the topic's relevance and learning objectives	Introducing study assistants and trainer, arising awareness and motivation	Impulse	PowerPoint
	15	Organisational and technical aspects of the forum and the survey	Providing guidance throughout the course	Short presentation Questions and answers	Consent form Data sheet
	5	Organisational aspects of independent training	Providing guidance throughout the independent training	Short presentation Questions and answers	PowerPoint Data sheet
	10	Reference to independent online-research during the independent training	Providing guidance on information throughout the independent training	Short presentation Questions and answers	ILIAS (online learning-platform)
TUE – THUR	optional	Independent training	Providing training option and requiring application of provided information	Independent, individual work	Online-forum (4 training cases)
FR start: 2 pm	10	Introduction and organisational aspects	Providing guidance throughout the course	Impulse	PowerPoint
	15	Feedback on main mistakes and selected cases of individual work	Providing improvement suggestions	Feedback	PowerPoint
	60	X_b: Additional information on "expert-guided online-counselling" and discussion about it	providing same amount of information during present sessions for fairness reasons	Seminar and discussion in group Questions and answers	PowerPoint
	5	Feedback of participants	Requiring oral feedback on the training program	Question to participants	Flipchart

Table 8 Didactical reasoning of concept G2. Differences to G1 are highlighted in grey.

Point of time	Min.	Content	Goal	Method	Material
MO	--	Announcement of the topic and the project	Preparing for the project and arising awareness	Information material	Flyer
TUE start: 2 pm	30	X_a: Presentation of the topic's relevance and learning objectives	Introducing study assistants and trainer, arising awareness and motivation	Impulse	PowerPoint
	15	Organisational and technical aspects of the forum and the survey	Providing guidance throughout the course	Short presentation Questions and answers	Consent form Data sheet
	70	X_b: Additional information on "expert-guided online-counselling" and discussion about it	Providing a seminar (extended information on the topic)	Seminar and discussion in group	PowerPoint
	5	Organisational aspects of independent training	Providing information on the topic and guidance throughout the independent training	Short presentation Questions and answers	PowerPoint Data sheet
TUE – THUR	Optional	Independent training	Providing training option and requiring application of provided information	Independent, individual work	Online-forum (4 training cases)
FR start: 2 pm	10	Introduction and organisational aspects	Providing guidance throughout the course	Impulse	PowerPoint
	15	Feedback on main mistakes and selected cases of individual work	Providing improvement suggestions	Feedback	PowerPoint
	5	Feedback of participants	Requiring oral feedback on the training program of participants	Question to participants	Flipchart

For the PowerPoint presentations of the Present sessions on Tuesday and Friday for G1 and G2, see attachment No. 6-9. For a summary of the information on ILIAS, see attachment No.10.

Implementation of the online-forum. In order to organise the process of interaction between participants and the simulated patients throughout the course concept, a standardised scheme was developed by which the different patient requests were posted into the participants' individual forum section. By the developed python scripts the process of posting simulated patient requests was automated and reduced on one command. Structure of the scheme was divided into three phases. (Table 9 "P1-P3") P1 represented the pretest, P3 the posttest, in which participants should be asked to counsel one of the comparable test cases under standardised conditions; P2 stood for the independent training period (see Table 9). Students participating in the particular week of semester (Table 9 "SW") were divided into two equal groups (one with even continuous numbers in individual codes and another with uneven continuous numbers in the code; Table 9 "Group X, Group Y"). The eight rated training cases were randomised into the phases 1 and 3 and the two groups (X, Y) for three consecutively weeks. Thus each group got to counsel different patient cases during pre- and post-test (Table 9 "Patient case A and B") that were all rated in the same level of difficulty by three experts.

This scheme of allocated patient cases was repeated after every 3rd week, in order to be able to technically implement the scheme into the forum through a written python script. Three weeks were chosen as time frame for the repetition cycle to insure that the participating students did not notice the periodic recurrence of the simulated patients. The developed scheme (Table 9) was implemented into the forum's technical organisation: Python scripts for every phase were written on basis of this pre-defined pattern. Hence they included the group of students (X, Y), patient cases / requests and their allocation to the particular group. Therefore the process of allocating the patient requests into the associated participants' individual sections could be reduced on one command: A study assistant gave this command for every phase in a certain time frame (P1: Monday; P2: Tuesday, 3-4 pm; P3: Friday, 12-2 pm) so that the particular patient requests were available to the participants at the adequate point of time throughout the proceeding of the training program.

Table 9 Pre-designed, standardised posting scheme. "SW" = Weeks of semester; "Group X, Y" = students devided into two equal groups; "P1-P3" = Three phases of posting Cases in P1 and P3 were rated at the same level of difficulty by 3 experts for pre/posttest

SW 1	**P1**	**P2**	**P3**
Group **X** (n=7)	Patient case A	Training patient cases 1-4	Patient case B
Even numbered codes	**Charlotte R.**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Mona F.**
Group **Y** (n=7)	Patient case B	Training patient cases 1-4	Patient case A
Uneven numbered codes	**Blinky**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Frau Pape**
SW 2			
Group **X** (n=7)	Patient case A	Training patient cases 1-4	Patient case B
Even numbered codes	**Lara M.**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Frau Gümmer**
Group **Y** (n=7)	Patient case B	Training patient cases 1-4	Patient case A
Uneven numbered codes	**Mona F.**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Frau Pape**
SW 3			
Group **X** (n=7)	Patient case A	Training patient cases 1-4	Patient case B
Even numbered codes	**Frau Kipp**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Frau Lani**
Group **Y** (n=7)	Patient case B	Training patient cases 1-4	Patient case A
Uneven numbered codes	**Frau Gümmer**	**Fipsi92** **Frau Brinker** **Frau Feldkamp** **Maria H.**	**Lara M.**

2.4.5 Implementation and setting

Implementation of the course into the curriculum was realised cooperation with the office of dean (organisational aspects, allocation of participants) and the department of Gynaecology, which offered integration of the course concept into the compulsory internship in Gynaecology during 9th semester, as well as the teacher for the present sessions.

The training program and the associated research project were implemented into a traditional 6-year curriculum of Tuebingen University, medical school. Participants of topical project were medical students in their 9th semester (year 5, clinical medical training). Since project was conducted with entire semester cohort, eligibility criteria for study participation were to be enrolled and present as 9th semester medical student at Tuebingen University. 9th semester curriculum involves 14 compulsory internships in differing professions, each with average period of one week and concluding with particular assignments (see Fig. 7). Allocation of students to the particular internships throughout the semester is organised through "SIMED-groups" by the dean's office. The topical training program was implemented into schedule of the one-week gynaecology internship, thus participants were also occupied with theoretical and practical gynaecology sessions during the day (from 8 am until early afternoon). The semester for implementation went from 14th of October 2013 until 31st of January 2014. Frame of the study were 14 weeks of semester with corresponding 14 groups of 8-11 students that participated in the training program for one week (see Fig. 7 "SW").

SW ►	1. SW	2. SW	3. SW	4. SW	5. SW	6. SW	7. SW	8. SW	9. SW	10. SW	11. SW	12.SW	13. SW	14. SW	15. SW	16. SW
Gr ▼	14.10. - 18.10.	21.10. - 25.10.	28.10. - 01.11.	04.11. - 08.11.	11.11. - 15.11.	18.11. - 22.11.	25.11. - 29.11.	02.12. - 06.12.	09.12. - 13.12.	16.12. - 20.12.	23.12. - 27.12.	30.12. - 03.01.	06.01. - 11.01.	13.01. - 17.01.	20.01. - 24.01.	27.01. - 31.01.
1	Auge	THG Mo KiCH Do	Innere LSC Klinische Praxis		Gyn	Psych	Uro Mo+Di	KiKli LSC iTüpFerl	Chir Crona	Chir BG	Ferien		Haut	Orth	HNO	Anä LSC Klinische Praxis
2 UG 1 2 UG 2	Auge	THG Di KiCH UG 1 Do KiCH UG 2 Fr	Innere LSC Klinische Praxis		Gyn	Psych	Uro UG 1 Mo+Di UG 2 Mi+Do	KiKli LSC iTüpFerl	Chir Crona	Chir BG	Ferien		Haut	Orth	HNO	Anä LSC Klinische Praxis
3	Auge	THG Mi KiCH Fr	Innere LSC Klinische Praxis		Gyn	Psych	Uro Mi+Do	KiKli LSC iTüpFerl	Chir Crona	Chir BG	Ferien		Haut	Orth	HNO	Anä LSC Klinische Praxis
4	THG Mo KiCH Mi	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	Gyn	Psych	Uro Mo+Di	Chir BG	Chir Crona	Ferien		Anä LSC Klinische Praxis	Haut	Orth	HNO
5 UG 1 5 UG 2	THG Di KiCH UG 1 Mi KiCH UG 2 Fr	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	Gyn	Psych	Uro UG 1 Mo+Di UG 2 Mi+Do	Chir BG	Chir Crona	Ferien		Anä LSC Klinische Praxis	Haut	Orth	HNO
6	THG Mi KiCH Fr	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	Gyn	Psych	Uro Mi+Do	Chir BG	Chir Crona	Ferien		Anä LSC Klinische Praxis	Haut	Orth	HNO
7	Psych	Gyn	THG Mo KiCH Mi	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	HNO	Uro Mo+Di	Anä LSC Klinische Praxis	Ferien		Chir Crona	Chir BG	Haut	Orth
8 UG 1 8 UG 2	Psych	Gyn	THG Di KiCH UG 1 Mi KiCH UG 2 Do	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	HNO	Uro UG 1 Mo+Di UG 2 Mi+Do	Anä LSC Klinische Praxis	Ferien		Chir Crona	Chir BG	Haut	Orth
9	Psych	Gyn	THG Mi KiCH Do	Auge	Innere LSC Klinische Praxis		KiKli LSC iTüpFerl	HNO	Uro Mi+Do	Anä LSC Klinische Praxis	Ferien		Chir Crona	Chir BG	Haut	Orth

Fig. 7 Excerpt from 9th semester medical curriculum. Vertical, left: "SIMED-groups"; horizontal: weeks of semester (SW); blocks: different internships ("Gyn" = Gynaecology internship, in which the course was integrated throughout the semester)

Present sessions were located at the computer rooms of Competence Centre for University Teaching in Baden-Wuerttemberg, since computers were needed, thus students needed to change location from Gynaecology sessions, which took a mean of 20 minutes. Present sessions of the course were placed in the afternoon (2 pm), since students were busy with Gynaecology sessions before.

3 Results

The first part of this chapter presents the online-forum's content and features. Secondly the data of the power analysis and the analysis sample (study group) is described; finally results of the training program's evaluation are presented.

3.1 Training instrument: online-forum

3.1.1 Concept of content and features

Results of the systematic analysis of common online-forums' design and features were used for developing the topical online-forum with a high level in closeness to reality: Next to websites for health information and field reports, there are websites with options to register, login and write with either fellow patients or medical experts in private settings of an online-forum; information about the patient can be displayed through a profile and conversations that the particular patient has already carried out in the forum. Also the development resulted in the required private and expert guided setting with the written and asynchronous way of communication in the forum. It was furthermore developed for being easy to handle and well accepted by participants (medical students).

Features that support comparability of communication processes and enable implementation of research into the forum were to be carried out by the administrator of the forum. Since the administrator got the option to easily adapt and change the content and features via written scripts, a high level in flexibility of the concept was given. This provided the option to transfer content and features to further disciplines and target groups throughout future studies. Resulting content and features of the forum are described by the following.

3.1.2 Users in the forum

Students. Participants signed into the forum in the role of a medical expert ("doctor"); associated logins were handed to them during present session. For signing into the forum, participants then typed in their individual code and password; appearance of this situation from a participant's point of view is illustrated by Fig. 8.

Their individual and private section (see Fig. 9) was directly entered after signing into the forum with their individual username; allocated patient requests then appeared to the participant. Therefore interaction in the forum was simply possible between participants and the simulated patients that appeared to them, since these were allocated to the particular individual and private section along the standardised posting scheme (see Table 9).

Simulated (virtual) patients. The simulated patients for the online-forum were created along a standardised scheme and summed up in form of vignettes (see Fig. 10). These included the patient's user name, personal and medical background information and information source, which was divided into given information displayed by the profile and the request text and pre-designed and relevant "missing" information.

This was not displayed to the participants when the patient and the associated first request appeared in their individual forum section. Content of this missing information was pre-designed in form of a text block and also saved in the vignette; if participants required this information by the patient throughout the communication process in the forum, this could simply be adapted to the precise circumstances and posted to the participant by study assistants.

The pool of pre-designed vignettes included the eight comparable cases, to be used during pre/post-test and four cases to be implemented during independent training period (see Table 2 "training cases" and "test cases").

Fig. 8 Screenshot of a participant signing into the online-forum "WIP". In German, since it is an original screenshot of the online-forum.

Username and password is typed in, the register button ("Anmelden") is marked in red.

Fig. 9 Screenshot of an individual forum section with four patient requests. In German, since it is an original screenshot of the online-forum. Appearance of patient requests in students' individual section in form of the concerned topic, thus all 4 requests are titled "Mammography-Screening" ("Screening-Mammographie"). Name of the simulated patient is listed below the topic.

FIRST REQUEST

Dear doctors,
My mother has received an invitation to a screening mammography recently. However, statistics show, that participation does not always lead to a reduction in mortality. Considering this, does it make sense for her to participate in this precautionary measure?

OPTIONAL RESPONSE

My mother is 52 years old. My aunt (motherly side) was diagnosed with breast cancer aged 42; no further illnesses are known in the family. I got access to the mentioned statistics via articles on "Wikipedia".

Maria H.

Given Information (Profile)
- Name: Maria H.
- Age (22)
- Student (Informatics)

Given Information (Text)
- Request for a third person
- Regular Invitation
- Reference to science
- Style of writing

Request (Demand)
- Information (current state of scientific research, weighing of pros/cons)
- Estimation of an expert

Missing Information
- Mothers age
- Medical history
- Indication of source/s

Fig. 10 Concept of a developed patient vignette: example "Maria H.".

To the left: pre-designed first request; below: pre-designed text block for relevant and missing information. Centred: patient's user name. To the right: Information available through the patient's profile. Below: summary of the request's content and the relevant and missing information, which was not illustrated to the students.

In the forum, participants ("doctors" in the forum) were able to access these information bits by selecting the theme of the particular request appearing in their individual section (see Fig. 9). Hereupon the associated first request of the simulated patient appeared to the participant (see Fig. 11).

Information about the simulated patients was available to the participants by the patient's user name, their pre-designed requests that appeared in the students' individual sections and a profile that was created for patients in the forum. Participants were able to access the patient's profile by selecting the particular patient name (Fig. 11, green box). Consequently, the simulated patient's pre-designed profile information appeared to the participant (Fig. 12, green box).

Fig. 11 Appearance of pre-designed patient request to students in the forum. In German, since it is an original screenshot of the online-forum; to the left. topic and text of request, to the right: Patient's user name ("Frau Bernd") with a shadow image above.

Fig. 12 Appearance of the patient's profile to students in the forum. In German, since it is an original screenshot of the online-forum.

3.1.3 Interaction in the forum

Since interaction was reduced on communication between "doctors" (participants) and "patients" (developed simulated patients) in the forum, basic demand on features was the construction of the participants' individual sections, in which the patient requests appeared to the students. Appearance of the particular requests was organised via a standardised scheme, allowing their randomised and controlled allocation to the individual sections in the forum at defined points of time throughout the course (see Table 9).

In order to access the patient request's text and the associated information, participants needed to click on the request's topic (see Fig. 9). Then request and additional information appeared (see Fig. 11, 12). Participants selected the reply button (Fig. 11 "Antworten"). Hereby an empty field appeared that provided the option to answer to the particular patient's request. For study reasons students were simply able to change the written message before selecting the send-button and not after selecting it. Fig. 13 illustrates the situation in the forum, after a student replied to a patient request.

If students posted an answer including a further information enquiry of the patient, study assistants were able to react in the role of that regarded simulated patient. They were able to log into the patient accounts through "patient's" user names as login and a standardised password. If the student's enquiry regarded the missing and relevant information of the simulated patient, study assistants simply needed to adapt the pre-designed text blocks (see Fig. 10) to the specific situation, and then paste the answer into the forum as a reply to the student. If the student's enquiry was not regarding the relevant and missing information, replies could be derived from a pre-developed word document with text blocks containing general answers to finish the conversation. Study assistants were logged into the regarded simulated patient accounts to potentially react to further enquiries of participants. Thereby development of communication threads was enabled (see Fig. 14).

Screening-Mammographie

von

Sehr geehrte Ärzte.
Meine Mutter hat vor kurzer Zeit eine Einladung zu einer
Screening-Mammographie erhalten.
Statistiken zeigen jedoch, dass eine Teilnahme nicht immer zur einer Senkung der Mortalität führt.
Ist es also nun sinnvoll für sie an einer Vorsorge Untersuchung teilzunehmen?

Re: Screening-Mammographie

von

Hallo,
ich kann Ihre Bedenken gut verstehen, denn beim Screening geht es ja immer darum, für sehr viele Menschen insgesamt einen positiven Effekt zu bewirken, wobei ein einzelner dabei vorher nicht weiß, ob er davon profitiert. Gerne gebe ich Ihnen Quellen für weitere Informationen zu Ihrer Frage. Unter den folgenden links finden sie gute und seriöse Artikel zu Brustkrebs und Mammographie-Screening:
http://www.gesundheitsinformation.de
http://www.krebsinformationsdienst.de
Bei Rückfragen können Sie sich gerne auch noch einmal melden. Mein Rat wäre auch, diese Frage noch einmal mit ihrem Hausarzt zu besrpechen, da er Ihre Mutter ja schon wesentlich länger und besser kennt und am besten hier gemeinsam eine Lösung gefunden werden kann, die für alle Parteien für gut erachtet wird.

Viele Grüße

Fig. 13 Appearance in the forum: patient request and reply of a student. In German, since it is an original screenshot of the online-forum; participant's username and time of communication process is made anonymous

Screening-Mammographie □von [ÄNDERN] [✖] [!] [?] [ZITIEREN]

Sehr geehrte Ärzte.
Meine Mutter hat vor kurzer Zeit eine Einladung zu einer
Screening-Mammographie erhalten.
Statistiken zeigen jedoch, dass eine Teilnahme nicht immer zur einer Senkung der Mortalität führt.
Ist es also nun sinnvoll für sie an einer Vorsorge Untersuchung teilzunehmen?

Re: Screening-Mammographie □von [ÄNDERN] [✖] [!] [⚠] [?] [ZITIEREN]

Sehr geehrte Frau H.

Eine Screening-Untersuchung ist darüber definiert, dass diese die Mortalität und die Morbidität senkt, also die Sterblichkeit und die Erkrankungsschwere einer Erkrankung, in diesem Fall Brustkrebs. Deshalb ist eine das Mammografiescreening auch nur für eine bestimmte Altersgruppe sinnvoll in der die Senkung der Mortalität und Morbidität in Studien nachgewiesen wurde. Ein Mammografie-Screening ist dann empfohlen, wenn Ihre Mutter zwischen 50 und 69 Jahre alt ist. Dann kann sie alle 2 Jahre dieses Angebot annehmen, wozu ich Ihr sehr raten würde. Bei familiärer Vorbelastung ist eventuell sogar ein individuelles und früheres Screening notwendig. Wie alt ist Ihre Mutter? Gibt es in Ihrer Familie Brustkrebserkrankungen?

Ich hoffe ich konnte Ihnen weiterhelfen. Haben Sie noch weitere Fragen an mich?
Mit freundlichen Grüßen,

Re: Screening-Mammographie □von [ÄNDERN] [✖] [!] [?] [ZITIEREN]

Meine Mutter ist 52 Jahre alt.
Meine Tante (mütterliche Seite) ist im Alter von 42 Jahren an Brustkrebs erkrankt. Weiterhin liegen keine Erkrankungen in der Familie vor.
Vielen Dank.

Re: Screening-Mammographie □von [ÄNDERN] [✖] [!] [⚠] [?] [ZITIEREN]

In Ihrem Fall würde ich Ihrer Mutter dann auf jeden Fall zu dem Mammographie-Screening raten. Gerade bei familiärer Vorbelastung ist es sehr wichtig, regelmäßig dieses Angebot anzunehmen. Ich würde Ihrer Mutter und Ihnen zusätzlich raten mit Ihrem niedergelassenen Frauenarzt Ihr persönliches Risiko und die individuelle Vorsorge zu besprechen, da bei Brustkrebserkrankungen in der Familie unter Umständen das Risiko für Verwante erhöht und eine individuelle Vorsorge indiziert seien kann.

Konnte ich Ihre Frage damit beantworten?
Mit freundlichen Grüßen,

Fig. 14 Appearance in the forum: development of a communication thread. In German, since it is an original screenshot of the online-forum; participant's username and time of communication process is made anonymous

### 3.1.4 Adaption due to piloting the online-forum

The online-forum and its implementation into the training program was tested and adapted along evaluation of the two pilot groups (see 2.1.4). Feedback by the first pilot group displayed the self-explanatory way of the features; the students were able to handle the online-forum straight away and without utilisation of the provided manual. There were no needs for optimisation of technical aspects, content and features.

Due to comments by the second pilot group and experience of study assistants and trainers in that period of the project, implementation of the forum into the flow of processes throughout the present sessions of the course was optimised: For instance every pilot participant was asked to type in the URL before starting, which took more time than expected. Thus a HTML document was developed and provided to participants, so that they could reach the online-forum's website straight away. Furthermore suitability of the simulated patients for training in the forum was tested and optimised. Evaluation illustrated the overall acceptance of the developed training-instrument among the students. Features for research on the project and for supporting comparability of processes appeared to be adequately implemented and workable for study assistants; thus a balance between a high level in closeness to reality, acceptance and options to integrate research into the forum was reached.

3.2   Evaluation of the training program's effectiveness

3.2.1 Analysis sample

Power analysis of data resulted in a needed sample size of 72 participants, 36 in G1 and 36 in G2 (G*Power $(1-\beta)$ > .8). The analysis sample of the topical project comprises 78 medical students (39 in G1 and 39 in G2) participating in the training program during 9th semester curriculum. 61 % of participants were female, 66 % of the students were 23-26 years old, and 84 % were German. 22 % of them had completed previous education, before starting their medical education. This is illustrated by Fig. 15.
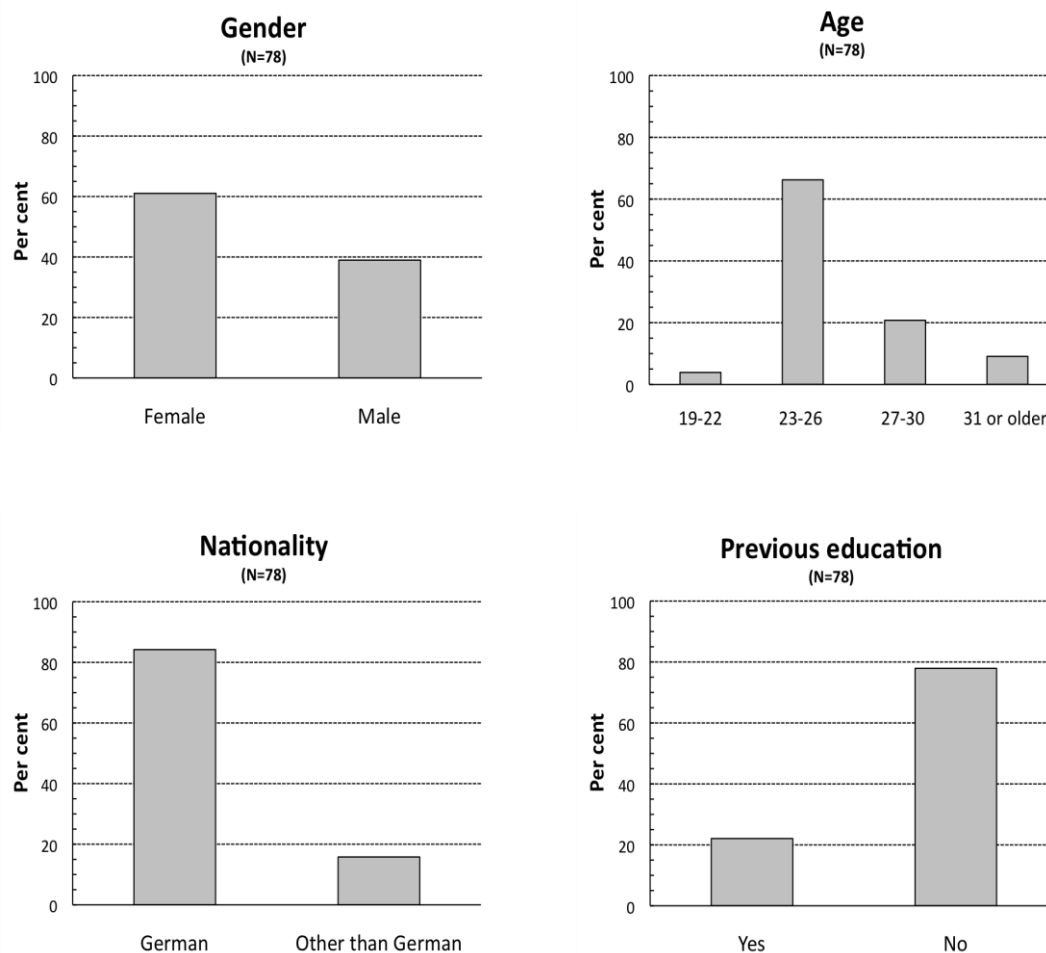
Fig. 15 Sociodemographic data of analysis sample (AS), illustrated by column charts. The analysis sample consists of 78 medical students (39 in G1 and 39 in G2). 61 % of participants in AS are female, 66 % 23-26 years old, 84 % are German and 22 % of them had completed previous education before.

3.2.2 Comparability of cohort and analysis sample, G1 and G2

Sociodemographic data of the analysis sample and cohort did not differ significantly regarding sociodemographic aspects: gender (χ^2 = .401; p = .527), age (χ^2 = .683; p = .877), nationality (χ^2 = .170; p = .680) previous education (χ^2 = .0; p = .995); data acquired from the analysis sample is thus representative for the cohort.

Group 1 and group 2 did not differ significantly regarding sociodemographic aspects either: gender (χ^2 = .312; p = .577), age (χ^2 = 4.633; p = .201), nationality (χ^2 =1.344; p = .246), previous education (χ^2 = 2.058; p = .151). Thus data from the cohort and data from G1 and G2 is comparable.

3.2.3 Acceptance of the training program

Learner's satisfaction with the training is an important factor supporting learning progress. Therefore the training program's evaluation by participants was acquired in order to gain information about effective application of resources and the participants' satisfaction with implementation of the course and the online-forum.

Furthermore information was collected on whether both groups were equally satisfied with the training conditions and none of them felt disadvantaged compared to the other group.

The course and online-forum's quantitative evaluation by the students results in: "External organisational circumstances" (*mean* = 2.79; *SD* = .142); "Performance and moderation of the course" (*mean* = 4.19; *SD* = .104) and "Application of online-forum" (*mean* = 3.90; *SD* = .103).

Analysis by Man-Whitney U test shows no statistically significant differences between data of group 1 and group 2 in all 3 variables: "External organisational circumstances" (*U* = 583; p = .343); "Performance and moderation of the course" (*U* = 603; p =.452) and "Application of online-forum" (*U* = 563; p =.298).

These results are illustrated by the bar charts in Fig. 16 and are specified by analysis of free-text comments from the post survey on this aspect: Aspect of time and long distance between gynaecology sessions and present sessions of the topical training program were negatively criticised regarding the quantitative aspect "External organisational circumstances". As representative examples, following citations from the texts are to be mentioned:

"Long distances took too much time of the day"
"The week of gynaecology internship is busy already"
"Hours of present sessions are too late during the day"

Furthermore participants mentioned that the training program should be integrated earlier into curriculum. Nevertheless, the students were generally satisfied with implementation of the training program during present sessions and comments of participants indicate high appreciation of the training-instrument amongst the students. As representative examples, following citations are to be named:

"Activity was stimulated"
"Creativity was promoted"
"It supported the hands on way of teaching"

A highly significant correlation between students' satisfaction in fields of "external organisational circumstances" with their statement on the level of profit throughout the training program in the post online-survey was analysed (Spearman's rho Correlation Coefficient = .517; p= .000). Comparison between quantitative evaluation of G1 and G2 is illustrated by Fig. 16.

Evaluation by participants
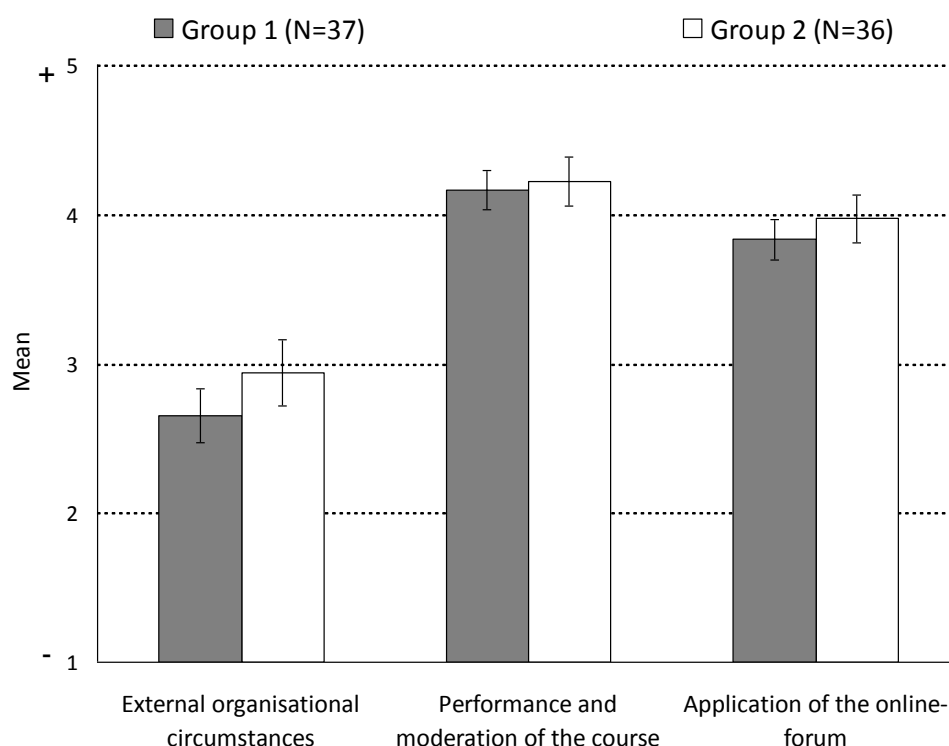
Fig. 16 Comparison of group 1 (G1, self-directed) and group 2 (G2, trainer-directed) regarding the training program's evaluation. No statistically significant differences were detected between evaluation of G1 and G2.

3.2.4 Learning progress of participants

In order to analyse whether the difference between course concept G1 (group 1, self-directed focus) and G2 (group 2, trainer-directed focus) has an impact on effectiveness of the training program; the learning progress of students was compared between the two groups.

Students were asked for global rating of their learning results through the pre/post self-assessment on visual analogue scales in view of the learning objectives concerning the two aspects "doctor patient communication" and "online-communication".

For group 1 a significant increase from pre-assessment to post-assessment in both aspects ("doctor-patient communication" and "online-communication") was observed by Wilcoxon test ("doctor-patient communication": Z = -2.036; *p* =.042; "online-communication": Z = -2.058; *p* =.04). This is illustrated by the bar charts in Fig. 17.

In contrast, for group 2 analysis of difference shows a small increase from pre-assessment to post-assessment, which is not significant in both aspects ("doctor-patient communication": Z = -.668; *p* =.504; "online-communication": Z = -1.226; *p* =.220). This is illustrated by Fig. 18.

Self-assessment - Group 1 (self-directed)
(N=39)

☐ before training program   ☐ after training program
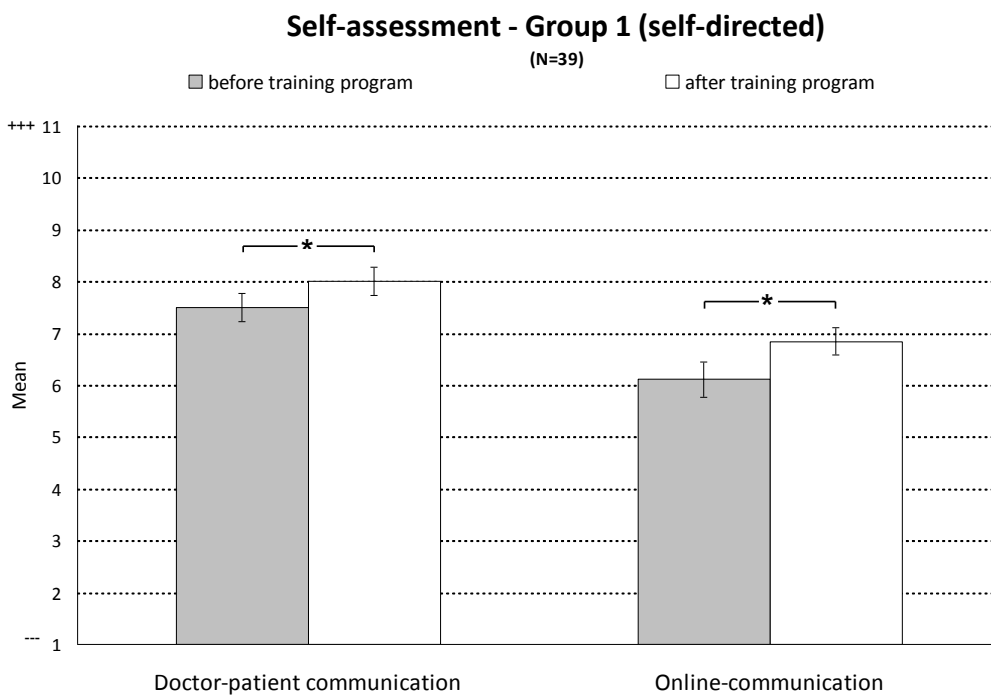
Fig. 17 Resulting differences between pre/post self-assessment by the students for G1 (self-directed). A significant increase from pre-assessment to post-assessment in both aspects is shown ("doctor-patient communication": Z = -2.036; p =.042; "online-communication": Z = -2.058; p =.04).

Self-assessment - Group 2 (trainer-directed)
(N=39)

☐ before training program   ☐ after training program
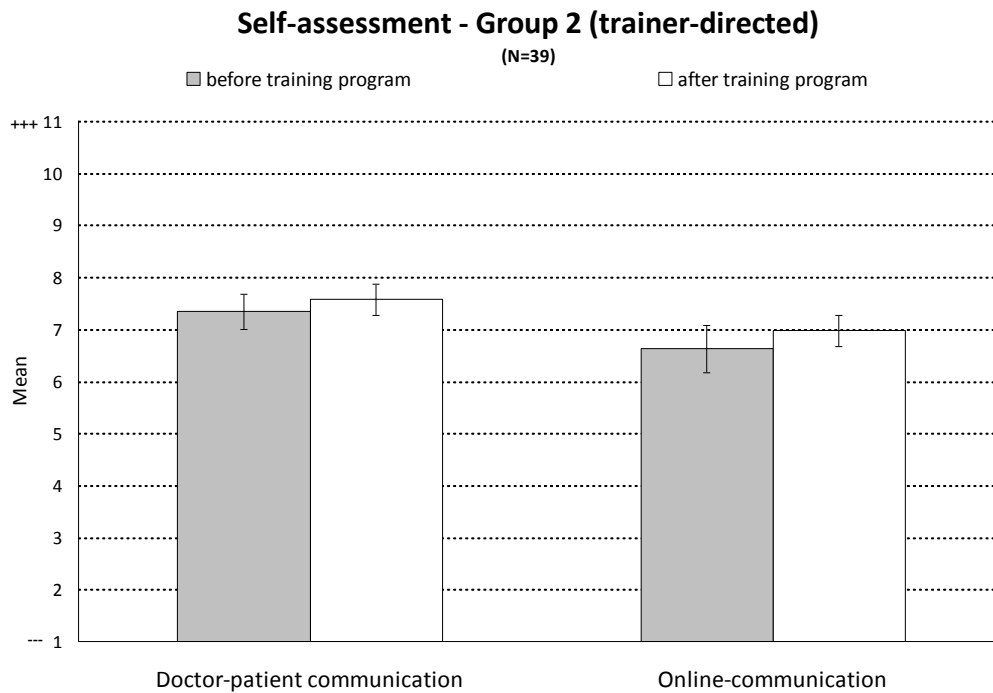
Fig. 18 Resulting differences between pre/post self-assessment by the students for G2 (trainer-directed). A small increase from pre-assessment to post-assessment, which is not significant in both aspects, is shown ("doctor-patient communication": Z = -.668; p =.504; "online-communication": Z = -1.226; p =.220).

3.2.5 Participants' activity during independent training

Students' learning activity during independent training is expected to influence their learning progress. Therefore it was analysed concerning the following criteria:

1) Number of completed training cases. For this, data was collected via web protocols, which were acquired and analysed by study assistants.
2) Frequency of students' use of sources: How often did the students make use of information from independent "online research" and trainer's instruction during "present sessions"? For this, data was derived from students' indication in the post survey.

Students were asked to complete at least two out of four cases during independent training in form of an optional task (Tuesday until Thursday), in order to be prepared for the present session on Friday. Comparison between the two groups shows that 49% of students in group 1 (self-directed) completed 2 training cases, in contrast to 38 % of students in group 2 (trainer-directed). Furthermore 51 % of students in group 2 denied working on any training case, compared to 33 % of students in group 1.

However, in any range students of group 1 (self-directed) were more active in completion of training cases. For details see Fig. 19, it illustrates the percentage of students that completed the range of 0-4 training cases.

Completed training cases
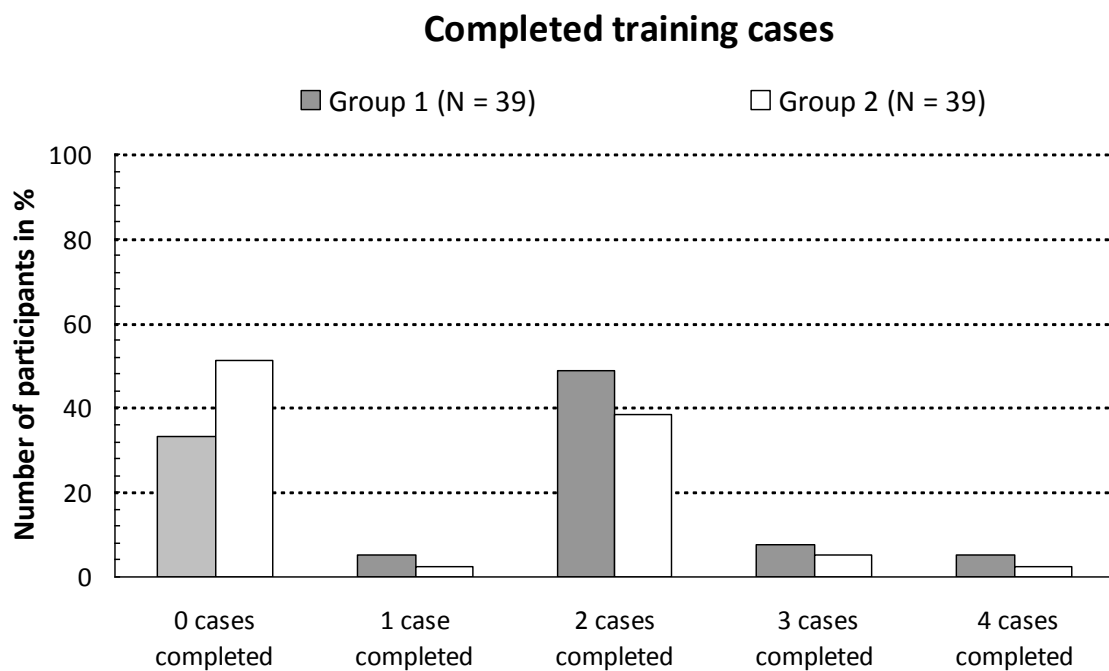
Fig. 19 Completion of training cases. Differences between G1 (self-directed) and G2 (trainer-directed); completed training cases, divided into the range from 0 – 4 completed cases; students were told to complete 2 out of four cases during independent training.

Comparison of both groups' mean value regarding the use of sources by Man-Whitney U test shows a difference of $U = 202.5$; $p = .073$ for "Online-research" (mean value in group 1 is 4.46 with a standard deviation of .352 and mean value in group 2 is 3.55 with a standard deviation of .425).

Values for "Present sessions" do not differ statistically significanty (U = 265.5; p =.663; mean value in group 1 is 3.42 with a standard deviation of .364 and mean value in group 2 is 3.64 with a standard deviation of .398) (see Fig. 20)

How often did students use information from online research and present sessions during independent training ?
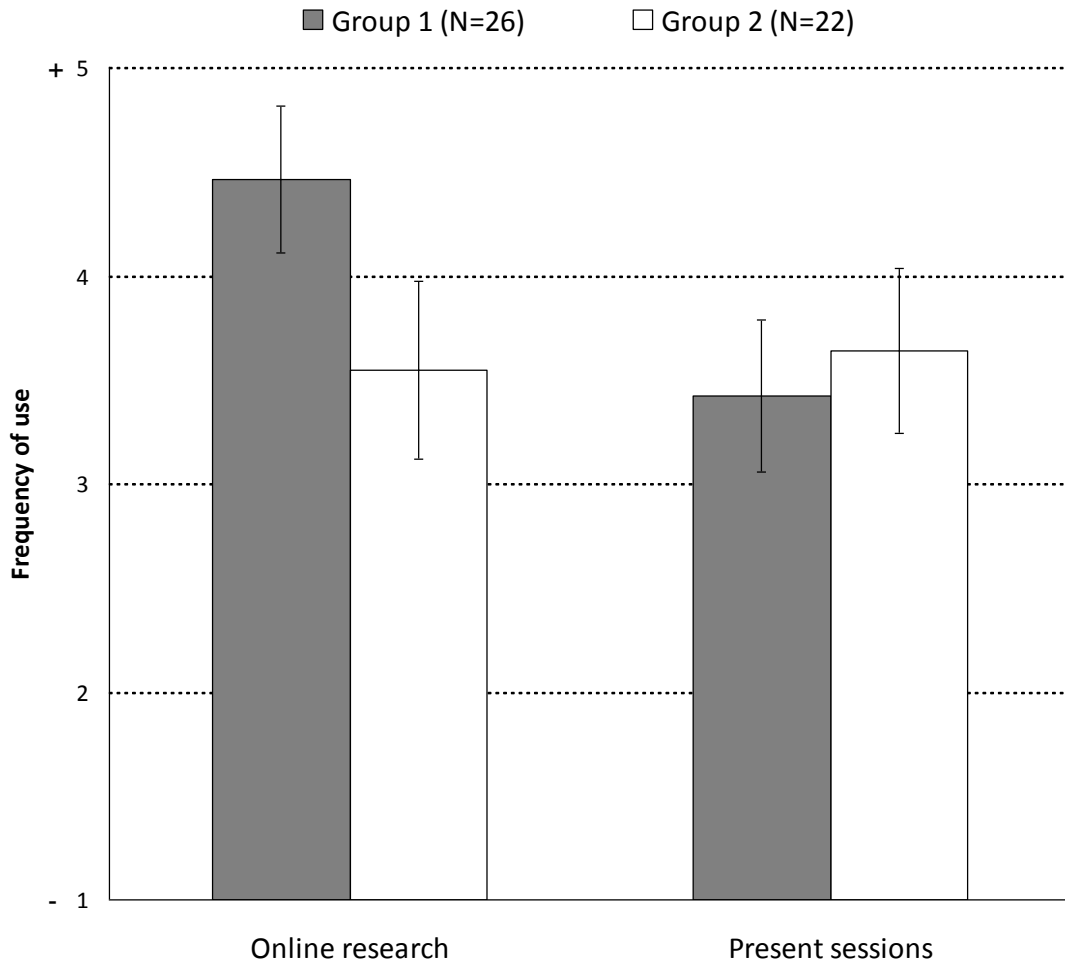
Fig. 20 Differences between G1 (self-directed) and G2 (trainer-directed) regarding their use of sources during independent training. Values: "Online-research" p =.073 "Present sessions" p =.663

Correlation between participants' activity and learning progress shows a moderate relation for participants of group 1 (correlation coefficient = .4; p = .08) and no relation for participants of group 2 (correlation coefficient = 0.03; p = .8).

4   Discussion

Throughout the discussion, aspects of the research project are discussed one after the other. Particular limitations and chances are outlined along with the discussion of every aspect.

4.1   Topical research project

The impact of the Internet on western medical care causes new challenges that need to be met by doctors today, particularly in fields of "expert-guided online-counselling regarding preventive interventions". However, there is still a lack of options to prepare medical students and doctors for these challenges. Therefore a simulation-based training program in a blended-learning format, involving an online-platform as training instrument was developed for medical students. It was implemented into undergraduate curriculum in two differing course formats, whereas one was focussed on self-directed learning and the other one was focussed on trainer-directed learning.

The training program was evaluated in form of a randomised, prospective trial, regarding its adequate implementation and effectiveness comparing the two educational intervention strategies. The acquired data involves a high level in force of expression (G*Power $(1-\beta) > .8$) and it was demonstrated to be comparable between the two groups (G1, G2).

The topical study presents data indicating great suitability of the online-platform for training and its high acceptance amongst the students. Furthermore it presents that students of the self-directed group (G1) show an increased learning outcome, compared to lower results for the trainer-directed group (G2), as well as greater learning activity during the independent training period.

To my knowledge this is the first project developing a training platform with a course concept in order to bridge the gap between demands on doctors in fields of expert-guided online-counselling regarding preventive interventions and the lack of options to prepare them for the arising challenges throughout medical curriculum. The project was conducted as part of a prospective, parallel group, randomised trial with pre/post analysis (Mad 2008). Acquisition and evaluation of data was single blinded via individual codes. The study was not double blinded, due to the educational context: Blinding of operator (trainer) and study assistants was not possible, since they were aware of the course concept variant (G1, G2) that they were carrying out and even though participants were not explicitly told which group they were allocated to, it could not be excluded whether they noticed differences between the course concepts by contacting fellow students. The educational context did also not allow implementing a control group consisting of participants without any intervention, since this would have been ethically problematic. However, the study aimed at describing the impact of the training program on participants' competencies and evaluation (after intervention); thus their current stand before intervention was chosen to represent control group (Nachtigall and Wirtz 2006).

4.1.1 Relevance of training options

The demand on doctors to be available to patients on the Internet for adequate counselling and the importance of providing training options in this field is not only illustrated by patients' demand on online-counselling and the rising technical potential through the Internet. It is also relevant on ethical levels, caused by "asymmetry of expert knowledge" (Bromme and Jucks 2014) between doctors and patients. To illustrate this, the four ethical principles for decisions in medical care are presented below (Beauchamp and Childress 2009).

1. Autonomy
2. Beneficence
3. Non-maleficence
4. Justice

Today patients' "autonomy" gains impact in fields of medical treatment, due to their increasing medical knowledge (Hewitt-Taylor and Bond 2012). On the other hand inadequate information sources can lead to patients' harm, which contrasts the third principle "non-maleficence" (Andreassen, Trondsen et al. 2006). In this case principles 2-4 predominate the first (Winkler 2012): It is the doctors' responsibility to provide and support patients with adequate expert knowledge (Fox and Duggan 2013, Bromme and Jucks 2014)

This context is illustrated by Fig. 21, in which the "asymmetry of expert knowledge" (Bromme and Jucks 2014) between patients and doctors is illustrated as "information gap".
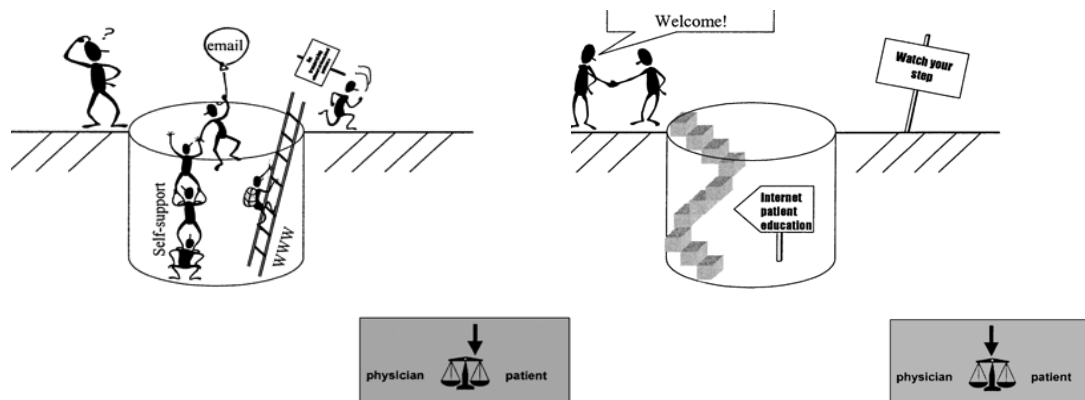
Fig. 21 Impact on the doctor-patient relationship in terms of the "information gap" (Anderson, Rainey et al. 2003). The left part illustrates patients unable to access doctors through the Internet. Therefore they support themselves to escape the "information gap" by searching the Internet independently, thus they do not watch the sign saying "no trespassing without professional guidance". The right part shows doctors that are accessible for those patients searching the Internet. The steps illustrate an organised and expert guided way out of the "information gap", which is realised in cooperation between doctors and patients.

In addition doctors "online reputation" gains significance. They should therefore give themselves more control over what appears on the Internet supporting the relevance of training even more. Thus Shamdas Mehta et al. 2015 state: "Universities should also take practical steps to help their students establish an online presence" (Shamdas, Mehta et al. 2015).

Not only the demand on doctors to be available for patients through the internet arises, there is also scientific evidence for the effectiveness of implementing online-counselling trials, especially regarding preventive medical procedures and with patients in chronic conditions (Dixon and Rao 2014, Brosseau and Wells 2015). Furthermore psychological online-counselling arises to be effective, which is yet completely covered by health insurance in the Netherlands (Nijhof, Bleijenberg et al. 2012).

4.2 Online-forum: an adequate training-instrument

4.2.1 Qualities of simulation-based learning

The training instrument was developed to simulate the topical setting "online-counselling simulated patients via asynchronous, written online-communication in a private and professional environment in the role of a doctor" with a high level in closeness to reality. Thus it involved virtual patients (VPs) that were developed in form of vignettes to be integrated into the forum. Students' individual sections provided the private and professional environment for counselling the VPs via asynchronous, written online-communication in the role of a doctor. The suitability of the VPs and features for interaction for training reason were clearly indicated along evaluation of the pilot groups.

Scientific evidence shows that simulation-based learning raises the effectiveness of medical education (Issenberg, McGaghie et al. 2005, Barsuk, Cohen et al. 2012), thus improves patient safety and outcome of their treatment (Cook, Hatala et al. 2011). Next to the scientific evidence, the problem of simulations' artificial training sessions arises. There is still not enough evidence on whether students transfer their gained skills adequately in real-life situations (Motola, Devine et al. 2013). Thus the significance of the learning outcome's long-term assessment is stressed.

Simulated patients (SPs) are widely and increasingly used for medical teaching and assessment (Motola, Devine et al. 2013); they simulate a real-life clinical scenario and enable learners to impersonalise the role of doctors (obtaining a

history, conducting a physical exam, and making diagnostic and therapeutic decisions) in a face-to-face setting. If this is implemented through a specific computer program, they are defined as virtual patients (VPs) (Association of American Medical Colleges 2007). VPs' digitalised characters are preferred over paper versions of patient cases and furthermore support learners' satisfaction with the training programs, which is a relevant basis for effective learning (Bergin 2003, Deladisma, Johnsen et al. 2008).

Their implementation furthermore provides the option to optimise medical examination in terms of objectivity and standardisation (Cleland, Abe et al. 2009). In order to reach training outcomes in fields of counselling patients in a face-to-face setting, VPs are described as an inadequate instructional modality, due to the problem of developing empathy with VPs in these artificial situations (Lehmann, Bosse et al. 2010).

Being able to develop a relationship and empathy to patients via the Internet is a major challenge arising through the change of communication medium from a face-to-face setting to online-communication with the patient. Due to the fact that topical project aims at preparing medical students these challenges, VPs arise to be the adequate instructional method by illustrating the topical challenges with a high level in closeness to reality (Deladisma, Cohen et al. 2007). Since the online-forum involves simulated patients, it therefore does not only raise students' satisfaction and the effectiveness of learning, it also supports patients' outcome and their security. Furthermore the option to raise objectivity and standardisation of examination through the online-forum is provided.

The application of simulated and virtual patients, integration of online-discussion and multimedia examples (audio, video) into training-instruments are described to support participants' satisfaction with the training program furthermore (Cook, Levinson et al. 2010).

In addition it is shown that integration of instruction and feedback into training-instruments increases students' learning outcome in fields of the particular training issue (Casebeer, Strasser et al. 2003). These additional features that support effectiveness of training, were not integrated into the online-forum, since this exceeded resources in fields of time and workforce. However, feedback and instruction were given by trainers during present sessions of the training program.

4.2.2 Features' characteristics

First of all, features allow the major requirement on the training instrument to provide the option for interaction between "doctors" (students) and "patients" (simulated patients) via the Internet. For this, patient requests were automatically allocated to the students' individual sections through a developed standardised scheme. Since this scheme was integrated into the forum via written python scripts, this part of interaction process was automated. Thus students started counselling the allocated requests straight away at reliable points of time throughout the training program and efficiency regarding resources of time and workforce was supported.

However, at this point of development the lack of resources in fields of time and workforce partly restricted processes of interaction between the simulated patients and the students in the forum: Even though the first requests of the simulated patients were logged into the individual sections by an automated process, the process of responding to the students' (doctors' in the forum) written replies was not automated yet. Therefore the time frame of 15 minutes for interaction during present sessions and three days for interaction during independent training, as well as workforce of one study assistant for writing further replies, limited the development of longer communication threads extending one additional answer by the simulated patients (altogether three posts). The need to automate processes of interaction in the forum furthermore, in order to meet the problem of limited resources and to raise efficiency of the training-instruments' features arises.

Due to its management via written python scripts, qualities of the developed training instrument allow flexible expansion of content and features. Therefore content of the online-forum is easily transferable to further topics and professions, as well as new target groups (for instance doctors) and its features are easy to expand and optimise (for instance further automation of processes).

The flexibility of content and features also supports the easy integrating of research into the online-forum: The forum database was accessible to study assistants, thus all written texts and information on the students' activity were easily transferable into SQL data scripts. Furthermore the students' individual login for the forum equalled their individual code, which they were requested to use for research instruments. Therefore connection of data derived from the forum with data from the research instruments (online-surveys) was enabled and made anonymous.

Implementing the training program into a research context also arises as limitation of the training instrument: Patient cases in the forum were standardised and developed to ensure a comparable level of difficulty, thus their requests were all concerning the same topic: "screening mammography". This limited the versatility of tasks for the students in the forum. Thus they indicated in the free text evaluation that working on different topics would be more challenging and diversified.

Furthermore, the students particularly describe the forum as activity and creativity stimulating. Thus the acceptance of the training instrument and the overall satisfaction arises as further chance, due to its positive impact on learning outcome (Deladisma, Johnsen et al. 2008).

Finally, major strength of the forum are the self-explanatory way of its features to the students, its easy handling and the easy way to integrate it into the course concept's flow of processes.

4.3 Self-directed vs. trainer-directed teaching approach

4.3.1 Qualities of the blended-learning format

The topical training program was developed in a blended-learning format with two differing didactical approaches. Three days of independent training through the developed training instruments (online-forum) were framed by two present sessions at the start and the end of the week.

Teaching in a blended-learning format is proved to be significantly more effective compared to teaching in a face-to-face setting or an internet-based setting alone (Bains, Reynolds et al. 2011). The training outcome is furthermore enhanced by internet-based configurations that support interactivity, practice exercises, repetition and feedback. (Cook, Levinson et al. 2010). In addition, the overall acceptance of training programs in this format is high among participants (Lehmann, Bosse et al. 2010, Lehmann, Bosse et al. 2013). Just as a curriculum should have clearly defined outcomes, so should a simulation-based education intervention (Motola, Devine et al. 2013): Therefore clearly defined goals and benchmarks were set and presented to the students in form of the training program's learning objectives during the first present session; hereby the course concept's effectiveness was raised even more.

This supports the effectiveness of the topical training program: Not only were discussions in the group implemented during present sessions, particularly the task to counsel the patients through the forum supported interactivity and repetition of tasks throughout the course and the implemented feedback sessions during the last present session supported the effectiveness of training.

Analysis of students' post evaluation concluded in low results regarding the aspect "external organisational circumstances" of the training program. This indicates criticism on organisational frame conditions of the training program that was specified through analysis of students' free text evaluation; aspect of time and long distance between gynaecology sessions and present sessions of the topical training program were criticised. This correlates highly significantly

with their statement on the level of profit through the training program in the post online-survey (Spearman's rho Correlation Coefficient = .517; *p*= .000). This relation indicates that the more participants were dissatisfied with frame conditions of the project, the less they felt to profit from the training program. Nevertheless an overall positive evaluation of the training program by students concluded, which might be likely to increase even more, as soon as these frame conditions are improved.

Students were generally satisfied with implementation of the training program. The aspect "performance and moderation of the course" resulted in a high mean value with no significant differences between the two groups. Thus the topical course arises as an adequate basis for effective training in this field (Deladisma, Johnsen et al. 2008). Additionally the perspective of increasing course evaluation arises, as soon as external organisational frame conditions of the course are improved. Furthermore the equality between course evaluations of both groups indicates that students of one group did not feel disadvantaged compared to students of the other group.

4.3.2 Comparison of the teaching approaches G1 and G2

In fields of the blended-learning format, one concept "G1" (self-directed) was focussed on the independent training session, to be compared to a concept "G2" (trainer-directed) focussed on the present sessions. This arises to impact learning outcome of the training.

Evaluation of the self-assessment regarding the topical learning objectives shows that participants of G1 (self-directed approach) indicate a significant increase of their competencies in this field, compared to lower results for participants of G2 (trainer-directed approach). This result shows that G1 students feel better prepared in this field. The difference between participants' use of sources regarding "online-research" during self-directed training shows a tendency towards a significant level (p =.05), which indicates that students of G1 did more research on the Internet independently.

In addition they completed more training cases. These facts indicate that participants of G1 (self-directed) were more active than participants of G2 in independent online-research while completing the training cases. Students were asked to respond to 2 out of 4 training cases; therefore not many completed more than 2 cases, this was also supported by the busy week of the gynaecology internship in which the course was integrated. The activity of students in G1 furthermore correlates with their significantly raised self-assessment on the topical learning objectives. The quality of the self-directed learning approach and the related impact of the students' activity arises.

4.3.3 Qualities of self-directed learning

Scientific literature describes self-directed learning (also defined as "individualised learning") as more effective, efficient and sustainable than a time-predefined intervention. It allows learners to progress through training at a pace, well suited to his/her skill acquisition and furthermore it stimulates students to actively process the learning content (Wolff, Wagner et al. 2015). The unsupervised learning periods should be instructed appropriately by the educators (Brydges, Dubrowski et al. 2010, Motola, Devine et al. 2013).

Furthermore there is evidence on the simulation devices being effectively used for individualized learning as part of directed, self-guided learning. Thereby the educational content and context that benefits the effect of self-guided learning is provided. (Brydges, Carnahan et al. 2009). Therefore medical educators are increasingly required to use techniques that support self-directed learning, such as fostering students' activity, motivation and commitment or implementing methods such as the "Flipped Classroom", which requires students to acquire knowledge independently at home, in order to implement it in interactive and hands-on methods during classroom time (Wolff, Wagner et al. 2015).

The course concept "G1" did not only contain aspects of the "Flipped Classroom" concept, through the focus on independent training via the online-forum it also involved methods fostering the students' motivation and activity.

Therefore the greater learning outcome of students in the self-directed group (G1) throughout the topical study is described to arise due to the qualities in fields of self-directed learning supporting effective training.

4.4   Assessment of learning outcome

Collecting data for analysing students' learning outcome via self-assessment was adequately implemented, since "gold standard" criteria in form of the learning objectives and feedback was given during the present sessions (Sclabassi and Woelfel 1984, Miller 2008). Self-assessment was implemented via global rating scales regarding the topical learning objectives due to limited resources of time. Even though no scientific literature on global rating scales in fields of self-assessment was found, scientific evidence shows that this kind of rating profits assessment by raters in connection with defined criteria for evaluation (Ma, Zalunardo et al. 2012). Strengths of this method are described as promotion of participants' self reflection, as well as economical reasons of evaluation and analysis (Cook, Garside et al. 2010). Furthermore, the self-assessment was integrated into the pre/post online-surveys on basis of visual analogue scales (VASs). This method does not only prevent the problem that students might keep the value thy indicated for the pre self-assessment in mind until post self-assessment; it also supports the detection of small differences and provides more possibilities for data analyses (Funke and Reips 2012).

However, the pre/post self-assessment as a method to analyse the students' learning outcome, needs to be regarded as limitation. It is shown that data acquired via self-assessment does not involve an appropriate degree of accuracy and reliability (Miller 2008). As a subjective method it is highly vulnerable to rater biases and likely to be influenced by individual and personal factors of participants. For instance better performing medical students tend to underestimate their performance and poorer performing students tend to overestimate their performance (Edwards, Kellner et al. 2003), as well as male students tend to overestimate their competencies compared to female students. (Kearney-Cooke 1999, Kling, Hyde et al. 1999, Jünger, Schellberg et al. 2006)

Therefore character of this assessment's results is preliminary and suitable to illustrate tendencies of results in this field. The significance to align these preliminary results with results derived from an objective evaluation method arises. Thus the ongoing evaluation of students' pre/post OSCE tests by two independent raters throughout a following research project arises as a significant perspective of the topical project; method for this was also implemented into the topical study design via the pre/posttest (see Table 4). Preliminary results of the OSCE evaluation in fields of the following research project indicate highly significant results concerning the learning outcome of participants in group 1 (self-directed course approach). This result corresponds with the self-assessment's preliminiary results indicating a higher effectiveness of the more self-directed course concept (group 1) regarding the students' learning outcome and activity throughout the self-directed training period. It would therefore confirm the described tendecy through data of the topical research project.

4.5   Perspectives

The combination of the training instrument and the course concept provides a basis for an effective training program supporting medical students' competencies in fields of expert-guided online-counselling regarding preventive interventions. Therefore the easy expansion of the training-instrument arises as perspective, as well as the training instrument's transfer to further topics and professions and new target groups (for instance doctors), throughout future research projects. The course concept (G1) involves the approach towards self-directed learning, which is increasingly required due to its effectiveness and sustainabiliy of learning outcome and efficiancy in training ressources (Tolsgaard 2013). Thus its expansion throughout future research project arises as relevant perspective.

Furthermore it is relevant to align results of the ongoing research project evaluating the OSCE tests with results from this project. In addition, a long term evaluation of the learning outcome's sustainability arises as perspective.

5   Summary

Introduction

The impact of the Internet on medical care leads to various medical information sources for patients and to an increasing demand for online-counselling. Thus new challenges for doctors arise. Aim of this project is to close the gap between these challenges and the current lack in options to prepare medical students for them. A training program in a blended-learning format with an online-platform as training instrument was designed and implemented into a gynaecology course during 9th semester of medical curriculum. It was analysed on basis of the following research question:

How can medical students be prepared effectively for current challenges in the field of expert-guided online-counselling on preventive interventions?

- A randomised, prospective trial exemplified by a case study of Mammography-Screening

1. How does an online-forum need to be designed, in order to provide an adequate training instrument simulating the arising challenges with a high level in closeness to reality?

2. Which didactical blended-learning approach (trainer-directed or self-directed) is most appropriate to prepare students effectively?

Methods

The online-forum's development is shown as well as the establishment of the two course formats along Kern's model. In a prospective, randomised, parallel group study the training outcome is evaluated by standardised and blinded pre/post analysis using a test, in which students counselled a simulated patient request through the forum. This was followed by an online-survey for students' self-assessment regarding the learning objectives. The survey also collected data on students' characteristics and course evaluation.

Results

The data shows a G*Power (1-β) > .8 and no significant differences between sociodemographic aspects ($p > .05$) of the two groups (G1, G2). Students' evaluation (lowest: 1, best: 5) results as follows: external organisational

circumstances (time, distances) (*mean* = 2.79; *SD* = .142), performance and moderation of the course (*mean* = 4.19; *SD* = .104), application of online-forum (*mean* = 3.90; *SD* = .103). The students of the self-directed group (G1) show a significant increase in their self-assessment (doctor-patient communication: $Z = -2.036$; *p* =.042; online-communication: $Z = -2.058$; *p* =.04), implemented independent online-research (*p* =.073) during independent training more often than G2 students and completed more training cases in any range.

Discussion

The data indicates great suitability of the online-forum for training and its high acceptance amongst the students. However, external organisational circumstances were criticised. The forum supports the effectiveness of training and since it is an instructional method in fields of simulation-based learning, it is shown to raise the effectiveness of medical education. Students of G1 (self-directed) arise to show a better learning outcome and their higher activity level correlates with their significantly raised self-assessment regarding the topical learning objectives. This is supported by scientific evidence describing the strengths of blended-learning and self-directed learning approaches in medical education. In particular, the limitation of self-assessment as a method for characterising the students' learning outcome needs to be regarded, since it is shown to be highly vulnerable to rater biases. Thus aligning the results with the subsequent OSCE evaluation of the students' texts from the pre/post test in the forum arises as relevant. In addition, the forum's content and features' high level in flexibility allows easy transfer to further disciplines and target groups.

Conclusion

The blended-learning course with the online-forum as training instrument provides a basis for an effective training of medical students in fields of expert-guided online-counselling regarding preventive interventions. Its transfer to other target groups in a self-directed approach arises as major perspective. The alignment of data from self-assessment with the subsequent OSCE evaluation arises as further relevant perspective, since its preliminary results appear to highly significantly confirm the tendency described throughout this study.

5.1   German summary

Einleitung

Der Einfluss des Internets auf den medizinischen Sektor führt zu einer Vielfalt an medizinischen Informationsquellen und einer zunehmenden Forderung nach Online-Konsultationen. Daraus entstehen neue Anforderungen an Ärzte. Ziel dieses Projektes ist die Lücke zwischen diesen Anforderungen und den gegenwärtig fehlenden Optionen Medizinstudierende und Ärzte darauf vorzubereiten zu schließen. Es wurde ein Trainingsprogramm mit einer Online-Plattform als Trainingsinstrument entwickelt, innerhalb eines Gynäkologie Kurses (9. Sem.) umgesetzt und anhand dieser Forschungsfrage analysiert: Wie können Medizinstudierende effektiv auf die Anforderungen im Bereich experten-gesteuerte Online-Beratung zu präventiven Interventionen vorbereitet werden? (Anhand des Fallbeispiels Mammographie-Screening)

1. Wie sollte ein Online-Forum konzipiert sein, um ein Trainingsinstrument zu bieten, welches die Anforderungen adäquat und realitätsnah simuliert?
2. Welcher Kursansatz im blended-learning Format (selbst-gesteuert vs. trainer-gesteuert) ist am geeignetsten für eine effektive Vorbereitung?

Methoden

Die Entwicklung der Inhalte und Funktionen des Online-Forums ist erläutert und der Aufbau der beiden Kurskonzepte ist anhand des Kern Modells beschrieben. In einer prospektiven, randomisierten Parallelgruppenstudie wird das Trainingsergebnis durch standardisierte prä/post Instrumente evaluiert. Durch einen Test, in welchem Studierende eine simulierte Patientenanfrage bearbeiten und einen darauf folgenden Online-Fragebogen für die Selbsteinschätzung der Studierenden bezüglich der Lernziele und für die Datenerhebung der Charakteristika und Kursevaluation der Studierenden.

Ergebnisse

Die Daten zeigen eine G*Power $(1-\beta) > .8$ und keine signifikanten Unterschiede ($p > .05$) zwischen den soziodemographischen Aspekten der beiden Gruppen (G1, G2). Die Kursevaluation (Min.: 1, Max.: 5) ergibt die folgenden Resultate:

Externe organisatorische Bedingungen (zeitlich, örtlich) (MW = 2.79; s = .142); Umsetzung und Moderation des Kurses (MW = 4.19; s = .104) und Anwendung des Online-Forums (MW = 3.90; s = .103). Studierende der Selbst-Gesteuerten Gruppe (G1) zeigen eine signifikante Steigerung ihrer Prä/Post Selbsteinschätzung (Arzt-Patienten Kommunikation: Z = -2.036; p =.042; Online-Kommunikation: Z = -2.058; p =.04) und eine stärkere Aktivität in der eigenständigen Trainings-Phase als G2 Studierende, durch häufigere Online-Recherche (p =.073) und stärkere Bearbeitung der Übungsfälle.

Diskussion

Die Daten verdeutlichen die gute Eignung des Online-Forums für das Training und die hohe Akzeptanz der Studierenden. Weiterhin unterstützt das Forum den Lerneffekt durch simulations-basiertes Lernen. Dies erhöht erwiesenermaßen den Lernerfolg im Bereich der medizinischen Lehre. Studierende der der selbst-gesteuert Gruppe (G1) weisen ein besseres Trainingsergebnis auf ihre höhere Aktivität korreliert mit ihrer signifikant gesteigerten Selbsteinschätzung im Hinblick auf die Lernziele. Dies ist auch durch wissenschaftliche Literatur belegt, die die Stärken von blended-learning und selbst-gesteuerten Lernansätzen in der medizinischen Ausbildung verdeutlicht. Vor allem die Selbsteinschätzung zur Beschreibung des Lernerfolgs erscheint als Limitation, da diese erwiesener Maßen stark durch subjektive Faktoren beeinflussbar ist. Daher ist der Abgleich der Ergebnisse mit der folgenden objektiven OSCE Auswertung des prä/post Tests der Studierenden notwendig. Außerdem erlaubt die Flexibilität des Inhalts und der Funktionen eine einfache Übertragung des Instruments auf weitere Zielgruppen.

Schlussfolgerung

Das Kurskonzept und das Forum bieten die Basis für ein effektives Training von Medizinstudierenden im Bereich experten-gesteuerter Online-Beratung zu präventiven Interventionen. Ausblick ist der Transfer zu weitere Zielgruppen im selbst-gesteuerten Ansatz. Der Abgleich der Ergebnisse mit der OSCE Evaluation ist relevant, vor allem da vorläufige Ergebnisse die beschriebene Tendenz durch die Selbsteinschätzungen hochsignifikant bestätigen.

6   Bibliography

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7 Declaration of the own contribution

The study was designed at the Competence Centre for University Teaching in Baden-Wuerttemberg, Faculty of Medicine, University of Tuebingen, in cooperation between Dr. Maria Lammerding-Köppel, MME (head of the Competence Centre for University Teaching in Medicine), Jan Griewatz (research associate at the Competence Centre for University Teaching in Medicine) and me. Supervision of my scientific work was implemented by Dr. Maria Lammerding-Köppel, MME and Jan Griewatz.

The research project was carried out within the framework of the study "The impact of patients' Internet use on the doctor-patient relationship", a cooperation between the Knowledge Research Centre in Tuebingen (KMRC) and the Competence Centre for University Teaching in Medicine, whereas the aspect "consequences of patients' acquisition of health-related knowledge on the Internet" (sub-project 1, 2) is examined by the KMRC and transfer of results into developing an adequate training program for medical students and doctors is carried out at the Competence Centre for University Teaching (sub-project 3, responsible: Dr. Maria Lammerding-Köppel, MME).

The vignettes of the simulated patients for the online-forum, as well as the standardised scheme for the development procedure were created by me. Clinical content of the patient requests was developed by me and its clinical correctness was supervised by Dr. Christian Gall (Department of Gynaecology, University Hospital Tuebingen). The organisation of interaction processes between students and simulated patients in the forum was implemented by me. This involved designing the individual forum sections and access data for the students, as well creating a standardised scheme for the allocation of simulated patient first requests to the students' individual sections. The technical control of this process throughout the training program was implemented by dipl. - biol. Thomas Grabe (technical assistant at the Competence Centre for University Teaching in Medicine).

If students replied to the patients' first requests, further communication along the standardised text blocks from the patients' vignettes was organised by me. The appearance of these features and content of the online-forum was designed by me and a manual on handling of the forum's features was developed by me. Technical realisation of the forum's content and features was implemented in cooperation between Manfred Knobloch (computer scientist at the KMRC) and me.

Scientific research in fields of the project's subject matter was implemented by me. The course's flow of processes was designed in cooperation between Jan Griewatz and me, including the development of time schedules and the PowerPoint presentations for the present sessions for the two course concepts (G1, G2).

The development and organisation of the data sheets with students' individual codes and access data to the forum, as well as the consent form for the students was developed by me, while being advised by Jan Griewatz. This also included the composition of information on ILIAS and on hand-outs for the students throughout the course. Implementation of the course was realised in cooperation between Dr. Christian Gall (Department of Gynaecology, University Hospital Tuebingen) as teacher and Jan Griewatz and me as study assistants and moderators.

The development of research instruments, including the pre/post online-surveys with the sections for students' self-assessment and the pre/post test through the forum was realised in collaboration between Jan Griewatz and me. Organisation of data acquired from the research instruments was implemented by me. This involved the establishment of an excel file ("data base") for storing and connecting data from the surveys and the forum along the individual codes of the students. The texts from the interaction processes in the online-forum were encoded and connected to the excel file via hyperlinks by me.

Methods for statistical analysis of data were confirmed by Gunnar Blumenstock (institute for clinical epidemiology) after a mutual discussion. Analysis of data was then implemented in cooperation between dipl. – psych. Amir Yousef (scientific assistant at the Competence Centre for University Teaching in Medicine) and me. This also involved the development of a codebook and evaluation of the qualitative course evaluation by the students, which was realised by me. Data was interpreted and discussed in cooperation between Jan Griewatz, Dr. Maria Lammerding-Köppel and me.

I ensure that I wrote the manuscript independently and that I did not apply any further sources than the sources specified by me.

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Julia Küppers   [Signature]   Tuebingen, Date

8   Publications

Parts of this doctoral thesis have been published:

1.   GMA Conference 2015 [presentation]
(Fig. 6, Fig. 16, Fig. 17, Fig. 18)

Citation of the abstract:
Griewatz, J., Küppers, J., Gall, C., Bientzle, M., Kimmerle, J., & Lammerding-Köppel, M. (2015, October). Herausforderung Patient 2.0 - Wie können Medizinstudierende effektiv auf web-basierte Kommunikation und experten-gestützte Online-Beratung von Patienten vorbereitet werden? *GMA-Conference (Gesellschaft für Medizinische Ausbildung).* Leipzig.

2.   AMEE Conference 2015 [e-poster]
(Fig. 6, Fig. 16, Fig. 17, Fig. 18)

Citation of the abstract:
Griewatz, J., Küppers, J., Gall, C., Bientzle, M., Kimmerle, J., & Lammerding-Köppel, M. (2015, September). Between Dr. Google and the web-patient: How can medical students be prepared effectively for the task of online counselling? *Annual AMEE Conference (Association for Medical Education in Europe).* Glasgow, GB.

3.   Journal of Medical Internet Research (JMIR) [article]

Citation:
Bientzle M, Griewatz J, Kimmerle J, Küppers J, Cress U, Lammerding-Koeppel M Impact of Scientific Versus Emotional Wording of Patient Questions on Doctor-Patient Communication in an Internet Forum: A Randomized Controlled Experiment with Medical Students J Med Internet Res 2015;17(11):e268
DOI: 10.2196/jmir.4597 PMID: 26607233
URL: http://www.jmir.org/2015/11/e268

9 Acknowledgments

10   Curriculum vitae – Julia Kueppers

Education:

December 2017	M3 third state exam
November 2016	Disputation
October 2016	M2 second state exam
SS 15	Exchange semester at the University of Queensland (Bisbane, Australia)
2012	M1 Physikum (first state exam in medical studies)
Since 2010	Study of Medicine at Eberhard Karls University Tuebingen
June 2010	Abitur (secondary school leaving examination)
2007-2008	Tenison Woods College, Mount Gambier SA
2006 (for 2 months)	Rockridge Secondary School, West Vancouver
2001-2010	Ratsgymnasium Minden (Highschool)
1997-2001	Domschule Minden (Primary school)

Extracurricular activities and volunteer work:

October 2015	Participation at the BKI conference (Society for internal medicine in Bavaria)
Since WS 15/16	Tutor for Paediatrics (Tutoring 9th semester students in their placement)
14.-15. March 2015	Participation at the iDEA conference 1015 in Sydney (Doctors for the Environment Australia)
WS 13 - WS 14	Doctoral thesis at the Competence Centre for University Teaching in Medicine (Baden-Wuerttemberg)
September 2013	Participation at the GMA conference in Graz (Society for medical education in Germany)
Since WS 2012	Member at the student orchestra "Studentenphilharmonie Tuebingen" (Violin)
Since SS 2014	Member of the orchestra's managing committee
Since SS 2012	Member of the committee „AK Mentorenprogramm" (Committee introducing students into 1st semester)
Since 2012	Tutor for Anatomy (Introducing first semester students into the subject)
Since WS 2011	Participation and foundation of "AG Professionalism" (Project in fields of competence oriented teaching)
Since SS 2011	Member of the committee "AK Examensball" (Committee for the Graduation Ball)

Languages:

First language: German
English (fluently)
French (basics)
Swedish (A1)
Latinum

Scientific work:

2013-2014	Student assistant job at the Competence Centre for University Teaching in Medicine (Baden-Württemberg)
2013	"Academic Writing" course at the Career Service, Tuebingen
2007	2nd Place at "Jugend Forscht" (Scientific competition for the youth)

International Experience:

SS 15	Exchange semester at the University of Queensland (Bisbane)
December 2014-January 2015	Concert tour to China with the student orchestra "Studentenphilharmonie Tuebingen" (As member of the managing committee and violin player)
2 Months in 2013	Medical placement and participation at medical lectures and seminars at Flinders Medical Centre, Adelaide (SA)
2 Months in 2008	Tanzania, participation at „Unduguexchange" (Youth Exchange by St. Marys Church Minden)
1 Year (2007-2008)	Mount Gambier, SA (Rotary Youth Exchange)
2 Months in 2006	Canada, Vancouver BG (Private School Exchange)
2 Months in 2004	Tanzania, participation at „Unduguexchange" (Youth Exchange by St. Marys Church Minden)