

Impact of Interprofessional Education for Medical and Nursing Students using Simulation Training and a Training Ward: A German Pilot Study

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Abstract

Background: Interprofessional teamwork has become increasingly important to provide patient centered care. Physicians and nurses as two major professions are needed to be adequately qualified. Interprofessional Education (IPE) is an eligible approach. Nevertheless, there is a lack of the impact for both professions. Therefore, we implemented and evaluated simulation training and a collaborative working sequence on a training ward. The aim was to analyze the course structure and assess learning effects to evaluate the suitability for IPE.

Methods: A mixed methods study with a sequential explanatory design was conducted. A total of five medical and five nursing students were involved. Students completed questionnaire based interviews after IPE lectures. Two group discussions were conducted to specify and expand quantitative evaluation results. For descriptive statistics, we used the software package SPSS. Both group discussions were analyzed by a qualitative content analysis using the software MAXQDA.

Results: Students rated IPE predominantly positive. The learning contents broadness and the links between theory and practice. Students identified six core learning effects: (1) Realization of the importance for collaborative working; (2) Gaining knowledge about the roles of both professions; (3) Realization, that interprofessional care facilitates work; (4) Practicing communication between physicians and nurses; (5) Improving collaborative communication with the patient; and (6) Understanding chances and challenges of joint decision making. Nevertheless, students suggested improvements, e.g., the scenarios of the simulation training should be expanded.

Conclusion: The results provide clear evidence that IPE by simulation training and a training ward is feasible and well accepted by students in a German medical school. Results can be used to adapt IPE lectures and to implement them for a larger number of students. The next step is to generalize findings and to sustainably implement IPE in both curricula.

Keywords: Interprofessional education; Education research; Education medical; Graduate education; Nursing; Baccalaureate; Health education; Empirical research

Introduction

Interprofessional teamwork among health care professionals has become increasingly important. A changing health care system caused by an aging population with increasing demands of health care services in both, primary care and hospitals, are the main challenges. This leads to a growing complexity of health care and the World Health Organization (WHO) already considered in 2006 that interprofessional teamwork is required to ensure appropriate patient centered health care [1]. Therefore, health care professionals must be qualified for an effective collaboration with other health care professions in a multidisciplinary team. Physicians and nurses as the two major professions in the health care system are affected in particular. Current health care education concepts do not adequately prepare medical and nursing students for interprofessional team work [2]. Hence, innovative educational approaches are required [3]. Interprofessional Education (IPE) is an effective tool for teaching team-based care [4,5]. Previous studies have proven that IPE supports a safe and high quality provision of patient care [6-8]. IPE can be divided into three primary areas: (1) Didactic learning; (2) Simulation training; and (3) Authentic clinical experiences [9]. The primary goal is to teach students in teamwork skills and to gain understanding of health care professionals roles [10].

In particular, learning in practice based settings by simulation trainings and clinical exercises on training wards are two important teaching methods for IPE [6,11,12]. Simulation trainings comprise a range of learning opportunities including communication, role

identification, team working and conflict resolution [7,13,14] and has been comprehensively explored for the medical and nursing profession [10]. Evaluations have shown their effectiveness for improving medical and nursing student's communication skills [15-17]. A training ward enables an exercise of care for patients in a learning environment under supervision [18]. Over the last 20 years, IPE implemented as clinical training wards has increased [19]. Morphet et al. stated that training ward enhance medical and nursing students' understanding of the importance of team-based care as well as their understanding of their roles and the roles of other health care professionals [18]. The implementation and evaluation of IPE by simulation trainings and training wards are still rare in Germany. Therefore, we implemented and evaluated an interprofessional simulation training and a collaborative working sequence at the palliative care training ward for medical and nursing students.

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Materials and Methods

Design and implementation of the IPE

The simulation training took place at the skills lab of the University Medicine Greifswald. Although this facility provides an ideal setting for IPE, this was the first time to use it for this learning approach. The simulation training case was on caring for a patient with a bronchial carcinoma in an advanced stage. The current state of patients' health required a hospital treatment.

In the first scenario, the nurse worked in a hospital setting at the department of internal medicine. It is weekend and the state of patient's health impaired (e.g., difficulty in breathing, strong sweating, fear of death). Now, the nurse is responsible to inform the physician about the patient's history and his current state of health. The challenge is the patient has not been treated by the physician until now. In the second scenario, the physician and nurse conducted an assessment regarding the current patient's health care needs (e.g., patient's posture, monitoring color, respiratory sounds, vital parameters, breathable quality). Subsequently, interventions were developed in collaboration. The patient was then informed about the next medical treatment steps and the nursing interventions. Both scenarios were monitored by the lecturer. Overall, the simulation training took 90 minutes including a (1) theoretical introduction to bronchial carcinoma, the (2) review of the two scenarios, the (3) exercise in the two simulation scenarios and a (4) feedback round among the students, the lecturer and the simulation patient. All students participated in the two simulation scenarios. During the simulation training, interprofessional teams, consisting of one medical and one nursing student were formed. The medical student was asked to act as the physician and the nursing student took the role of a nurse.

The IPE working sequence on the palliative care training ward went for four hours per team (one medical and one nursing student). This lecture took place on the palliative care training ward of the University Medicine Greifswald, which was previously available only for nursing students in their 3-year vocational nursing training.

The working sequence was conducted with a 'real patient' (one patient per team) including an (1) introduction of the training ward, (2) enabling patient file viewing (identification of primary health care needs), (3) first patient contact (collect general data about the disease and patient history), (4) conducting an assessment regarding the current patient's health status (e.g. activities of daily living, pain, mobility, nutrition), (5) reflection of the assessment data and information exchange between the medical and nursing student, (6) collecting vital parameters, (7) identification of treatment goals and development of interventions in collaboration between the medical and nursing student, (8) reflection round between the students and the lecturer. During the patient contact (see 3,4,6), students were entirely interactive with each other, learning from each other's perspective and helping each other (e.g., handling blood pressure monitor) when needed. The lecturer was present the entire time to aid or support in case of questions.

Research questions and study aim

We examine following research questions: (1) How assess students the course structure? (2) What are the learning effects of IPE? and (3) How evaluate students both lectures suitable for IPE? The aim is to prove feasibility of IPE and to prepare a sustainable implementation of IPE by simulation trainings and training wards in Germany.

Research design

We conduct a mixed methods study with a sequential explanatory design to evaluate the course structure, learning effects and the suitability of simulation training and working sequences on a training ward for IPE.

Medical and nursing students

A total of ten students (n=5 medical students of the University Medicine Greifswald, n=5 nursing students of the University of Applied Science Neubrandenburg) participated in the study. Both student groups were in the first year of their academic programs and had no previous experiences in IPE. We verbally invited students in their introduction lectures of the academic programs to participate in the study and they received written project information's and a written informed consent. Upon written informed consent of the first five medical and five nursing students, ten students were enrolled in the study.

Four medical students are male and the average age is 26 (SD: 4.0). Two of them had completed a 3-year vocational training in nursing before their medical academic training. Four nursing students are female and the average age is 25 (SD: 3.0). Four nursing students already had completed a 3-year vocational training in nursing.

Lecturers

We recruited faculty members of the University Medicine Greifswald, who had clinical experiences of both student's groups and had taught in simulation training as well as on a training ward. The lecturer of simulation training was a general practitioner and an expert in palliative care. He had extended experiences in teaching clinical skills by simulation trainings and was one of the lecturers, who implemented and Objective Structured Clinical Examinations (OSCE) for medical students at the University Medicine Greifswald. A practice supervisor of the 3-year vocational nursing training was the lecturer for the collaborative working on the palliative care training ward. She had comprehensive experience on the training ward and with supervision of nursing students. One study team member briefed both lecturers prior to IPE regarding the learning contents, tasks and learning objectives.

Data collection

The Bildungscluster study is one of the first studies in Germany exploring IPE by simulation training and collaborative working on a training ward. No valid and reliable instrument for the quantitative quantitative interprofessional course evaluation was available. Consequently, we developed a questionnaire which consists of 13 items in three sections: (a) content-related design of the lecture and evaluation of the lecturer (three items), (b) learning effects (seven items) and (c) suggestions for improvement (three items). Eight items were scored on a 4-point Likert scale with anchors 1 (completely agree) to 4 (completely disagree) or 1 (very well) to 4 (bad) or 1 (substantially higher) to 4 (unchanged). The group size assessment for a learning success were evaluated by 1 (spot on), 2 (too small) and 3 (too big). Four items (description of learning effects by IPE [1 item] and suggestions for improvement [3 items]) were captured as free text.

We pre-tested the survey instrument in small groups with representatives of both student groups and then digitized it using TeleForm® (Electric Paper Information Systems GmbH Lüneburg Germany, version 10.2). The students completed the questionnaire after the two IPE lectures. We scanned all questionnaires and verified them in TeleForm®. For analysis, we documented the data in an MS-

access data base and transferred them to the software package IBM® SPSS® Statistics (Version 22, Ehningen). To specify aspects, which could not be adequately addressed in the quantitative evaluation, we conducted two group discussions (one with the medical students and one with the nursing students). Semi-structured questions were developed based on the results of the quantitative evaluation and addressed (a) the learning effects of IPE in general, (b) the learning effects by the simulation training and on the training ward as well as (c) the suggestion for improvement. We audio recorded and transcribed both group discussions.

Data analysis

For descriptive statistics, we used the software package SPSS. To analyze both group discussions, we conduct a qualitative content analysis using the software MAXQDA (Version 12, VERBI GmbH, Berlin) [20]. Two study team members conducted the coding of the group discussions according to the consensual coding approach [20]. In a first step, both team members coded the discussions separately. In a second step, both coders compared their category system with respect to similarities and differences. Differences were discussed and the category system was modified if both coders agreed. In the majority of cases, this caused an extension of the category system. Subsequently, we developed a system with categories, sub-categories and codes based on the code systems of both coders. The qualitative results were then integrated to the quantitative results for data interpretation.

Results

IPE lectures-course structure and lecturer

Both student groups rated the course structure and the lecturers predominantly positive. Especially the learning content broadness and the linkage of theory and practice were assessed as 'very well' and 'well' for both, the simulation training and the training ward (Table 1).

In addition, the majority of students reported, that the group size for effective learning was 'spot on' for both IPE lectures (n=10 simulation training, n=9 training ward). Only one medical student stated the theoretical introduction of the simulation training with all students as 'too big'.

Comments for the lecturers were positive by a considerable number of both student groups. All students stated that both lecturers were well prepared, very involved and able to explain complex contents. Differences between medical and nursing students concerned the assessment of lecturer's promotion of student's active involvement in IPE and giving feedback: while all medical students 'completely agree' or 'agree' with the respective statements, three nursing students only 'less agree' and one nursing student completely disagreed with the lecturers' feedback giving. These results are summarized in Table 2.

Learning effects

All participating medical and nursing students reported learning effects and both IPE lectures were rated as interesting as well as the IPE approach promotes the interest for these lectures. Therefore, the majority of students would participate in these two IPE lectures again. Only one nursing student mentioned that it is rather unlikely to participate in IPE by collaborative working on the training ward again (Table 3).

A detailed description of the learning effects by IPE in general and for the two lectures is reported in Table 4. Students identified six core learning effects: (1) Realization of the importance for collaborative

working; (2) Gaining knowledge about roles of both professions; (3) Realization, that interprofessional care facilitates work; (4) Exercise communication between physicians and nurses; (5) Exercise collaborative communication with the patient; and (6) Making joint decisions (Table 4).

These learning effects were specified in the qualitative group discussions. For example, the realization of the importance for collaborative working is to student's opinion connected with the recognition that physicians and nurses complement each other in patient care and can work as equal collaboration partners.

Therefore, IPE can promote the openness of medical and nursing students for interprofessional care practice. In addition, both student groups reported special learning effects for both IPE lectures. The simulation training allows students to exercise collaboration by a feeling of a 'real patient' situation.

Five students pointed out (n=2 medical, n=3 nursing) that the learning effect could be enhanced by a real patient instead of a professional actor. The collaborative working on the training ward supports students to realize the importance of patient collaborative assessment (e.g., mutual support in patients' assessment, information exchange) and allows to exercise practical skills (e.g., assessment of vital parameters, correct measurement of blood pressure).

In summary, IPE lectures had a positive effect on the medical and nursing students' level of knowledge. The majority reported, that their level of knowledge is 'substantially higher' or 'higher' (n=9 simulation training, n=7 training ward) after both IPE lectures. One nursing student stated hardly any change in her state of knowledge by the simulation training and the collaborative working on the training ward. Two other nursing students agree with this assessment with respect to the training ward. In consequence, all medical students and eight nursing students rated the simulation training and the collaborative working on the palliative care training ward as suitable for IPE. Only two of the nursing students mentioned, that the collaborative working on the training ward is to their opinion less eligible for IPE (Table 3).

Suggestions for improvement

To further enhance learning effects both student groups suggested improvements. The Table 5 shows that five students (n=2 medical, n=3 nursing) would appreciate when IPE lectures would be taught by lecturers of both professions.

The simulation training would be more effective with a preparatory seminar for theoretical knowledge about the disease of the simulation patient would be preceded before. Three students expressed their wish to expand the number of exercises for the two scenarios which includes a changing role between medical and nursing students. For further development of the simulation training, the expansion of scenarios to other diseases and a more detailed feedback to students' performance in the scenarios would be desirable.

An adaption of the schedule to one day for the collaborative working on the palliative care training ward would enhance the learning effects to one medical student's point of view.

Discussion

The results provide clear evidence that IPE by simulation training and collaborative working on a training ward is feasible and suitable for medical and nursing students in a German medical school. In particular, the study demonstrated that IPE can help to adequately

	Simulation Training								Training ward							
	Medical students (n)				Nursing students (n)				Medical students (n)				Nursing students (n)			
	very well	well	less well	poor	very well	well	less well	poor	very well	well	less well	poor	very well	well	less well	poor
Course structure	3	2			2	3			5				3	2		
Learning content broadness	4	1				4	1		3	2			1	3	1	
Linkage theory and practice	3	2			2	3			3	2			3	1	1	
Learnability in predefined time	1	3	1			5			2	3				5		

Table 1: Quantitative evaluation results of the students regarding the course structure (N=10).

	Simulation Training								Training ward							
	Medical students (n)				Nursing students (n)				Medical students (n)				Nursing students (n)			
	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree
Lecturer was well prepared	5				3	2			5				5			
... was very involved	5				3	2			5				5			
... making complicated understandable	5				1	4			3	2			4	1		
... promoting active involvement	3	2			1	2	2		5				5			
... gave feedback to active involvement	5				1	2	1	1	4	1			4	1		

Table 2: Quantitative evaluation results of the students regarding the lecturer assessment (N=10).

	Simulation Training								Training ward							
	Medical students (n=5)				Nursing students (n=5)				Medical students (n=5)				Nursing students (n=5)			
	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree	completely agree	agree	less agree	completely disagree
The lecture was interesting	5				4	1			4	1			3	2		
IPL promoting my interest for the lecture	2	3			1	3	1		2	3			2	3		
I would participate in this IPL lecture again	3	2			2	3			2	3			2	2	1	
There is a learning effect by IPL	4	1				3	2		2	2	1		1	2	1	1
The lecture is eligible for IPL	3	2			3	2			3	2			3		2	

Table 3: Students learning effects (N=10), quantitative results.

prepare medical and nursing students to work in a collaborative team approach. The students of both professions rated the lectures predominantly positive.

One important finding was that a course structure including a linkage of theory and practice is important and the chosen group sizes for the IPE lectures could be implemented well. A second major finding was the identification of the six core learning effects of IPE including the realization of the importance of collaborative working, gaining knowledge about other health care professional's roles and practicing collaborative communication. These findings are comparable to recent studies. Ker et al. mentioned that structured IPE in a realistic clinical environment can support the development of competences in interprofessional working. This approach allows medical and nursing students to exercise skills by a multidisciplinary exchange and getting feedback from different perspectives in order to maximize learning effects [21]. To enhance students' understanding of their own professional roles and the roles of the other profession is

one of the most commonly mentioned benefit of IPE. It includes the willingness to learn more about each other's philosophy and to share knowledge within an interprofessional team [22-25]. This supports correct decision making in the treatment of patients [26].

Based on IPE lectures in the Bildungscluster study, both student groups learn more about health care professional roles and conclude that physicians and nurses complement each other. Furthermore, a patient centered care requires a collaborative communication between both professions including making joint decisions. This underlines the urgency to improve teaching interprofessional communication skills by IPE [27,28].

To further develop IPE in Germany, participating medical and nursing students made suggestions for improvement, e.g. that IPE should be taught by lecturers of both professions and the scenarios of the simulation training should be expanded. This result agrees with some prior research. For example, Bastami et al. reported of an IPE lecture for medical and nursing students to exercise communication

Learning effects
<p>Both IPL lectures</p> <p>Realization of the importance for collaborative working working as equal collaboration partners physicians and nurses complement each other greater openness for interprofessional collaboration</p> <p>Gaining knowledge about the roles of both professions capable to understand specific roles of both professions</p> <p>Interprofessional care facilitate the work hierarchical structures are counterproductive</p> <p>Exercise communication between physicians and nurses active listening negotiate agreements respond to each other have the guts to ask questions accepting feedback to patient care from the nursing profession</p> <p>Exercise collaborative communication with the patient empathic patient care</p> <p>Make joint decisions</p>
<p>Simulation Training</p> <p>Feeling of real patient situation real patients as simulation patient increase the learning effect</p>
<p>Training ward</p> <p>Realization of importance of collaborative patient assessment and patient admission collaborative patient file viewing mutual support by patients assessment information exchange between both professions requirement of adaption of assessment documentation as one for both professions</p> <p>Exercising practical skills assessment of vital parameters correct measurement of blood pressure</p>

Table 4: Detailed description of students learning effects (N=10), qualitative data.

Suggestion for improvement
<p>Both IPL lectures</p> <p>IPL lectures should be taught by lecturers of both professions</p>
<p>Simulation Training</p> <p>A seminar for theoretical knowledge about the disease of simulation patient should be preceded before expand the number of the exercises of the two scenarios for increasing the learning effect changing role of medical and nursing student's development of scenarios for other diseases expansion of the feedback round for student expansion of feedback to nursing student performance.</p>
<p>Training ward</p> <p>Time scale should be expanding to one full day</p>

Table 5: Students suggestions for improvement (N=10), qualitative results.

in breaking bad news. Lecturers of both professions were included to ensure a specific feedback for both students groups as well as to reflect the lecture from different perspectives [29]. The German Medical Association underlines in their position paper 'Interprofessional Education for Health Care Professionals, 2015, that IPE lectures should always involve lecturers from all professions included in IPE. Thereby, a specific qualification for instructors is required and suitable concepts for advanced trainings are needed to develop [30].

The number of scenarios in IPE simulation trainings varies in different studies from one to four or more depending on the schedule and the focus of the IPE lectures [14,26]. The Bildungscluster Study used two scenarios based on the two primary learning aims of collaborative communication (scenario one) and exercising practical skills (scenario two).

The study has several limitations. First, the small number of ten participating students and the selection process maybe, was biased. The Bildungscluster Study addresses the feasibility of IPE for medical

and nursing students in Germany. Based on that, we chosen a small group size of ten. Internationally, IPE in small groups with ten to 15 students is widely used [29,31,32]. A first implementation with a small group size allows to test IPE courses and subsequently to adapt the lectures for a larger number of students [33]. Four nursing students and two medical students completed a 3-year vocational nursing training. Consequently, the chosen recruiting procedure suggests that we enrolled students, who are more interested in IPE in contrast to other medical and nursing students. Therefore, the generalization of the results is limited.

Secondly, no valid and reliable instrument for the quantitative evaluation was available. Internationally, a range of instruments has been proposed to evaluate different aspects of IPE [34]. In Germany, there is only the German version of the "Readiness for Interprofessional Learning Scale" (RIPLS) available. Mahler et al. conducted a validation study and concluded that a further development of the instrument is needed [35]. In addition RIPLS evaluates attitudes to IPE in contrast to the main focus the Bildungscluster Study, which includes the evaluation of the course structure, learning effects and eligibility to IPE. Therefore, we developed and pre-tested a questionnaire with ten representatives of both student's groups. No adaptations were required and subsequently we used the instrument for the Bildungscluster study with no changes.

In summary, we implemented and evaluated as one of the first studies in Germany the feasibility of IPE by using simulation training and a collaborative working on a training ward. We used places of learning, which had been not available for medical or nursing students before. The results are the basis to improve both IPE lectures (e.g., lecturers from both professionals should be involved, expansion of simulation scenarios) and to implemented and to evaluated them with a larger number of medical and nursing students. Further studies are needed to address changes in learning effects by the expansion of simulation scenarios and the involvement of lecturers of both professions. This is required to be able to generalize findings and to sustainably implement IPE in both curricula in Germany.

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Ethical Considerations

Drugs and medical devices were not applied in the study. No interventions were conducted. Only questionnaire based interviews were conducted with students. Side effects of interviews have not been identified yet. Consequently, statement by the ethics committee of the University of Greifswald was not necessary.

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Authors' Contributions

ADW and WH are the principal investigators of the Bildungscluster study. Both develop the study design and were responsible for the IPE lecturers, data collection, data management and data analysis. ADW was the major contributor in

writing the manuscript. SH supervise IPE lecturers and collect data together with AB and SK. SH verify and analyze data. SH, AB, SK, RFO interpreted the results. RFO recruits the nursing students for the Bildungscluster study. All authors read and approved the final manuscript.

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