

Digitale Ansätze für die interprofessionelle Lehre in der medizinischen Ausbildung.

Wie interprofessionelle Kollaboration und
Wissensrezeption durch deren Darstellung in digitalen
Lehrformaten unterstützt werden kann.

Eine empirische Analyse.

Dissertation

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Zusammenfassung

Aufgrund zunehmender Komplexität und Spezialisierung des Gesundheitssystems werden interprofessionelle Ausbildungsansätze, bei denen Lernende durch Vertreter verschiedener Professionen unterrichtet werden, immer wichtiger. Durch diese können neben der Wissensvermittlung auch Kompetenzen gefördert werden, die eine erfolgreiche interprofessionelle Zusammenarbeit ermöglichen. Bislang werden die Potentiale interprofessioneller Ausbildung jedoch kaum ausgeschöpft, da sie schwierig in bestehende Curricula zu implementieren sind. Eine niedrigschwellige Möglichkeit, interprofessionelle Kompetenzen anwendungsorientiert zu vermitteln, bieten onlinegestützte interprofessionelle Lehransätze.

Im Rahmen dieser Dissertation wurden anhand eines Literaturreviews wichtige Aspekte und Gestaltungsrichtlinien herausgearbeitet, an denen sich interprofessionelle Lehransätze orientieren können. Dabei wurde deutlich, dass die realitätsnahe modellhafte Darstellung interprofessioneller Kollaboration einen vielversprechenden Ansatz für die Förderung Interprofessionellen Verhaltens und darüber hinaus auch für die Wissensvermittlung bietet. Anhand von drei experimentellen Studien wurde der Einfluss verschiedener Aspekte bei der Gestaltung von interprofessionellem Videomaterial untersucht.

In den Studien zeigte sich, dass Videos, die interprofessionelle Wissensinhalte in einem realitätsnahen und praxisorientierten Zusammenhang präsentierten als verständlicher, nachvollziehbarer und auch unterhaltsamer wahrgenommen wurden. Eine Interprofessionelle Darstellung motivierte dabei die Lernenden zu interprofessionellem Handeln und half ihnen, die Kompetenzen beteiligter Professionen besser einzuschätzen. Ebenso zeigten sich durch die realitätsnahe Darstellung Vorteile bei der Vermittlung von Wissensinhalten. Lernende konnten bei der Darstellung von interprofessionellen Inhalten sich verstärkt Wissen aus den ihnen unbekanntem Wissensbereichen aneignen.

Die Ergebnisse der Dissertation zeigen, dass die Darstellung von interprofessioneller Zusammenarbeit in einem Lehrvideo ein vielversprechender und relativ einfach zu handhabender Ansatz ist, um das Bewusstsein für interprofessionelle Arbeitssituationen in der Ausbildung von medizinischen Berufen zu schärfen und relevantes Wissen an Lernende verschiedenen Professionen zu vermitteln.

Summary

Due to the increasing complexity and specialization of the healthcare system, interprofessional education approaches, where experts from different professions are teaching together, are becoming increasingly important. In addition to their ability for knowledge transfer, these interprofessional education approaches can also promote competencies that enable successful interprofessional collaboration. However, the potentials of interprofessional education have hardly been used to their full promises since they are difficult to implement in existing curricula. A low-threshold possibility to teach interprofessional competencies in an application-oriented way is offered by online-based interprofessional teaching approaches.

In the context of this dissertation, a literature review was conducted to identify important aspects and design guidelines that can guide interprofessional education approaches. It became clear that a realistic and model-like representation of interprofessional collaboration offers a promising approach for the promotion of interprofessional behavior and furthermore for the transfer of knowledge. Three experimental studies were used to investigate the influence of different aspects in the design of interprofessional videos.

The studies showed that videos presenting interprofessional knowledge content in a realistic and practice-oriented context were perceived as more comprehensible, conceivable, and entertaining than the presentation in classical lecture settings. An interprofessional presentation motivated learners to act interprofessionally and further helped them to better understand the competencies of the professions involved in comparison to a monoprofessional presentation. Similarly, the realistic presentation showed advantages in conveying knowledge content. Learners were able to acquire more knowledge from the knowledge areas they were unfamiliar with when interprofessional content was presented.

The results of the dissertation show that the depiction of interprofessional collaboration in instructional videos is a promising and relatively easy-to-use approach to raise awareness for interprofessional work situations in the education of medical professions and to provide relevant knowledge for healthcare students.

Genderhinweis

In dieser Arbeit wurde auf eine gendergerechte Sprache geachtet, indem geschlechtsneutrale Formulierungen verwendet wurden. In Fällen, die die Lesbarkeit zu stark beeinträchtigten, wurden andere Sprachformen verwendet. Diese schließen selbstverständlich alle Geschlechter mit ein.

Einleitung:

Aktuelle Herausforderungen des Gesundheitssystems

1.1 Spezialisierung und Interprofessionalität

Die COVID-19 Pandemie hat in den letzten zwei Jahren die Gesundheitssysteme weltweit vor große Herausforderungen gestellt. Zusätzlich befinden sich diese seit Jahrzehnten aufgrund des großen technischen und damit verbundenen medizinischen Erkenntnisfortschritts in einem erheblichen permanenten Wandel: So erweiterte der medizinische und technische Fortschritt ständig das Repertoire an Diagnoseverfahren, Interventionsmöglichkeiten und therapeutischen Ansätzen, wodurch sich die Gesundheitssysteme immer weiter spezialisieren und ausdifferenzieren. Durch die Ausdifferenzierung ist die Gesundheitsversorgung leistungsfähiger geworden und bietet Patient*innen eine bessere medizinische Versorgung (Hensen, 2012). Gleichzeitig führt diese Entwicklung aber auch zu einer erhöhten Komplexität des Gesundheitssystems. Bereits im Jahr 2012 existierten etwa 150 gesundheitsbezogene Masterstudiengänge und unzählige weitere gesundheitsbezogene Ausbildungsberufe. Dadurch sind neben ärztlichem Personal zahlreiche weitere hoch spezialisierte Professionen mit unterschiedlichen fachlichen Hintergründen im Gesundheitssystem tätig (Feuchtinger, 2016). In den klinischen Bereichen sind verschiedenste Gesundheitsfachberufe vertreten, die das ärztliche Personal bei Behandlungen unterstützen, wie zum Beispiel Akteur*innen der Pflege, Logopädie, und Medizintechnik. Auch wenn interprofessionelle Zusammenarbeit in der Medizin seit jeher für eine gute Patientenversorgung notwendig war, gewinnt die Etablierung einer koordinierten Zusammenarbeit und Kommunikation zwischen den verschiedenen Spezialist*innen durch die zunehmende Komplexität des Gesundheitssystems immer mehr an Bedeutung. Der Klinikalltag zeigt jedoch, dass häufig Schwierigkeiten in der interprofessionellen Kommunikation und Zusammenarbeit auftreten (Cichon & Klapper, 2018).

1.2 Interprofessionelle Lehre

Diese Veränderungen des Gesundheitssystems stellen insbesondere Studierende der Medizin vor wachsende Herausforderungen. Während die fachlichen Anforderungen des Studiums unverändert hoch geblieben sind, werden auch Teamfähigkeit und Kompetenzen in der Zusammenarbeit mit anderen Professionen

immer wichtiger (Cichon & Klapper, 2018). Einen Schlüssel zur erfolgreichen Bewältigung dieser Herausforderungen bieten interprofessionelle Ausbildungsansätze, wie sie im skandinavischen (Jakobsen, 2016; Wilhelmsson et al., 2009) und englischsprachigen Bereich bereits weit verbreitet sind (Hammick et al., 2007; Kirch & Ast, 2015). Auch in Deutschland erfährt dieser Aspekt seit einigen Jahren immer mehr Beachtung. Seit 2014 gibt es die Forderung des deutschen Wissenschaftsrats, vermehrt interprofessionelle Ausbildungsansätze im Medizinstudium zu verankern und in einigen ausgewählten Veranstaltungen eine Vernetzung der human- und zahnmedizinischen Studiengänge mit pflege-, therapie- und hebammenwissenschaftlichen Studiengängen vorzunehmen (Wissenschaftsrat, 2014). Dem hat sich 2015 auch die Gesellschaft für Medizinische Ausbildung (GMA) mit der Forderung für die Entwicklung interprofessioneller Ausbildungskonzepte und der Schaffung von dafür notwendigen Strukturen im deutschsprachigen Raum angeschlossen (Walkenhorst et al., 2015). Umgesetzt werden soll interprofessionelle Lehre zum Beispiel in Lehrsituationen, in denen Lernende sich mit Protagonist*innen aus mindestens zwei Gesundheitsfachberufen aktiv auseinandersetzen. Im Rahmen derartiger interprofessioneller Veranstaltungen sollen Lernende die Möglichkeiten erhalten, neben Fachwissen auch soziale Fähigkeiten und Einstellungen zu entwickeln, die gut koordinierte interprofessionelle Zusammenarbeit unterstützen. Auch wenn interprofessionelle Ausbildungsansätze ein Potenzial für den Erwerb relevanter Kompetenzen der interprofessionellen Zusammenarbeit aufweisen, ist deren Umsetzung in der Praxis sehr aufwendig und scheitert oft daran, dass die notwendigen Strukturen noch nicht flächendeckend etabliert sind. So sind in Deutschland oftmals die Bildungseinrichtungen der Medizin und der Gesundheitsfachberufe in unterschiedlichen Organisationen angesiedelt (Universitäten, Fachhochschulen, Berufsfachschulen) und somit institutionell voneinander getrennt. Übergreifende Ausbildungseinheiten finden bislang nur selten statt (Ewers & Reichel, 2017) und wurden durch die Auswirkungen der COVID-19 Pandemie zusätzlich erschwert (Kelly et al., 2020). Marinoni, van't Land und Jensen (2020) berichten, dass während des Pandemie-bedingten ersten Lockdowns in den meisten europäischen Ländern zwischen März und April 2020 an 85 Prozent der europäischen Universitäten kein Unterricht mehr in Präsenz stattfand und stattdessen auf digitale Lehre umgestellt wurde oder die Lehre zeitweilig ausgesetzt wurde. So wurde auch interprofessionelle Lehre, die klassischer Weise in Präsenz stattfindet,

ausgesetzt. Doch auch im Regelfall haben die meisten gesundheitsbezogenen Ausbildungen und Studiengänge ohnehin schon eine hohe zeitliche Belastung (AWMF, 2014; Fischer, 2014), was die Implementierung weiterer Inhalte erschwert. Die Notwendigkeit einer gut umgesetzten interprofessionellen Lehre in der Ausbildung von Mediziner*innen wird durch Metaanalysen gestützt, die bessere Behandlungsergebnisse (McCutcheon et al., 2017; Solomon et al., 2010) und eine größere Patientenzufriedenheit auf die Einführung interprofessioneller Lernmethoden zurückführen konnten (Guraya & Barr, 2018; Karim & Ross, 2008). Um den bestehenden Herausforderungen für eine ausbildungsübergreifende Interprofessionelle Lehre zu begegnen, weisen die Möglichkeiten der Digitalisierung ein großes Potential für die medizinische Lehre auf, insbesondere da sie investitionsarm und niedrigschwellig umsetzbar sind.

Im Rahmen dieser Dissertation wurden Gestaltungsmöglichkeiten digitaler interprofessioneller Lehre in der medizinischen Ausbildung untersucht. Anhand eines Reviews (Grosser, Bientzle, et al., 2020) wurden didaktische Ansätze auf ihre Anwendbarkeit in der digitalen interprofessionellen Lehre untersucht und diskutiert. Dabei zeigte sich insbesondere das Potential von Videomaterial für die Förderung interprofessioneller Lehre. Basierend auf theoretischen Schlussfolgerungen wurden Hypothesen zur Gestaltung von digitalen interprofessionellem Lehrmaterial abgeleitet und diese anhand von drei experimentellen Studien (Grosser et al., 2019, 2021; Grosser, Kimmerle, et al., 2020) empirisch überprüft. Dabei wurde der Einfluss verschiedener Gestaltungsmöglichkeiten von medizinischen Lehrvideos auf die Einstellung zu interprofessioneller Zusammenarbeit sowie den Wissenserwerb bei Studierenden der Medizin sowie anderen Gesundheitsberufen untersucht.

1. Literatur-Review zu den theoretischen Hintergründen des Lernens in digitalen Lehrszenarien

Dieses Review wurde am 14. Mai 2020 unter dem Titel: A Literature Review on the Foundations and Potentials of Digital Teaching Scenarios for Interprofessional Health Care Education im International Journal of Environmental Research and Public Health in englischer Sprache veröffentlicht.

Aufgrund der steigenden Bedeutung von erfolgreicher interprofessioneller Zusammenarbeit im Gesundheitswesen und der Notwendigkeit, entsprechende Inhalte in der Ausbildung von medizinischen Berufen zu vermitteln, werden gut überlegte und wissenschaftlich fundierte didaktische Konzepte benötigt. Um einen theoretischen Rahmen für Gestaltung niedrigschwelliger digitaler Lehransätze zum Thema Interprofessioneller Lehre und Interprofessioneller Zusammenarbeit in Gesundheitsberufen ableiten zu können, wurden relevante didaktische Konzepte beschrieben und diskutiert. Dabei wurde zunächst allgemein auf digital realisierbare didaktische Ansätze eingegangen, die zur Überwindung der im vorherigen Abschnitt genannten Herausforderungen dienen können.

2.1 Digitale Lehrsettings

Digitale Lernplattformen bieten eine gute Möglichkeit zum Austausch von Lernenden aus verschiedenen Professionen, da die asynchrone Nutzungsmöglichkeit Lernenden ermöglicht, nicht zeitgleich an dem Material zu arbeiten und die Geschwindigkeit des Lernprozesses selbst zu bestimmen. Jedoch gibt es aufgrund der großen Bandbreite digitaler Lernplattformen kaum generalisierbare Evidenz zum Nutzen für Lernprozesse. Hean und Kollegen (2009) geben einen umfassenden Überblick über Lerntheorien, die herangezogen werden können, um onlinebasierte Prozesse des interprofessionellen Lernens zu beschreiben. Hervorzuheben ist der Ansatz von Hughes et al. (2004), die mit Bezug auf das Konzept des *Enquiry-Based Learning* darstellen, in welcher Hinsicht Online-Umgebungen förderlich für die interprofessionelle medizinische Ausbildung sein können. Mit dem Konzept des *Enquiry-Based-Learning* werden die Lernprozesse zusammengefasst, die durch aktives, selbstgesteuertes Handeln der Lernenden zur Entdeckung neuer kausaler Zusammenhänge beitragen (Pedaste et al., 2015). Zentral dabei ist die aktive Teilnahme, der Austausch zwischen Lernenden sowie die Verantwortung Lernender

für ihre eigenen Lernfortschritte (De Jong & Van Joolingen, 1998; Pedaste et al., 2015). Dementsprechend wird angenommen, dass Lernen als iterativer Prozess stattfindet, bei dem zunehmend tiefere Verständnisebenen erreicht werden. Dies führt dazu, dass in heterogenen Gruppen Lernende mit mehr Vorwissen beim Lernen schneller voranschreiten und ihre Erkenntnisse kommunizieren können als Lernende mit weniger Vorwissen. Die in der Gruppe geteilten Wissensinhalte können wiederum Lernenden mit geringerem Vorwissen als Orientierung und Impulsgeber für den eigenen Wissenskonstruktionsprozess dienen (Hughes et al., 2004). Somit stehen bei asynchronen Online-Plattformen die Lernenden selbst im Mittelpunkt und haben die Möglichkeit, ihre Lernprozesse selbst zu bestimmen.

Zwar eignen sich insbesondere asynchrone, digitale Lernplattformen gut für die Vermittlung von Wissensinhalten, jedoch stoßen sie bei der Vermittlung von sozialen Interaktionsformen und Werten, die in einem interaktiven Prozess zwischen den Lernenden ausgehandelt werden müssen, schnell an ihre Grenzen (Kamin, 2013). Für die Vermittlung interprofessioneller Zusammenarbeit sollten daher synchrone digitale Formate in Betracht gezogen werden. Ein Vorteil synchroner Lehrformate ist, dass sie auch informell genutzt werden und so zum sozialen Austausch anregen können (Cress & Kimmerle, 2013; Holtz et al., 2018), was wiederum zur Entwicklung interprofessioneller Kompetenzen sowie positiver Einstellungen gegenüber anderen Professionen beitragen kann. Dabei müssen die Lernenden selbst gar nicht in eine synchrone Interaktion treten. Nach den Grundannahmen der sozialkognitiven Lerntheorie von Bandura (Bandura, 1986, 2001) ist das Erlernen neuer Verhaltensweisen und Einstellungen durch Beobachtung von Modellen und die Antizipation des gesehenen Verhaltens möglich. Demnach können Lernende Expert*innen bei der Ausführung komplexer Aufgaben beobachten und dabei eine adäquate kognitive Repräsentation der Handlungen konstruieren. Dies ist insbesondere im Hinblick darauf interessant, dass Beobachtungslernen sich auch für den Erwerb von Sozialverhalten eignet (Bandura, 2001). Die Beobachtung von erfolgreicher interprofessioneller Kollaboration sollte daher sowohl einen Einfluss auf den Erwerb von Handlungswissen als auch auf die Einstellung zum interprofessionellen Arbeiten haben. Eine Möglichkeit, interprofessionelle Handlungen modellhaft darzustellen, besteht in der Verwendung von Videos.

2.2 Der Einsatz von Videos in der medizinischen Lehre

Videos sind in der medizinischen Lehre schon heute weit verbreitet und erfreuen sich großer Beliebtheit bei Lernenden, nicht zuletzt, weil diese sich als effizientes und anschauliches Lehrmaterial etabliert haben (van Es et al., 2014). Durch den Zeitbezug lassen sich dynamische Handlungen gut darstellen, was Lernenden beim Verständnis helfen kann. Damit können sich videobasierte Formate deutlich von klassischer Lehre abheben (Azer, 2015; Jang & Kim, 2014). So konnte beispielsweise in zahlreichen Studien gezeigt werden, dass die Betrachtung von Videos sich im Allgemeinen für den Erwerb von prozeduralem Wissen eignet und beispielsweise im Vergleich zum Lernen mit klassischem Lehrmaterial zu besseren chirurgischen Fähigkeiten von Medizinstudierenden führt (Domuracki et al., 2015; Rapp et al., 2016; van Es et al., 2014; Welsher & Grierson, 2017).

Für interprofessionelle Lehrsettings stellt dieser Aspekt einen Vorteil dar, da dabei das koordinierte Handeln von Protagonisten verschiedener Professionen eine wesentliche Rolle spielt. Ebenso bietet videobasiertes Lehrmaterial eine weitere Möglichkeit zur Unterstützung des Wissenserwerbs durch die strukturierte Beschreibung einzelner Schritte bei komplexen Problemlösungsprozessen durch Experten und Expertinnen. So können Lernende sich beim Verwenden ausgearbeiteter Lösungsbeispiele besser auf die Problemstellung und die notwendigen Lösungsschritte fokussieren als ohne diese Hilfestellung (vgl. auch Worked-examples Effekt (Atkinson et al., 2000; Renkl, 2014)).

2.3 Der Einsatz von Videos für die digitale Interprofessionelle Lehre

Da im Gesundheitsbereich die Zusammenarbeit verschiedener Professionen notwendig ist, sollte effiziente Interprofessionelle Lehre schon in frühen Ausbildungsabschnitten implementiert werden (Coster et al., 2008). Bereits die medizinischen Grundlagenfächer sollten daher unter einer interprofessionellen Perspektive unterrichtet werden, um dies von Beginn an zu verankern. Als Grundlagenfach bietet sich dazu das Fach Anatomie an, da es für nahezu alle Gesundheitsberufe fundamental ist (Rafai et al., 2016). Studien zeigen zudem, dass die Fähigkeit von Medizinstudierenden, Wissen aus dem Hörsaal auf reale klinische Situationen anzuwenden, eher gering ist (Norman, 2009). Den Studierenden gelingt es oft nicht, eine Verbindung zwischen ihrem anatomischen Wissen und der klinischen Anwendung herzustellen (Ahmed et al., 2010; Böckers et al., 2014; Fitzgerald et al.,

2008; Lazarus et al., 2012). Diese Ergebnisse legen nahe, dass es sinnvoll ist, eine explizite Verbindung zwischen anatomischen Informationen und klinischer Praxis bereits in der in einer frühen Phase der Ausbildung zu implementieren und diese realitätsnah und interprofessionell zu gestalten.

2.4 Implikationen für digitale videobasierte Lehrkonzepte

2.4.1 Realitätsnahe Darstellung

Die realitätsnahe Darstellung zeichnet sich im Vergleich zu klassischem Lehrmaterial durch eine hohe Informationsdichte aus, da zusätzlich zu den zu vermittelnden Wissensinhalten zahlreiche weitere Informationen dargestellt werden. Die Darstellung von Inhalten, die nicht unmittelbar für den Wissenserwerb notwendig sind, kann gemäß der Cognitive Load Theory (Chandler & Sweller, 1991; Sweller, 2012) zu einer erhöhten Belastung von kognitiven Ressourcen (Cognitive Load) führen und somit von den für den Wissenserwerb relevanten Informationen ablenken (Bartsch & Cobern, 2003; Schrader & Bastiaens, 2012). In abstrakten Kontexten, wie zum Beispiel bei einer Vorlesung in einem Hörsaal, ist die Anzahl an ablenkenden Details im Vergleich zu authentischen, realen Kontextsituationen stark reduziert und die Aufmerksamkeit kann verstärkt auf relevante Lerninhalte gerichtet werden, was einem Wissenserwerb zuträglich sein sollte (Harp & Mayer, 1998). Demgegenüber steht, dass ein authentischer, realer Kontext hilfreich für die Wissensvermittlung ist (Thistlethwaite et al., 2015). Authentische, realitätsnahe Kontextsituationen können dazu beitragen, das Interesse der Lernenden zu wecken, indem realitätsnahe Handlungsschemata während der Lernphase aktiviert werden (Smith & Vela, 2001). Eine Studie von Robert und Dennis (2005) kam zu dem Schluss, dass zusätzliche Informationen, wie die Darstellung von Interaktionen, die Lernmotivation erhöhen kann. So konnte beispielsweise gezeigt werden, dass Lernende bei der Betrachtung von Videos, in denen einen Dialog gezeigt wurde, einen deutlichen Vorteil hinsichtlich ihres Wissenserwerbs zeigten im Vergleich zu Lernenden, die die gleichen Inhalte in einer klassischen Vorlesung vermittelt bekamen (Chi et al., 2017). Auch können Lernende von Interaktionen mehrerer Akteure dadurch profitieren, dass diese oft aus Fragen und entsprechenden Antworten bestehen und somit die Verknüpfung verschiedener Informationen unterstützt wird (Craig, Sullins, Witherspoon, & Gholson, 2006). Lernenden sollte also die Möglichkeit gegeben werden, die Interaktion zwischen Akteuren verschiedener Professionen zu beobachten. Dabei sollte darauf geachtet

werden, dass die Akteurinnen und Akteure einen Expert*innenstatus haben. Informationen von Expert*innen werden als besonders glaubwürdig und vertrauenswürdig eingeschätzt (König & Jucks, 2019). Auch kann ein authentischer Kontext als Anhaltspunkt für die Expertise der Protagonisten dienen, so dass Lernende verstärkt auf die Kommunikation achten. Daher kann angenommen werden, dass sich realitätsnahe Darstellungen von Lerninhalten und deren Anwendung positiv auf die Vermittlung von Wissensinhalten auswirkt (vgl. Hoogerheide, van Wermeskerken, Loyens, & van Gog, 2016). Insbesondere aufgrund der Vorteile, die sich hinsichtlich der Darstellung von Interaktionen bieten, sollten realitätsnahe Darstellungen einen Vorteil für Vermittlung von klinischen Handlungswissen bieten.

2.4.2 Darstellung von Interprofessionalität

Ein Ziel interprofessioneller Lehre ist ein Bewusstsein für die professionsspezifischen Rollen, Kompetenzen und Verantwortungen zu vermitteln (Schmitt et al., 2011). Die Rollen und Verantwortlichkeiten der einzelnen Berufe sind zwar durch gesetzliche Vorgaben festgelegt, in der klinischen Praxis können jedoch Unklarheiten auftreten. Deshalb ist ein konkretes Verständnis für Grenzen der Expertise zwischen den Professionen (Edwards, 2011) und Wissen über Kompetenzen der Professionen (Jakobsen et al., 2011) entscheidend und sollte in interprofessionellen Lehrkontexten vermittelt werden. Videos bieten dazu als Lehrmaterial eine entsprechende Möglichkeit interprofessionelle Inhalte zu vermitteln, zumal Lernende wie zuvor beschrieben von der Darstellung von Wissensinhalten in Form von Dialogen und Interaktion profitieren können. Dabei ist jedoch nach wie vor unklar, ob die Profession der Lehrenden die Vermittlung interprofessioneller Themen beeinflusst. Insbesondere in der Medizin herrscht ein berufsspezifisches Wertesystem vor, das laut Kirch und Ast (2015) "traditionell autonome Individuen schätzt, die in hierarchischer Weise konkurrieren und auf den medizinischen Expertenstatus fokussiert sind" (S. 297), wobei dies nicht unbedingt förderlich ist für eine interprofessionelle Zusammenarbeit. Dieses Selbstverständnis sowie ausgeprägte Stereotype und Vorurteile gegenüber anderen Berufsgruppen (Ponzer et al., 2004; Rudland & Mires, 2005) können Barrieren für die Interprofessionelle Lehre darstellen, wenn beispielsweise bei einer dargestellten interprofessionellen Kollaboration ein Teil des Teams nicht ernstgenommen wird und dadurch relevante Inhalte nicht beachtet werden (Visser et al., 2017). Andererseits können in interprofessionellen Kontexten

Lernenden neue Perspektiven eröffnet werden, die es ihnen ermöglichen, größere Zusammenhänge zu erfassen (Hober & Bonnel, 2014) und selbst metakognitive Kompetenzen zu entwickeln, die für eine interprofessionelle Praxis relevant sind (Clark, 2006).

2.4.3. Vorwissen

Lehrmaterialien, die realitätsnah und modellhaft interprofessionelle Wissensinhalte darstellen, können in der Ausbildung von verschiedenen Professionen genutzt werden. Hierbei ist zu beachten, dass sich Lernende verschiedener medizinischer Fachrichtungen hinsichtlich ihres Vorwissens erheblich unterscheiden, was einen Einfluss auf deren Wissenserwerb hat (Hailikari et al., 2008; Robert & Dennis, 2005). Allerdings ist noch unklar, wie sich dies konkret auf die Lernprozesse auswirkt. Einerseits kann reichhaltiges realitätsnahes Material Lernende mit wenig spezifischem Vorwissen vor die Herausforderung stellen, dass sie die präsentierten Informationen nicht schnell genug einordnen können, eine hohe kognitive Beanspruchung erleben und sich schnell überfordert fühlen können (Mayer, 2010; Schrader & Bastiaens, 2012; Sweller, 2012). Überforderung kann zu einem Verlust an Motivation führen, sich mit den Inhalten auseinanderzusetzen (Schneider et al., 2018). Unterforderung hingegen kann zu einem passiven Betrachten führen und damit einhergehen, dass vermittelte Inhalte nicht weiter elaboriert werden und der Wissenserwerb so stagniert. Andererseits kann auf Grundlage der Medienreichhaltigkeitstheorie (Daft et al., 1986) angenommen werden, dass komplexe Inhalte deutlich besser vermittelt werden können, wenn die Inhalte auf mehreren Kanälen verarbeitet werden. Durch die Darbietung der Lerninhalte auf mehreren Verarbeitungskanäle reduziert sich die kognitive Beanspruchung, sodass insbesondere Lernende mit weniger Vorwissen von reichhaltigen Darstellungen profitieren können (Aly et al., 2004; Holzinger et al., 2009).

2.5 Zusammenfassung

Die didaktischen Ansätze legen nahe, dass Interprofessionelle Lehre eine zunehmende Relevanz für die Ausbildung medizinischer Berufe hat und dass diese auch digital umsetzbar ist. Dafür eignet sich insbesondere Videomaterial, in dem die Interaktion verschiedener Professionen in realitätsnahen Kontexten dargestellt wird. Ein Vorteil von der videobasierten digitalen Umsetzung interprofessioneller Lehre ist,

dass das Material so für Lernende verschiedener Professionsgruppen zugänglich gemacht werden kann. Nachteilig hingegen könnte sich die große Varianz im Vorwissen von Lernenden aus unterschiedlichen Professionen auswirken. Hierzu mangelt es jedoch an Forschung, die sich mit der Gestaltung von solchem Lehrmaterial beschäftigt um Hinweise für die Praxis zu geben.

3. Zusammenfassung der empirischen Untersuchungen

Wie bereits ausgeführt, ist es wichtig, interprofessionelle Zusammenarbeit bereits in der Ausbildung medizinischer Berufe zu verankern. Digitale videobasierte Lehrkonzepte stellen eine kostengünstige sowie niedrighschwellige Möglichkeit dar, komplexe Themen wie die Zusammenarbeit verschiedener Professionen in der Ausbildung zu adressieren, da so die Interaktion von Protagonisten verschiedener Professionen in realitätsnahen Kontexten gezeigt werden kann. Es existieren bereits Modellprojekte, die digital lehren und Elemente interprofessioneller Lehre einbinden.

3.1. Die Tübinger Sectio Chirurgica (TSC)

Ein Format, das sich explizit einer digitalen und professionsübergreifenden Lehre verschrieben hat, ist die Tübinger Sectio Chirurgica (*TSC*; Hirt, Shiozawa, Herlan, Wagner, & Küppers, 2010; Shiozawa, Butz, Herlan, Kramer, & Hirt, 2017). Dabei handelt es sich um ein freiwilliges, synchron dargebotenes Lehrformat der Universität Tübingen, das sich an verschiedene Professionen im Gesundheitsbereich richtet. Lernende dieser Professionen können dieses Material ergänzend für ihre Ausbildung nutzen. Dabei hat es sich die TSC zum Ziel gesetzt, anatomisches Grundlagenwissen unter einer realitätsnahen klinischen Perspektive zu vermitteln. Anhand der Simulation chirurgischer Eingriffe an anatomischen Präperaten werden medizinisch relevante Fälle und anatomische Strukturen aus unterschiedlichen professionellen Sichtweisen dargestellt und diskutiert. Die Videos werden während des akademischen Semesters inhaltlich parallel zur Anatomievorlesung produziert und live gestreamt. Sie stehen aber auch nach der live-Übertragung noch in einer Mediathek als asynchrones Lehrmaterial zur Verfügung.

Das Videomaterial der TSC setzt bereits einige Empfehlungen zur Gestaltung von videobasiertem Lehrmaterial für die Vermittlung von anatomischen Wissen und interprofessionellem Verhalten um. Damit eignet sich die TSC optimal als Forschungsumgebung, um die Gestaltung von Video-gestützten Lehransätzen zur Förderung interprofessioneller Lehre empirisch zu untersuchen.

3.2. Überblick zu den empirischen Studien:

Um neue Implikationen für die weitere Forschung zu didaktischen Konzepten für die Vermittlung von interprofessionellen Inhalten abzuleiten zu können, wurden drei experimentelle Studien durchgeführt. Hierfür wurde das Material der TSC genutzt. In der ersten experimentellen Studie (Grosser et al., 2019) wurde die Bedeutung realitätsnaher Darstellungen für die Vermittlung von anatomischen Wissensinhalten untersucht. In der zweiten experimentellen Studie wurde der Einfluss einer interprofessionellen Darstellung auf die Einstellung zu interprofessionellem Verhalten und den Wissenserwerb von Medizinstudierenden untersucht (Grosser, Kimmerle, et al., 2020). In der dritten Studie wurde der Nutzen einer interprofessionellen Darstellung für Lernende verschiedener Professionen betrachtet (Grosser et al., 2021).

3.3. Potential realitätsnaher Darstellung auf die Vermittlung von anatomischen Wissensinhalten

Diese Studie wurde am 16. November 2018 unter dem Titel: "Acquiring Clinical Knowledge from an Online Video Platform: A Randomized Controlled Experiment on the Relevance of Integrating Anatomical Information and Clinical Practice" in der Fachzeitschrift Anatomical Sciences Education in englischer Sprache veröffentlicht.

3.3.1. Einleitung und Hypothesen

Wenn interprofessionelles Verhalten in einem digitalen Kontext anhand von Videomaterial gefördert werden soll, sollte dazu Material verwendet werden, das für viele Professionen eine Relevanz hat. Im Kontext der Gesundheitsberufe bietet sich dazu das Fach Anatomie an (Rafai et al., 2016). Lernenden gelingt es oft nicht, ihr anatomisches Wissen später in klinischen Kontexten anzuwenden (Ahmed et al., 2010; Böckers et al., 2014; Fitzgerald et al., 2008; Lazarus et al., 2012), weshalb empfohlen wird, anatomisches Wissen anhand klinischer Inhalte zu lehren. Die TSC eignet sich als entsprechendes Lehrmaterial, bei der die Bedeutung anatomischer Strukturen für das klinische Vorgehen in einem realitätsnahen Setting erklärt wird. Dabei ist jedoch unklar, ob sich diese Form der realitätsnahen Darstellung tatsächlich für die Vermittlung von klinischen Wissensinhalten eignet. Die große Informationsdichte und Komplexität bei einer realitätsnahen Darstellung kann den Cognitive Load der Lernenden übersteigen, sodass eine Informationsverarbeitung nicht mehr möglich ist. Andererseits kann eine ansprechende Gestaltung des Lehrmaterials einen positiv-affektiven Zustand hervorrufen, der bei der Kodierung und Speicherung von Informationen zuträglich ist (Fredrickson, 1998; Isen, 2009). Eine ansprechende und unterhaltsame Gestaltung ist für freiwilliges, ergänzendes Lehrmaterial von Vorteil, damit es genutzt wird (Collaço, 2017). Um zu überprüfen, ob sich das deutlich komplexere realitätsnahe Video-Material der TSC für den für die Vermittlung von Wissensinhalten eignet, sollte darauf geachtet werden, wie das Material von den Lernenden wahrgenommen wird. Dabei sollte es in der Lage sein, Zusammenhänge verständlich und nachvollziehbar darzustellen. Da für ein freiwilliges, ergänzendes Lehrangebot wie die TSC insbesondere auch der Aspekt der Nutzungsmotivation eine Rolle spielt, soll zudem der empfundene Unterhaltungswert des Lehrangebots untersucht werden. Daher sollte untersucht werden, ob die realitätsnahe Darstellung, wie sie in der TSC gezeigt wird, als anschaulich,

nachvollziehbar und unterhaltsam empfunden wird und ob dieses Format sich für die Vermittlung von anatomischen und klinischen Wissensinhalten eignet. Zur Untersuchung dieser Fragestellung wurde Videomaterial aus der TSC mit einer herkömmlichen Vorlesungsaufzeichnung verglichen.

3.3.2. Experimenteller Aufbau

Bei dem Experiment handelte es sich um eine Online-Studie, bei der das Ausmaß der realitätsnahen Darstellung eines klinischen Eingriffs anhand zweier Bedingungen miteinander verglichen wurde. Als Probanden nahmen 114 Studierende ($M = 24.3$ Jahre, $SD = 7.37$; 51% weiblich) teil, die über die den Email-Verteiler der TSC-Plattform rekrutiert wurden. Es handelte sich ausschließlich um Medizinstudierende, von denen 57% bereits in der klinischen Phase ihrer Ausbildung waren. Die Probanden wurden randomisiert einer der beiden Bedingungen des Experiments zugeordnet.

Zwischen den beiden Bedingungen wurde das Ausmaß der realitätsnahen Darstellung variiert. Dazu wurde in einer Bedingung anatomisches Lehrmaterial aus der TSC verwendet (TSC-Bedingung), indem eine bereits existierende Folge zum Thema labraskopische Operation eines Kreuzbandrisses auf etwa 15 Minuten gekürzt wurde. Bei dieser Darstellung wurden die Handlungen am Lernobjekt sowie die Kollaboration der beteiligten Protagonisten direkt dargestellt. In der anderen Bedingung wurde ein Video verwendet, das inhaltlich sich dem gleichen Thema widmete und in der Form hinsichtlich Dauer pro Thematik und Wortanzahl parallel zu dem TSC-Video aus der ersten Bedingung gestaltet war. Die Inhalte wurden in Form einer herkömmlichen Vorlesung dargestellt und gefilmt (VL-Bedingung). Um eine möglichst große Parallelität beider Bedingungen zu gewährleisten, wurde die Vorlesung von demselben Professor gehalten, der als Moderator in der TSC auftritt. Außerdem wurde zur Abbildung von anatomischen Strukturen relevantes statisches Bildmaterial aus dem TSC-Video verwendet. Die Bedingungen unterschieden sich daher ausschließlich in der Realitätsnähe der Darstellung voneinander: Eine Bedingung zeigte realitätsnah das Vorgehen und die Kollaboration von Ärzten verschiedener Disziplinen bei der Operation eines Kreuzbandfraktur. In der anderen Bedingung wurden die relevanten Schritte unter Verwendung von Bildmaterial in einer Vorlesung dargestellt.

3.3.3. Abhängige Variablen

Um den Nutzen für die Vermittlung von Wissensinhalten auf die vermittelnden Prozesse zu untersuchen, wurde als abhängige Variable die Wahrnehmung der Videos hinsichtlich der Verständlichkeit der Darstellung, der Nachvollziehbarkeit des chirurgischen Eingriffs sowie der Unterhaltungswerts des Videos anhand einer adaptierten Skala von Kuo und Kollegen (2009) gemessen. Zudem wurde im Anschluss an die Präsentation des Videos ein Wissenstest zu anatomischen und klinischen Informationen aus dem Videomaterial durchgeführt.

3.3.4. Ergebnisse

Bei den drei Bewertungsvariablen der Videos zeigten sich durchgängig Haupteffekte mit positiveren Bewertungen in der TSC-Bedingung (Verständlichkeit der Darstellung: $M_{TSC} = 4.20$, $SD = 0.85$ vs. $M_{VL} = 3.75$, $SD = 0.78$, $F(1, 111) = 9.027$, $p = 0.003$, $\eta_p^2 = 0.075$; Nachvollziehbarkeit des chirurgischen Eingriffs: $M_{TSC} = 3.42$, $SD = 0.76$ vs. $M_{VL} = 3.11$, $SD = 0.71$, $F(1, 111) = 5.009$, $p = 0.027$, $\eta_p^2 = 0.044$; Unterhaltungswert des Videos: $M_{TSC} = 4.13$, $SD = 0.85$, $M_{VL} = 3.17$, $SD = 0.83$, $F(1, 111) = 38.126$, $p < 0.001$, $\eta_p^2 = .257$). Hinsichtlich der Leistung im Wissenstest wurde ein Haupteffekt zwischen beiden Bedingungen für die klinischen Wissensinhalte gefunden ($M_{TSC} = 4.76$, $SD = 2.01$, $M_{VL} = 4.06$, $SD = 1.85$, $F(1, 111) = 4.187$, $P = 0.043$, $\eta_p^2 = 0.036$), nicht aber für anatomische Wissensinhalte ($F(1, 111) = 0.001$; $p = 0.989$). Teilnehmer der TSC-Bedingung verfügten im Anschluss der Einheit über mehr klinisches Wissen als die Teilnehmer der VL-Bedingung. In Bezug auf den Wissenstand im anatomischen Wissen unterschieden die sich Bedingungen nicht voneinander.

Mediationsanalyse

Anhand einer Mediationsanalyse wurde anschließend getestet, ob der Haupteffekt des klinischen Wissens durch die Wahrnehmung des Videos vermittelt wurde. Es zeigte sich, dass die Wahrnehmung des Videos die Leistung im Wissenstest für klinisch Inhalte signifikant mediiert, wobei als stärkster Mediator der Unterhaltungswert des Videos identifiziert wurde ($\beta_{\text{Unterhaltung}} = 0.09$, $SE_{\text{Unterhaltung}} = 0.10$, 95% CI [0.162; 0.555]). Auch bei den beiden anderen Bewertungsfaktoren zeigte sich ein Mediationseffekt zwischen Format und klinischem Wissen, wobei diese aber

geringer ausfielen ($\beta_{\text{Verständlichkeit}} = 0.15$, $SE_{\text{Verständlichkeit}} = 0.06$, 95% CI [0.033; 0.282]; $\beta_{\text{Vorstellbarkeit}} = 0.09$, $SE_{\text{Vorstellbarkeit}} = 0.05$, 95% CI [0.002; 0.210]).

3.3.5. Interpretation der Ergebnisse

Die Ergebnisse zeigen, dass Lernende gern mit Videomaterial lernen, in dem das Handeln bei einem chirurgischen Eingriff in einem realitätsnahen Kontext dargestellt wird. Dies wird insbesondere deutlich im Vergleich zur Darstellung derselben Thematik in einer Vorlesung. Realitätsnah dargestelltes Lehrmaterial wird von den Probanden der TSC-Bedingung deutlich positiver hinsichtlich Verständlichkeit und Nachvollziehbarkeit beurteilt als von Probanden, die die Lerninhalte in einem Vorlesungsvideo dargestellt bekamen. Zudem konnten die Probanden der TSC-Bedingung die Wissensinhalte im Anschluss der Einheit besser abrufen als die Probanden der VL-Bedingung.

Das niedrigere Maß an Verständlichkeit und Nachvollziehbarkeit des Vorlesungsmaterials könnte darauf zurückzuführen sein, dass klassische Vorlesungen nicht dafür geeignet sind, klinische Abläufe und Tätigkeiten anschaulich und realitätsnah darzustellen. In Vorlesungen vermitteln Lehrende die Inhalte anhand von Handlungsbeschreibungen und bewegungslosen Bildern, während die für die Operation höchst relevanten Interaktionen zwischen den beteiligten Akteuren entweder gar nicht oder nur sehr wenig berücksichtigt werden können (Garside, 1996). In der TSC-Bedingung hingegen wurden diese Interaktionen anhand eines realitätsnahen chirurgischen Eingriffs aus verschiedenen professionellen Blickwinkeln betrachtet und explizit dargestellt, wodurch ein umfangreiches Verständnis für die Handlungen und Interaktionen der Protagonisten vermittelt werden konnte. Auch der Kontext, in dem die Handlung stattfindet, erleichtert das Verständnis für die Handlungen bei dem Eingriff (Choi und Johnson, 2005). Authentische, realitätsnahe Kontextsituationen können dazu beitragen, das Interesse der Lernenden zu wecken, indem realitätsnahe Handlungsschemata während der Lernphase aktiviert werden (Smith & Vela, 2001). Die Ergebnisse stützen die Annahmen: So berichteten Probanden der TSC-Bedingung im Vergleich zu den Probanden der VL-Bedingung höhere Maße der Verständlichkeit und Anschaulichkeit der Darstellung.

Des Weiteren zeigte die Mediationsanalyse, dass der positive Effekt der realitätsnahen Darstellung auf den Abruf von klinischen Wissensinhalten durch den unterhaltsamen Charakter der TSC-Bedingung ausgelöst wird. Dieses Ergebnis steht in Einklang mit anderen Studien, die gezeigt haben, dass Freude beim Betrachten von Videos den Erwerb von Wissensinhalten unterstützen kann (Mattheiß et al., 2013; Weinmann et al., 2013). Zwar ist die realitätsnahe Darstellung in der TSC-Bedingung deutlich reichhaltiger und dichter an Informationen im Vergleich zur auf wesentliche Inhalte beschränkten Darstellung von Inhalten in einer Vorlesung und beansprucht dementsprechend verstärkt den Cognitive Load (Sweller et al., 1998). Jedoch kann ein positiv-affektiver Zustand bei der Kodierung und Speicherung von Informationen helfen und somit den Wissenserwerb erleichtern (Fredrickson, 1998; Isen, 2009). Auch durch die im Vergleich zu einer Vorlesung unterhaltsam empfundenen Interaktionen der beteiligten Protagonisten, die unter anderem aus Dialogen und somit aus Fragen und entsprechenden Antworten bestehen, können die Verknüpfungen von verschiedenen Informationen unterstützen (Craig, Sullins, Witherspoon, & Gholson, 2006) und somit zu einem Wissenserwerb beitragen.

Vor diesem Hintergrund sollte bei der Gestaltung von Lehrmaterial, das Grundlagen der Anatomie vermittelt, darauf geachtet werden, dieses in einem klinischen und realitätsnahen Kontext, bei dem verschiedene Protagonisten miteinander interagieren, unterrichtet wird. Klassische Vorlesungsvideos, wie sie in Folge der COVID-19 Pandemie in den meisten Universitäten in der digitalen Lehre im Lockdown eingesetzt werden, sind dafür weniger geeignet, da sich diese Vorlesungen hauptsächlich auf die Vermittlung von anatomischem Grundwissen konzentrieren. Wie die hier vorgestellte Studie zeigt, kann die Kombination von anatomischem Grundwissen mit klinischer Anwendung als vielversprechender didaktischer Ansatz angesehen werden.

3.4. Der Einfluss interprofessioneller Darstellung auf interprofessionelle Einstellung und Wissenserwerb

Diese Studie wurde am 18. August 2020 unter dem Titel: "Observing Inter-Professional Videos: Impact of Collaboration Between Physicians and Psychologists on Attitude and Knowledge Acquisition" in der Fachzeitschrift Journal of Medical Education and Curricular Development in englischer Sprache veröffentlicht.

3.4.1. Einleitung und Hypothesen

In der klinischen Praxis ist interprofessionelle Zusammenarbeit eine notwendige Voraussetzung für das Gelingen einer erfolgreichen Patientenversorgung (Gill et al., 2017) und sollte deswegen bereits in frühen Phasen der Ausbildung gefördert werden. Interprofessionelle Lehreansätze haben eine hohe Beliebtheit bei Lernenden der meisten Professionsgruppen im Gesundheitswesen (Grace, 2021), jedoch ist vor allem unter Medizinstudierenden die Einstellung verbreitet, sich nicht mit interprofessionellen Kontexten auseinandersetzen zu wollen (Davidson & Lucas, 1995; Pirrie et al., 1998). Diese Einstellungen sind problematisch für die Etablierung interprofessioneller Kompetenzen; sie lassen sich jedoch durch die Darstellung von positiven Modellverhalten ändern (Conroy, 2019).

Wie die Ergebnisse der ersten experimentellen Studie zeigen, hat sich die realitätsnahe Darstellungsformat der TSC für die Vermittlung von klinisch relevantem anatomischem Grundlagenwissen gegenüber klassischen Lehrformaten als wirksam erwiesen. Darüber hinaus ermöglicht dieses Darstellungsformat, Interprofessionalität anhand von positivem Modellverhalten in einer anschaulichen und unterhaltsamen Weise in der Lehre umzusetzen. Lernenden können so neue Perspektiven eröffnet werden, die dem Wissenserwerb zuträglich sind.

Insbesondere organisatorische Schwierigkeiten erschweren die Umsetzung von interprofessioneller Lehre, bei der die Interaktion zwischen Akteurinnen und Akteuren verschiedener Professionen dargestellt wird (Lawlis et al., 2014). Daher ist eine beliebte Möglichkeit, diesen Schwierigkeiten zu begegnen, die Vermittlung interprofessionellen Handelns aus der Perspektive einer Profession. Dabei ist jedoch unklar, ob die Schilderung des Handelns in einem interprofessionellen Setting von Vertretern einer Profession genügt, um interprofessionelle Kompetenzen und

Wissensinhalte zu vermitteln oder ob die Interaktion von Protagonisten aus verschiedenen relevanten Professionen explizit dargestellt werden sollte.

Aus den Grundannahmen der sozialkognitiven Lerntheorie (Bandura, 2001) lässt sich die Hypothese ableiten, dass sich die explizite Darstellung der Interaktion von Vertretern verschiedener Professionen positiv auf die Einstellung der Lernenden zu interprofessionellem Verhalten auswirken kann. Lernende haben beim Beobachten erfolgreicher Interaktionen von Protagonisten verschiedener Disziplinen die Möglichkeit, selbst positive Einstellungen zu diesem Verhalten zu entwickeln. Neben der allgemeinen Haltung dazu, selbst in interprofessionellen Kontexten arbeiten und lernen zu wollen, sollte eine wertschätzende Haltung zu den beteiligten Professionen entwickelt werden. Durch die Beobachtung einer realitätsnahen interprofessionellen Behandlung wird den lernenden zudem die Möglichkeit gegeben, die Bedeutung von Interprofessionalität an einem konkreten Beispiel wahrzunehmen.

Wie bereits in der vorhergehenden Studie erläutert, ist es für den Wissenserwerb wichtig und förderlich, dass das Lehrmaterial als nachvollziehbar und anschaulich wahrgenommen wird. Insbesondere bei Lehrmaterialien, die zusätzlich zum Prüfungsstoff genutzt werden können, ist zudem die wahrgenommene Unterhaltsamkeit des Lehrmaterials ein Aspekt, der den Lernprozess beeinflussen kann, da als unterhaltsam empfundenes Lehrmaterial von Lernenden mit einer größeren Wahrscheinlichkeit genutzt wird, insbesondere wenn dieses als freiwilliges, ergänzendes Material zur Ausbildung angeboten wird. Aus nicht-digitalen Lehrsettings ist bekannt, dass interprofessionelle Ausbildungsangebote, bei denen Protagonisten aus verschiedenen Disziplinen interagieren, bei der Vermittlung klinischer Wissensinhalte als unterhaltsamer und in ihren Schilderungen nachvollziehbarer erlebt werden als Angebote, die eine monoprofessionelle Interaktionen darstellen (Solomon et al., 2010).

In der vorhergehenden Studie wurde gezeigt, dass auch in digitalen Settings Lehrmaterial, in dem Interaktionen gezeigt werden, als unterhaltsamer und nachvollziehbarer erlebt wird und für den Wissensabruf förderlicher ist als Lehrmaterial, in dem eine Person die Wissensinhalte vorträgt. Aufgrund des organisatorischen Aufwands ist es von Interesse herauszufinden, ob hierbei Interaktionen zwischen Protagonisten verschiedener Professionen beobachtet werden sollten oder ob Interaktionen zwischen Protagonisten einer Profession ausreichend

sind. Da die Wahrnehmung des Lehrmaterials den Umgang damit maßgeblich beeinflusst, sollte untersucht werden, ob Lehrmaterial, das Interaktionen zwischen Protagonisten verschiedener Professionen zeigt, als anschaulicher und unterhaltsamer empfunden sowie zuträglicher für den Wissenserwerb ist als Lehrmaterial, das Interaktionen zwischen Protagonisten ausschließlich einer Profession zeigt.

3.4.2. Experimenteller Aufbau

Zur Untersuchung der Fragestellung wurde eine experimentelle Untersuchung in Form einer Onlinestudie durchgeführt. Als Material wurde videobasiertes Lehrmaterial aus der TSC verwendet, bei dem die Behandlung von Parkinson-erkrankten Patienten mittels Tiefenhirn-Stimulation realitätsnah dargestellt wurde. Diese Thematik eignet sich für die Fragestellung, da sie eine hohe interprofessionelle Relevanz hat: Bei diesem neurochirurgischen Verfahren werden Elektroden in bestimmte Gehirnareale implantiert (Bronstein et al., 2011), weshalb dieser Eingriff oft mit starken Ängsten und Affektveränderungen einhergeht (Perozzo et al., 2001; Synofzik & Schlaepfer, 2008). Eine interprofessionelle Behandlung unter Einbezug von Psychologen wird daher empfohlen (Morishita et al., 2014).

Zunächst wurden die demografischen Daten der Probanden sowie deren Grundeinstellung zu interprofessionellem Handeln erhoben. Anschließend sahen die Probanden ein TSC-Video, bei dem die Anwesenheit verschiedener Professionen bei der Darstellung des chirurgischen Eingriffs variiert wurde: In der monoprofessionellen (MP-) Bedingung wurde der fachliche Austausch über diesen Eingriff nur unter Ärzten geführt, während in der interprofessionellen (IP-) Bedingung ein Psychologe den fachlichen Austausch ergänzte. Als abhängige Variablen wurde die Wahrnehmung des Videos, ein Wissenstest, die Einstellung zu interprofessionellem Handeln, die Einstellung zu den beteiligten Professionen sowie die wahrgenommene Bedeutung interprofessioneller Zusammenarbeit im Anschluss an das Video erhoben. Bei den Probanden handelte es sich um 140 Medizinstudierende ($M = 23.13$ Jahre, $SD = 3.53$; 81 weiblich), die über die den Email-Verteiler der TSC-Plattform rekrutiert wurden. Die Probanden wurden randomisiert den Bedingungen des Experiments zugeordnet: 74 Probanden der monoprofessionellen Bedingung und 66 der interprofessionellen Bedingung.

3.4.3. Abhängige Variablen

Für die Bewertung des gezeigten Videomaterials wurden erneut anhand der adaptierten Skala von Kuo und Kollegen (2009) die abhängigen Variablen Nachvollziehbarkeit des chirurgischen Eingriffs sowie der Unterhaltungswerts des Videos gemessen. Für den Wissenstest wurden den Probanden acht Aussagen präsentiert, die Richtig oder Falsch sein konnten. Für eine bessere Interpretierbarkeit der Ergebnisse sollten die Probanden zusätzlich angeben, wie sicher sie sich bei der Antwort waren. Diese Angaben wurden nach der Confidence-Based-marking-Methode (Gardner-Medwin & Gahan, 2003) zu einem Gesamtwert verrechnet. Die Fragen des Wissenstests umfassten ausschließlich Inhalte, die in beiden Videos in identischer Form gezeigt wurden. Die Einstellung zu interprofessionellem Handeln (Subskalen IP-interaction und IP-learning des University of the West of England Interprofessional Questionnaire (UWE-IP; Mahler (2017))) sowie die Bewertung der subjektiven Einstellungen zu den beteiligten Professionen (adaptierte Skala von Marteau und Kollegen (2001)) wurde vor und nach der Präsentation des Videos erhoben. Die Einschätzung der Bedeutsamkeit einer interprofessionellen Behandlung wurde anhand einer Skala aus sechs selbstentwickelten Items (Cronbach's alpha = 0.815) gemessen.

3.4.4. Ergebnisse

Es zeigte sich, dass das Lehrmaterial in der interprofessionellen Bedingung von den Probanden als nachvollziehbarer ($M_{IP} = 3.20$; $SD = 1.30$ vs. $M_{MP} = 2.17$; $SD = 0.92$; $t_{(138)} = -6.269$; $p < .001$; $d = 1.06$) und unterhaltsamer ($M_{IP} = 2.65$; $SD = 0.45$ vs. $M_{MP} = 2.47$; $SD = 0.49$; $t_{(138)} = -2.227$; $p = .028$; $d = 0.38$) bewertet wurde als das Material in der monoprofessionellen Bedingung. Auch hinsichtlich des Abrufs von Wissensinhalten zeigte sich die Interprofessionelle Bedingung überlegen. Es zeigte sich, dass Probanden mehr Wissensinhalte wiedergeben konnten, wenn ihnen diese in einem interprofessionellen Setting dargeboten wurden im Vergleich zur Darstellung in einem monoprofessionellen Setting ($M_{MP} = 4.25$, $SD = 10.54$ vs. $M_{IP} = 8.32$, $SD = 10.45$; $t_{(138)} = -2,285$; $p = .024$; $d = 0,04$ für monoprofessionelle Darstellung vs. Interprofessionelle Darstellung).

In Bezug auf die Bewertung von Interprofessionellem Handeln waren die Ergebnisse nicht so eindeutig. Zwar zeigten die Probanden nach dem Video positivere Einstellung zu interprofessionellem Lernen als davor ($M_{pre} = 3.48$, $SD = 0.56$; $M_{post} = 3.59$, $SD = 0.51$; $F_{(1,137)} = 5.176$, $p = .024$), jedoch zeigte sich kein Unterschied zwischen beiden Bedingungen ($F_{(1,137)} = 1.499$, $p = .223$). Dieses Muster wurde auch hinsichtlich der Einstellung zur interprofessionellen Kollaboration ($M_{pre} = 3.79$, $SD = 0.87$; $M_{post} = 3.91$, $SD = 0.80$; $F_{(1,137)} = 6.482$, $p = .012$) gefunden. Auch hier zeigte sich kein Unterschied zwischen den Gruppen ($F_{(1,137)} = 0.364$, $p = .547$). Bezüglich der Einstellung zu den beteiligten Professionen zeigten sich nur geringfügige Unterschiede zwischen den Bedingungen. In der monoprofessionellen Bedingung verbesserte sich die Einstellung der Probanden gegenüber Medizinern geringfügig ($M_{pre} = 6.48$, $SD = 0.75$; $M_{post} = 6.75$, $SD = 0.55$; $F_{(1,138)} = 4.860$, $p < .001$, $\eta^2 p = 0.11$), während sie sich gegenüber Psychologen nicht änderte ($M_{pre} = 2.22$, $SD = 0.55$; $M_{post} = 2.41$, $SD = 1.66$; $F_{(1,138)} = 2.135$, $p = .146$). In der interprofessionellen Bedingung zeigten sich keine Veränderung der Bewertung, weder für Mediziner, noch für Psychologen ($F_{(1,138)} = 0.392$, $p = .532$). Die Bedeutsamkeit einer interprofessionellen Behandlung zeigte sich ein signifikanter Unterschied zwischen den Bedingungen: Probanden der IP-Bedingung bewerteten ein interprofessionelles Vorgehen bei der Behandlung von Parkinson mittels Tiefenhirnstimulation bedeutsamer als Probanden der MP-Bedingung ($M_{IP} = 4.18$; $SD = 0.48$ vs. $M_{MP} = 3.53$; $SD = 0.48$; $t_{(138)} = -7.954$; $p < .001$; $d = 1.35$).

3.4.5. Interpretation der Ergebnisse

Für die Vermittlung von interprofessionell relevanten Wissensinhalten und Kompetenzen ist die videobasierte Darstellung von interprofessioneller Kollaboration, wie sie in der TSC dargestellt wird, ein sinnvolles Format. Dies ist insbesondere der Fall, wenn dabei die Interaktion von Protagonisten verschiedener Professionen dargestellt wird: Lernende können durch eine entsprechende Darstellung die Handlungen bei einer Tiefenhirnstimulation besser nachvollziehen und erleben die Darstellung auch als unterhaltsamer, als wenn die interprofessionell relevanten Handlungsschritte nur von Protagonisten einer Profession erklärt werden. Auch half die explizite Darstellung der Interaktion von Vertretern verschiedener Professionen den Lernenden, die Notwendigkeit eines interprofessionellen Vorgehens bei der Behandlung von Parkinson mittels Tiefenhirnstimulation zu verstehen, was sich

zusätzlich auch in einem besseren Wissensabruf in der interprofessionellen Bedingung zeigte.

Zur Förderung allgemeiner interprofessioneller Einstellungen scheint es jedoch unerheblich, ob bei der Darstellung tatsächlich Protagonisten verschiedener Professionen ihre Perspektiven und Handlungsansätze vorstellen, solange die Thematik selbst eine interprofessionelle Behandlung notwendig macht und diese bei der Darstellung betont wird. Darüber hinaus zeigte sich, dass die Probanden in der mono-professionellen Darstellung ihre Einstellung gegenüber Ärzten verbesserte, während sie sich gegenüber Psychologen nicht änderte. Dieses Ergebnis sollte vor dem Hintergrund verstanden werden, dass alle Probanden selbst Studierende der Medizin waren und in der monoprofessionellen Bedingung die Ärzte als die einzigen verantwortlichen Protagonisten auftraten. Es könnte also der Eindruck entstanden sein, dass nur Diese besondere medizinische Leistungen erbringen. Die Leistung der eigenen Gruppe am Behandlungserfolg wird dabei oft überbewertet, während die Bedeutung von Mitgliedern anderer Professionen am Behandlungserfolg eher unterschätzt wird (Sollami et al., 2018).

Es lässt sich zusammenfassen, dass bei der Gestaltung von Lehrmaterial, dass interprofessionelles Verhalten fördern soll, darauf geachtet werden sollte, dass die Notwendigkeit eines interprofessionellen Handelns deutlich werden muss. Die explizite Darstellung von positivem interprofessionellem Rollenverhalten erleichtert den Abruf von Wissensinhalten und wird von Lernenden als unterhaltsam und anschaulich erlebt, was vor allem eher kritisch gegenüber Interprofessionalität eingestellten Lernenden helfen kann, sich mit der Thematik auseinanderzusetzen und eigene, eventuell problematische Einstellungen zu überdenken.

3.5. Das Potential interprofessioneller Darstellung für die interprofessionelle Lehre

Diese Studie wurde am 31. Juli 2020 unter dem Titel: "Observing interprofessional collaboration: Impact on attitude and knowledge acquisition" in der Fachzeitschrift Anatomical Sciences Education in englischer Sprache veröffentlicht.

3.5.1. Einleitung und Hypothesen

Die beiden ersten experimentellen Studien hatten das Ziel, verschiedene Aspekte bei der Gestaltung von Lehrvideos zu untersuchen, die bei der digitalen Umsetzung interprofessioneller Lehre hilfreich sein können. Es konnte gezeigt werden, dass sich die interprofessionelle und realitätsnahe Darstellung der TSC für die Vermittlung von klinisch relevantem anatomischem Grundlagenwissen und zur Förderung positiver interprofessioneller Einstellungen eignet. Anhand modellhaft dargestellter interprofessioneller Kollaboration in einem realitätsnahen Setting haben Lernende die Möglichkeit, Wissensinhalte zu erwerben sowie Einstellungen und Werte vermittelt zu bekommen, die dem eigenen interprofessionellem Handeln positiv zuträglich sind. Bei den Probanden der oben beschriebenen Studien handelte es sich ausschließlich um Medizinstudierende. Digitale interprofessionell gestaltete Lehrkontexte wie die TSC haben jedoch das Potential, dass das Lehrmaterial für die Ausbildung mehrerer Professionen verwendet werden kann, da digitales Material ohne Aufwand vielen Menschen zur Verfügung gestellt werden kann und so neben der Vermittlung von Wissensinhalten auch zur Förderung interprofessioneller Lehre beitragen kann. Eine gut gestaltete interprofessionelle Lehre kann dazu beitragen, dass Lernende positive Einstellung zu interprofessionellem Verhalten schon in der Ausbildung erwerben und diese später auch in der klinischen Praxis zeigen (Thistlethwaite et al., 2015). Dabei ist jedoch unklar, ob interprofessionell gestaltetes Lehrmaterial von Lernenden verschiedener Professionen gleichermaßen rezipiert wird und so gleichermaßen für Ausbildungszwecke genutzt werden kann.

Die Ausbildungen im Gesundheitsbereich weichen teilweise erheblich voneinander ab (Walkenhorst, 2013), sodass Lernende aus verschiedenen Professionen über ein teilweise sehr unterschiedliches Vorwissen verfügen, auch wenn sie sich inhaltlich mit denselben Thematiken auseinandersetzen (Freeth, 2001). Dies kann dazu führen, dass Lernende verschiedener Professionen sehr

unterschiedlich von interprofessionellem Lehrmaterial profitieren. Lernende können bei Themen, zu denen sie wenig spezifisches Vorwissen haben, vor die Herausforderung gestellt sein, dass sie die präsentierten Informationen nicht gut einordnen können, eine hohe kognitive Belastung erleben und sich schnell überfordert fühlen (Mayer, 2010; Schrader & Bastiaens, 2012; Sweller, 2012). Das kann zu einem Verlust an Motivation führen, sich weiter mit den Inhalten auseinanderzusetzen (Schneider et al., 2018). Haben Lernenden andererseits das Gefühl, dass ihnen keine neuen Informationen präsentiert werden, kann wiederum Motivationsverlust die Folge sein und dem Wissenserwerb schaden, da vermittelte Inhalte nicht weiter elaboriert werden. Eine anschauliche und unterhaltsame Darstellung des Materials kann jedoch dazu beitragen, dass die kognitive Belastung bei der Betrachtung des Lehrmaterials reduziert wird (Isen, 2009; Morgan et al., 2015) und so der Wissenserwerb begünstigt wird. Daher sollte untersucht werden, ob Lehrmaterial, das die Interaktionen zwischen Protagonisten verschiedener Professionen darstellt, bei Lernenden verschiedener Professionen zu unterschiedlichen spezifischen Wissenszuwächsen führt.

Es ist davon auszugehen, dass sich die Lernenden nicht nur in ihrem professionsspezifischen Vorwissen unterscheiden, sondern auch in ihrer Wahrnehmung der beteiligten professionellen Rollen (Fernandes et al., 2015; Zheng et al., 2019). Es ist wichtig, dass Lernende Klarheit über die professionsspezifischen Rollen erwerben, da dies eine wichtige Voraussetzung für die Etablierung einer guten interprofessionellen Zusammenarbeit ist (Friberg et al., 2016). Es ist anzunehmen, dass dies durch modellhafte Darstellung interprofessioneller Kollaboration gefördert und Vertrauen zu den beteiligten Professionen aufgebaut werden kann (Kenny et al., 2003; Wahyuni et al., 2020). Daher sollte untersucht werden, welchen Einfluss die Darstellung interprofessioneller Zusammenarbeit auf das Rollenbewusstsein von Lernenden verschiedener nimmt.

3.5.2. Experimenteller Aufbau

Zur Untersuchung der Fragestellungen wurde eine quasi-experimentelle Längsschnittstudie durchgeführt. Untersucht wurde, wie sich digitales Lehrmaterial, in dem interprofessionelle Kollaboration dargestellt wird, auf den Wissenserwerb, die Entwicklung von Rollenverständnissen und die Einstellung zu interprofessioneller

Kollaboration von Lernenden von zwei medizinischen Berufen auswirkt. Als Untersuchungsmaterial wurde eine vollständig live-übertragene Folge der TSC genutzt. Bei der TSC werden professionsspezifische Wissensbereiche von Protagonisten verschiedener Professionen vorgestellt und diskutiert, wie zum Beispiel von Mediziner*innen und Physiotherapeut*innen. Die Inhalte richten sich an Lernende verschiedener Professionen, wie zum Beispiel Schüler*innen der Physiotherapie und Studierende der Medizin. In der TSC-Folge wurde die Versorgung einer Tuberculum majus-Fraktur dargestellt. Dieses Thema hat eine hohe interprofessionelle Relevanz für Mediziner*innen und Physiotherapeut*innen. Dementsprechend wurde die interprofessionelle Versorgung am Patienten durch Lehrkräfte der Anatomie, Chirurgie und Physiotherapie dargestellt. Die Probanden waren 113 Studierende und Auszubildende der Gesundheitsprofessionen Physiotherapie (38 Proband*innen) und Medizin (75 Proband*innen). Die Gruppen waren vergleichbar hinsichtlich Alter ($t(111) = -0.54; p = 0.591$) und Geschlechterverteilung ($\chi^2(1) = 0.231; p = 0.631$).

3.5.3. Abhängige Variablen

Als abhängige Variablen wurden die Wahrnehmung des Materials, die Einstellung zu interprofessionellem Lernen, das interprofessionelle Rollenbewusstsein, sowie ein Wissenstest erhoben. Die Einstellung und das Rollenbewusstsein wurden sowohl vor und nach der Präsentation des Materials erhoben. Die Wahrnehmung des Videomaterials (Nachvollziehbarkeit, Unterhaltung) wurde wie in den vorhergehenden Studien mit der adaptierten Skala von Kuo und Kollegen (2009) erhoben. Die Einstellung zu interprofessionellem Lernen wurde anhand der *IP-learning* Subskala des *UWE-IP* (Mahler et al., 2017; Pollard et al., 2005) erhoben. Da für die Messung des professionellen Rollenbewusstseins keine geeigneten Instrumente existieren (Oates & Davidson, 2015), wurde dieses bei beiden Gruppen mit zwei selbstentwickelten Items erhoben. Dabei handelte es sich um die Statements „Für einen guten Behandlungserfolg sollte ein Physiotherapeut einen Teil der ärztlichen Diagnostik übernehmen.“ und „Für einen guten Behandlungserfolg sollte ein Arzt die Patienten bei physiotherapeutischen Übungen anleiten“, zu denen sich die Probanden auf einer fünf-stufigen Likertskala positionieren konnten. Für den Wissenstest wurden den Probanden 13 Aussagen präsentiert, die Richtig oder Falsch sein konnten. Für eine bessere Interpretierbarkeit der Ergebnisse sollten die

Probanden zusätzlich angeben, wie sicher sie sich bei der Antwort waren. Diese Angaben wurden nach der Confidence-Based-marking-Methode (Gardner-Medwin & Gahan, 2003) zu einem Gesamtwert verrechnet. Die Fragen des Wissenstests umfassten 3 Themengebiete, bei denen die Lernenden verschiedenes Vorwissen haben sollten: medizinisches Wissen, physiotherapeutisches Wissen und klinisches Wissen. Im Gegensatz zu den professionsspezifischen Wissensanteilen, bei dem sich die Lernenden in Abhängigkeit von ihrem Ausbildungsberuf unterscheiden sollten, ist bezüglich des klinischen Wissens anzunehmen, dass die Lernenden beider Professionen aufgrund bereits bestehender klinischer Vorerfahrungen wie Praktika und Famulaturen über vergleichbares Vorwissen verfügen sollten.

3.5.4. Ergebnisse

Die Darstellung der interprofessionellen Interaktion wurde von beiden Lernenden-Gruppen gleichermaßen nachvollziehbar, unterhaltsam und für die Vermittlung von interprofessionellen Lerninhalten geeignet eingeschätzt ($t(110) = -1.54$; $p = 0.127$). Die Einstellung aller Probanden zu Interprofessioneller Lehre war schon zu Beginn der Studie relativ hoch und konnte durch die Darbietung des interprofessionellen Lehrmaterials weiter gefördert werden ($M_{pre} = 3.68$, $SD = 0.63$; $M_{post} = 3.83$, $SD = 0.77$; $t(110) = -3.83$, $p < 0.001$, $d = 0.21$).

Bei der Bewertung der professionellen Rollen zeigte sich eine Interaktion zwischen Ausbildungsberuf und Messzeitpunkt ($F(1, 111) = 4.56$, $p = 0.035$, $\eta^2 = 0.04$). Die Überzeugungen der Medizinstudierenden, dass im Kontext interprofessioneller Kollaboration bestimmte Aufgabenbereiche von der jeweils anderen Profession übernommen werden können, änderte sich nicht zwischen den Messzeitpunkten ($M_{prä} = 2.67$, $SD = 0.69$; $M_{post} = 2.74$, $SD = 0.97$; $t(74) = -5,75$, $p = 0,567$) für Anleitung von Krankenübungen; $M_{prä} = 2.54$, $SD = 1.01$; $M_{post} = 2.49$, $SD = 1.09$; $t(74) = 0,39$, $p = 0,694$ für medizinische Diagnose). Die Physiotherapieschüler*innen hingegen stimmten nach der Präsentation eher der Aussage zu, dass ärztliches Personal in der Lage ist, Krankenübungen anzuleiten, als vorher ($M_{prä} = 1.47$, $SD = 0.69$; $M_{post} = 1.95$, $SD = 1.38$; $t(37) = -3,67$, $p < 0,001$, $d = 0,44$). Die Überzeugung der Physiotherapieschüler*innen, dass Physiotherapeut*innen in der Lage sind, Teile der

medizinischen Diagnose zu übernehmen, reduzierte sich geringfügig ($M_{prä} = 3.55$, $SD = 0.76$; $M_{post} = 3.24$, $SD = 0.94$; $t(37) = 2,23$, $p = 0,032$, $d = 1,128$).

Hinsichtlich des Wissenserwerbs konnten alle Lernenden von dem Lehrmaterial profitieren ($M_{prä} = 72.30$; $SD = 11.65$, $M_{post} = 81.86$; $SD = 11.77$; $t(111) = -8.46$, $p < 0.001$, $d = 0.82$). Die Analyse der Daten zeigt das erwartete Muster in Bezug auf den Wissenserwerb in verschiedenen Bereichen in Abhängigkeit vom Ausbildungsberuf. Die Leistung im medizinischen Wissenstest verbesserte sich in der Gruppe der Physiotherapie-Schüler*innen stärker als in der Gruppe der Medizinstudierenden ($F(1,111) = 21.54$, $p < 0.001$, $d = 0.91$). Im physiotherapeutischen Wissenstest hingegen verbesserte sich die Leistung in der Gruppe der Medizinstudierenden stärker als in der Gruppe der Physiotherapieschüler*innen ($F(1,111) = 4.30$, $p = 0.040$, $d = 0.41$). Im klinischen Wissenstest konnten sich beide Gruppen gleichermaßen durch die Darstellung des interprofessionellen Lehrmaterials verbessern: $F(1, 111) = 83.01$, $p < 0.001$, $d = 0.43$.

3.5.5. Interpretation der Ergebnisse

Das Format der TSC wurde für die medizinische Lehre entwickelt und ist daher auf Medizinstudierende ausgerichtet. Es werden jedoch immer wieder Themen bearbeitet, die auch für die Ausbildung in anderen Gesundheitsberufen relevant sind. Da digitales Material ohne Aufwand Lernenden verschiedener Berufe zur Verfügung gestellt werden kann, ist es nützlich zu untersuchen, ob das Material auch Lernenden anderer Professionen nutzen kann. Die Ergebnisse der vorliegenden Studie zeigen, dass Lernende der Medizin und der Physiotherapie das Format gleichermaßen als anschaulich und unterhaltsam erleben. Die Ergebnisse zeigen weiterhin, dass sich durch das Material bei Lernenden beider Berufe die Einstellung zu Interprofessioneller Lehre verbesserte, was sich positiv auf eine interprofessionelle Zusammenarbeit in der Klinik auswirken kann (Reeves et al., 2017). Somit stellt das Format der TSC eine anschauliche und unterhaltsame digitale Ergänzung zum klassischen Lehrmaterial dar, das in der Lage ist, interprofessionelles Verhalten zu fördern.

Des Weiteren zeigen die Ergebnisse, dass sich das Format der TSC auch zur Vermittlung von Wissensinhalten für Lernende verschiedener Gesundheitsberufe eignet, da sowohl Medizinstudierende als auch Physiotherapieschüler*innen nach der

Betrachtung des Videos mehr Wissen abrufen konnten als zuvor. Insbesondere im Wissensbereich der jeweils anderen Profession zeigten die Lernenden nach der Präsentation einen Wissenszuwachs. Dass die Studierenden mehr Wissenserwerb in Bereichen zeigten, für den sie wenig Vorwissen hatten, im Vergleich zu Bereichen, in dem sie bereits viel wussten, steht im Gegensatz zu früheren Annahmen, dass Vorwissen in einem spezifischen Bereich den Wissenserwerb unterstützt und zu besseren Wissenstestergebnissen führt (Tedman et al., 2011; Oza und Nesbit, 2018). Gründe dafür könnten sein, dass Medizinstudierende während ihrer Ausbildung wenig Möglichkeiten haben, Einblicke in andere Gesundheitsberufe zu bekommen und Lernende somit möglicherweise stärker motiviert sind, sich mit ihnen Unbekannten Themen auseinanderzusetzen. Diese Ergebnisse passen zu den Erkenntnissen von Shields et al. (2015) und Herrmann et al. (2015), die Lernende der Medizin und Physiotherapie nach einer interprofessionellen Lehreinheit zu ihrer Zufriedenheit mit der interprofessionellen Erfahrung befragten. Lernende beider Gruppen gaben an, dass die interprofessionelle Erfahrung ihr Interesse an tieferen Einblicken in den Behandlungsansatz der anderen Profession weckte.

Die Beobachtung modellhafter interprofessioneller Kollaboration ermöglicht Lernenden ihr Rollenverständnis und professionelle Kompetenzen zu adjustieren. Die Ergebnisse der Studie zeigten, dass Physiotherapieschüler*innen durch die Beobachtung von positiven interprofessionellem Modellverhalten ihre zuvor sehr kritische Einschätzung zu den Kompetenzen des ärztlichen Personals bei der Anleitung von physiotherapeutischen Übungen ändern konnten. Ein Grund für die anfängliche Skepsis der Physiotherapiestudenten könnte darin liegen, dass sie sich bereits in der klinischen Phase ihrer Ausbildung befanden, wo sie sowohl gute als auch schlechte interprofessionelle Kollaboration erlebt hatten, während Medizinstudenten diese Erfahrung noch nicht gemacht hatten. Auch änderte die Beobachtung von positiven interprofessionellem Modellverhalten die Selbstüberschätzung von Physiotherapie-Schüler*innen, dass Physiotherapeut*innen Teile der medizinischen Diagnose übernehmen sollten, da diese rechtlich dazu nicht befugt sind. Bei den Medizinstudierenden änderten sich die Überzeugungen bei beiden Statements kaum, sondern bewerten sich im Mittel der Skala, was auf noch wenig ausgebildetes Rollenverständnis der größtenteils noch sehr jungen Medizinstudierenden schließen lässt (Wilson et al., 2013).

Insgesamt zeigt sich, dass die Darstellung interprofessioneller Zusammenarbeit in einem Lehrvideo ein vielversprechender und relativ einfach umzusetzender Ansatz ist, um bei Lernenden verschiedener Professionen das Bewusstsein für interprofessionelle Arbeitssituationen zu schärfen und relevante Kenntnisse aus anderen Gesundheitsprofessionen zu gewinnen. Dabei eignet sich besonders Material, das wie die TSC anatomisches Basiswissen unter einer angewandten klinischen Perspektive vermittelt, da dieses für fast alle Professionen des Gesundheitswesens relevant ist und in der einen frühen Phase der Ausbildung vermittelt wird.

4. Zusammenfassende Diskussion

4.1. Zusammenfassung

Für alle Akteure des Gesundheitssystems gewinnen soziale Kompetenzen wie Teamfähigkeit und die Fähigkeit zur interprofessionellen Kollaboration immer mehr an Bedeutung, da die Gesundheitsversorgung zunehmend komplex ist. Dabei geht eine erfolgreiche interprofessionelle Kollaboration mit besseren Behandlungsergebnissen und einer höheren Patientenzufriedenheit einher. Eine frühe Etablierung interprofessioneller Lehre in Studium und Ausbildung ist wichtig, um Lernenden die notwendigen Kompetenzen für die Herausforderungen in der klinischen Praxis zu vermitteln. Zwar existieren bereits interprofessionelle Ausbildungsprogramme, allerdings sind diese sehr aufwändig zu organisieren, außerdem lassen diese sich nur in Präsenzkontexten umsetzen und sind somit schwer fächerübergreifend in bestehende Curricula zu integrieren.

Eine Möglichkeit, interprofessionelle Lehre vergleichsweise unaufwändig zu gestalten, bieten digitale Formate, da diese unter Lernenden der Gesundheitsberufe institutionsunabhängig eine große Reichweite haben können, leicht umzusetzen sind (Shrader et al., 2016) und ausbildungsübergreifend einsetzbar sind. Für nahezu alle Lernenden im Gesundheitswesen sind Themen aus dem Fachbereich der Anatomie relevant und werden in den jeweiligen Ausbildungen entsprechend vermittelt. Damit bieten Themen aus dem Fachbereich der Anatomie einen geeigneten Kontext für digitale Formate. Eine niederschwellige Möglichkeit, interprofessionelle Lehransätze fächerübergreifend umzusetzen, bietet die modellhafte Darstellung interprofessioneller Kollaboration.

Diese Dissertation soll dazu beitragen, ein besseres Verständnis für die Wissensrezeptionsprozesse bei der Darstellung von interprofessioneller Kollaboration in der medizinischen Ausbildung zu gewinnen. Darüber hinaus untersucht diese Arbeit, welche Faktoren einen Einfluss auf die Einstellung Lernender zu interprofessionellem Lernen und Handeln nehmen. Anhand eines Reviews wurden didaktische Ansätze auf ihre Anwendbarkeit in der digitalen interprofessionellen Lehre untersucht und diskutiert. Dabei zeigte sich insbesondere das Potential von Videomaterial für die Förderung interprofessioneller Lehre. Basierend auf theoretischen

Schlussfolgerungen wurden Hypothesen zur Gestaltung von digitalem interprofessionellem Lehrmaterial abgeleitet und Aspekte für die Gestaltung von medizinischen interprofessionellen Lehrvideos herausgearbeitet. Anschließend wurde in drei experimentellen Studien der Einfluss verschiedener Gestaltungsmöglichkeiten von medizinischen Lehrvideos auf die Einstellung zu interprofessionellem Verhalten sowie den Wissenserwerb bei angehenden Medizinerinnen und Physiotherapeuten untersucht. Für diese Studien wurde Videomaterial der Tübinger Sectio Chirurgica (TSC) genutzt, da dieses Empfehlungen zur Gestaltung von videobasiertem Lehrmaterial für die Vermittlung von anatomischen Wissen und interprofessionellem Verhalten bereits umsetzt. Zudem wird die TSC bereits als freiwilliges, ergänzendes Lehrformat von vielen Lernenden genutzt (Shiozawa et al., 2017), und stellt somit eine extern valide Forschungsumgebung dar.

Damit Lernende sich freiwillig zusätzlich zur formellen Ausbildung mit ergänzendem Lehrmaterial auseinandersetzen, ist eine wichtige Voraussetzung, dass dieses ansprechend gestaltet ist. Lernenden nutzen solches Lehrmaterial selbstgesteuert. Eine externe Kontrolle darüber, ob Lernende das Lehrmaterial tatsächlich beachten, existiert dabei nicht. Eine unterhaltsame Gestaltung des Lehrmaterials trägt dazu bei, dass Lernende sich tatsächlich mit dem Inhalt auseinandersetzen. In allen drei Studien konnte gezeigt werden, dass Lehrvideos beliebt sind. Dabei zeigte sich, dass die Darstellung im Video besonders nachvollziehbar und unterhaltsam empfunden wird, wenn Interaktionen von beteiligten Protagonisten in einem realitätsnahen Kontext am Lehrmaterial direkt dargestellt werden. Bei interprofessionellen Themen ist dies insbesondere der Fall, wenn die im Video dargestellten Interaktionen interprofessioneller Natur sind.

Damit bieten interprofessionell gestaltete Lehrvideos eine vielversprechende Möglichkeit, den Schwierigkeiten bei der Umsetzung von fächerübergreifender interprofessioneller Lehre zu begegnen. Werden Lehrvideos über das Internet zur Verfügung gestellt, können sie professionsübergreifend eine große Reichweite haben und von Lernenden unabhängig von ihren Ausbildungscurricula genutzt werden. Dabei ist interprofessionelle Lehre nicht unumstritten und stößt besonders bei Medizinstudierenden auf Skepsis. In der zweiten Studie wurde daher untersucht, wie sich die Video-basierte Darstellung modellhafter interprofessioneller Zusammenarbeit auf die Einstellung von Medizinstudierenden zu interprofessioneller Lehre und

Zusammenarbeit auswirkt. Dabei wurde deutlich, dass die Betonung der Relevanz von interprofessioneller Zusammenarbeit dazu beitragen kann, Einstellungen von Medizinstudierenden gegenüber interprofessioneller Zusammenarbeit zu fördern. Außerdem kann durch anhand der direkten Darstellung die Bedeutung von interprofessioneller Zusammenarbeit bei bestimmten medizinischen Behandlungen hervorgehoben werden. Die Ergebnisse der dritten Studie zeigten, dass die Darstellung interprofessioneller Zusammenarbeit nicht nur bei Medizinstudierenden, sondern auch bei Auszubildenden der Physiotherapie zu einer Verbesserung ihrer Einstellung zu interprofessioneller Zusammenarbeit führten. Eine positive Einstellung zu interprofessioneller Zusammenarbeit kann als Prädiktor verstanden werden, dass ein solches Verhalten auch in späteren klinischen Praxissituationen gezeigt wird. Darüber hinaus unterstützte die Darstellung interprofessioneller Zusammenarbeit Lernende dabei, ein klareres Bewusstsein über die Rollen und Kompetenzen sowie eine bessere Einstellung zu den an der Behandlung beteiligten Berufsgruppen zu entwickeln.

Interessant bei der Gestaltung von Lehrmaterial ist natürlich immer, wie es sich auf den Wissenserwerb auswirkt. Wissenstests wurden in allen drei Studien eingesetzt. Es konnte in den sehr unterschiedlichen Szenarien gezeigt werden, dass die Betrachtung realitätsnaher interprofessioneller Kollaboration sich auf den Wissenserwerb auswirkte. In der ersten Studie hatten Probanden bessere Ergebnisse im Wissenstest, wenn sie die Kollaboration zweier Experten einer Profession direkt beobachteten, im Vergleich zur Darstellung ohne jegliche Kollaboration. In der zweiten Studie schnitten Probanden im Wissenstest besser ab, wenn sie eine interprofessionelle Kollaboration zweier verschiedener Professionen beobachteten, im Vergleich zur Betrachtung des Handelns von Experten nur einer Profession. Dass die Darstellung von interprofessioneller Kollaboration sich auf den Wissenserwerb auswirkt, legen diese Ergebnisse im Hinblick auf die Ergebnisse des dritten Experiments nahe: Dabei zeigte sich, dass Lernende zweier verschiedener Professionsgruppen von der realitätsnahen Darstellung interprofessioneller Kollaboration unterschiedlich hinsichtlich ihres Wissenserwerbs profitierten. Lernende konnten dabei insbesondere in dem ihnen jeweils unbekanntem Bereich ihr Wissen vertiefen. Dies ist vorteilhaft für die interprofessionelle Zusammenarbeit in der Praxis, da Lernende so schon während ihrer Ausbildung eine Vorstellung über das Handeln und Wissen ihrer interprofessionellen Kolleg*innen entwickeln können.

4.2. Limitationen

4.2.1. Wissenserwerb

Der Wissenserwerb lässt sich nur schwer messen, da Wissenstest kaum in der Lage sind zu unterscheiden, ob es sich um tief verarbeitetes Wissen handelt, das komplex verstanden wurde und somit über einen längeren Zeitraum verfügbar ist, oder ob es sich dabei um Informationen handelt, die während der Wissenstestung aus dem Kurzzeitgedächtnis abgerufen wurden. Um dieser Problematik zu begegnen wurde bei der Gestaltung der Wissensfragen darauf geachtet, dass diese nicht nur dem *Remembering-Level*, sondern auch dem *Understanding-* und *Apply-Level* nach *Blooms Taxonomie* (Bloom, 1965) entsprachen und somit eine gewissen Transferleistung voraussetzten. Einschränkend ist zu bemerken, dass sich aus den durchgeführten Studien nur eingeschränkt Aussagen über das Potential der verwendeten Videos für die Vermittlung von Wissensinhalten ableiten lassen. Insbesondere bei den ersten beiden Studien ist problematisch, dass der Wissenstest nur nach der Intervention durchgeführt wurde und die Testergebnisse somit nur als Gruppenvergleich zwischen den Variationen der Intervention vorliegen. Ob die Probanden die abgefragten Wissensinhalte durch die Videos vermittelt bekamen und der Unterschied zwischen den Gruppen durch die Manipulation des verwendeten Videomaterials zu erklären ist, kann mit diesem Design nicht abschließend geklärt werden. Da die Stichproben randomisiert jeweils aus den gleichen Grundgesamtheiten gezogen wurden und sich hinsichtlich Alter, Geschlecht und Ausbildungsstand nicht unterschieden, sollten Unterschiede in der Leistung im Wissenstest jedoch nicht auf demographische Variablen zurückzuführen sein. Es ist weiterhin anzunehmen, dass sich die Probanden der verschiedenen Bedingungen hinsichtlich ihres Vorwissens nicht unterschieden haben, da alle Probanden Medizinstudierende in einem vergleichbaren Ausbildungsabschnitt waren. In zukünftigen Studien sollte dies allerdings kontrolliert werden.

4.2.2. Onlinestudien

Zwei der Experimente wurden online durchgeführt, weshalb manche Einflussfaktoren nicht auszuschließen sind und eine standardisierte Durchführung nicht zwingend gewährleistet werden kann. Bei der Gestaltung des Studienmaterials wurde jedoch eine große Aufmerksamkeit auf eine klare und eindeutige Instruktion

gelegt und die Einhaltung mittels Kontrollfragen überprüft. Allerdings sind Online-Studien in dem Kontext sehr passend, da die Nutzung von freiwilligem ergänzendem Lehrmaterial untersucht wurde, das online zur Verfügung steht. Daher ist das Onlineformat bei Studien, die sich mit der Digitalisierung beschäftigen, als extern valide einzuschätzen.

4.2.3. Stichproben

Die Teilnehmer der Online-Experimente wurden über die Datenbank der Tübinger Sectio-Chirurgica rekrutiert, wobei es sich zum größten Teil um Medizinstudierende der Universität Tübingen handelte. Da das Eintragen in die Datenbank der TSC ebenso wie auch die Studienteilnahme freiwillig war, ist anzunehmen, dass die Studienteilnehmer überdurchschnittlich motiviert waren. Dementsprechend lassen sich die Ergebnisse nur eingeschränkt auf die Gesamtheit der Lernenden im Gesundheitswesen generalisieren. Für die Gruppe der Lernenden, die sich jedoch selbstmotiviert zusätzliches video-gestütztes Lehrmaterial im Internet suchen, kann die Stichprobe jedoch als repräsentativ angesehen werden. Um eine möglichst große Aussagekraft zu erreichen, wurden die in den Studien verwendeten Szenarien an den Ausbildungsinhalten im Medizinstudium und der Physiotherapeutenausbildung angelehnt.

4.2.4. Darstellung interprofessioneller Zusammenarbeit

Es wurde keine Messung von interprofessionellem Verhalten in klinischen Praxissituationen vorgenommen, sodass keine Aussagen über die Wirksamkeit interprofessioneller Videos für eine interprofessionelle Praxis getroffen werden können. Für ein besseres Verständnis von diesem Zusammenhang könnten interprofessionelle Kommunikationsprozesse zwischen Lernenden, beispielsweise anhand quantitativer und qualitativer Daten (z. B. durch die Analyse von Chats oder kollaborativen Übungen) untersucht werden. Weiterhin wäre es für zukünftige Studien interessant zu untersuchen, ob ein Betrachten realer interprofessioneller Kollaboration zusätzliche Vor- oder Nachteile gegenüber der Beobachtung von der in den Studien verwendeten realitätsnahen interprofessionellen Darstellungen bietet. Bei dem in den Studien verwendeten Videomaterial wurde eine optimale interprofessionelle Kollaboration ohne Konflikte und Missverständnisse gezeigt. Dies ist nicht unbedingt realistisch für den klinischen Alltag, bei dem durchaus Konflikte auftreten. Eine

erfolgreiche realistische interprofessionelle Teamarbeit zeichnet sich dadurch aus, dass die interprofessionellen Teams auch in der Lage sind, auftretende Probleme lösen zu können, was ihr interprofessionelles Verhalten weiter festigt (Paletz et al., 2011, 2013).

4.3. Implikationen für die Praxis

Videos bieten ein großes Potential für die fächerübergreifende Ausbildung von Lernenden im Gesundheitswesen. Insbesondere eignet sich dazu Videomaterial, das anatomische Informationen vermittelt, da praktisch alle Lernenden in diesem Bereich anatomische Grundkenntnisse erwerben müssen.

Die realitätsnahe Darstellung anatomischen Wissens in einem klinischen Setting ermöglicht es Lernenden, die dargestellten Handlungen verständlich und nachvollziehbar wahrzunehmen. Zudem trägt eine ansprechende Gestaltung des Lehrmaterials dazu bei, Lernenden den Wissenserwerb zu erleichtern. Die Darstellung von interprofessioneller Zusammenarbeit wird dabei als unterhaltsam erlebt und hilft Lernenden, insbesondere Wissen aus anderen beteiligten Professionsbereichen zu erwerben. Die interprofessionelle Gestaltung von Lehrvideos trägt dazu bei, dass Lernende die Notwendigkeit interprofessionellen Handelns verstehen und positive Einstellungen zu einer Zusammenarbeit mit anderen Professionen entwickeln.

Interprofessionell und realitätsnah gestaltete Anatomie-Lehrvideos stellen somit eine einfach umzusetzende Möglichkeit dar, interprofessionelles Verhalten bereits in einer frühen Ausbildungsphase fächerübergreifend zu fördern. Mit der Sectio Chirurgica existiert bereits ein vielversprechendes Angebot, das diese Implikationen umsetzt und somit zu einer interprofessionellen, leistungsfähigen Gesundheitsversorgung beitragen kann.

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6. Anhang: Akzeptierte Publikationen

Publikation 1

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Publikation 2

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Publikation 3

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Publikation 4

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Eigenanteil an den Publikationen

Die Anteile des Doktoranden und aller Co-Autoren an den Veröffentlichungen, die Teil dieser kumulativen Dissertation sind, können den folgenden Tabellen entnommen werden:

| Titel der Veröffentlichung: | | A Literature Review on the Foundations and Potentials of Digital Teaching Scenarios for Interprofessional Health Care Education | | | |
|-----------------------------|------------------|--|---------------------|----------------|---------------------------------|
| Autor | Autoren Position | Idee und Konzeption | Literatur-recherche | Interpretation | Verfassung der Veröffentlichung |
| Johannes Großer | 1 | 70% | 80% | 70% | 50% |
| Martina Bientzle | 2 | 15% | 10% | 10% | 10% |
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|-----------------------------|------------------|--|---------------|----------------------------------|---------------------------------|
| Autor | Autoren Position | Idee und Konzeption | Datenerhebung | Datenauswertung & Interpretation | Verfassung der Veröffentlichung |
| Johannes Großer | 1 | 40% | 60% | 70% | 60% |
| Martina Bientzle | 2 | 30% | 20% | 20% | 30% |
| Thomas Shiozawa | 3 | 5% | 10% | 0% | 0% |
| Bernhard Hirt | 4 | 5% | 10% | 0% | 0% |
| Joachim Kimmerle | 5 | 20% | 0% | 10% | 10% |
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| Johannes Großer | 1 | 50% | 60% | 70% | 70% |
| Joachim Kimmerle | 2 | 20% | 0% | 10% | 20% |
| Thomas Shiozawa | 3 | 5% | 10% | 0% | 0% |
| Bernhard Hirt | 4 | 5% | 10% | 0% | 0% |
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| Martina Bientzle | 1* | 50% | 35% | 30% | 40% |
| Thomas Shiozawa | 2 | 20% | 20% | 0% | 0% |
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Review

A Literature Review on the Foundations and Potentials of Digital Teaching Scenarios for Interprofessional Health Care Education

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Abstract: The health care system is increasingly complex and specialized, but it presents the actors involved with the challenge of working together in interprofessional teams. One way to meet this challenge is through interprofessional training approaches, where representatives of different professions learn together with learners of other professions. This article contributes to the question of how interprofessional teaching in health care education can be designed with a low threshold by using digital media. We focus on learning with digital learning platforms and learning with videos. Based on existing empirical findings, these approaches are discussed in terms of their potential and limitations for interprofessional teaching. In particular, we examine how these approaches influence the core competence domains of interprofessional collaborative practice. Digital collaborative learning platforms are suitable for teaching interprofessional competences, since they enable social and professional exchange among learners of different professions. Videos are suitable for imparting medical declarative and procedural knowledge. Based on these considerations, the use of videos in combination with interaction possibilities is presented as a didactic approach that can combine the aspect of knowledge transfer with the possibility of interprofessional computer-based collaboration.

Keywords: Medical education; interprofessional collaboration; health care; digital learning platforms; videos

1. Introduction

The demand to implement interprofessional training concepts in medical education has been repeatedly raised by various actors [1–3]. Successfully meeting this demand requires well-considered and scientifically sound didactic concepts in addition to the establishment of appropriate structures. With the present article we want to contribute to the question of how interprofessional teaching in medical education can be shaped by the appropriate use of digital media. First, we present current challenges in the implementation of interprofessional training concepts. We then describe selected theoretical considerations and empirical findings that are of central importance for digital interprofessional training concepts. In the course of this presentation, we explain and evaluate these didactic approaches with the aim of developing concepts that can prepare future doctors and trainees in health care professions for efficient and smooth interprofessional collaboration in their everyday work.

2. Current Challenges

2.1. Specialization and Interprofessional Collaboration

The environment in which students of medicine and other health professions work is becoming increasingly challenging [4,5]. Medical and technical progress is constantly expanding the repertoire of diagnostic procedures, interventions, and therapeutic approaches, which has led to the health care system becoming ever more specialized and differentiated. As a result, it has become more efficient and offers patients better medical care. At the same time, these developments have led to an increased complexity of the health care system [6]. In addition to doctors, numerous other specialized professions with different professional backgrounds are active in the health care system [7,8]. In the clinical areas, representatives of a wide range of health care professions are active, who support the medical staff in their treatment. These include nurses, physiotherapists, speech therapists, and many others. Even though interprofessional collaboration in medicine has always been necessary for good patient care, the increasing complexity of the health care system makes the establishment of coordinated collaboration and communication among the various specialists more relevant today than ever.

Members of different health care professions may hold different views, perspectives, and attitudes [9–11]. In general, people tend to form groups based on social categories, such as gender, ethnicity, or, in the present case, professional identity [12]. This has an impact on their self-concepts and sense of belonging to certain groups, which can lead to some kind of “tribalism” and, as a consequence, to failures in communication [13]. All health care professions aim for effective patient care, but tribalism and persisting professional stereotypes [14,15] may impair successful teamwork [16,17]. Everyday clinical practice shows that difficulties often arise in interprofessional communication and collaboration [3].

2.2. Interprofessional Education

Medical students are facing growing challenges due to these changes in the health care system. While the professional demands of medical education have remained consistently high, the ability to work in a team and to work together with other professions are becoming increasingly important [3]. A key to successfully meeting these challenges is offered by interprofessional training approaches, such as those already prevalent in the Scandinavian- [18,19] and English-speaking countries [20,21]. In other countries, like Germany, there is also a call for more interprofessional training approaches to be implemented in medical education, and for human and dental medicine courses to be networked with courses in nursing, therapy, and midwifery [22,23]. Students may enter their academic studies with negative stereotypes of other health care professions, which may influence their future work behavior [24] and which is also reinforced by educators [25]. Thus, it is important to implement positive interprofessional experiences and scenarios in the curriculum in order to prevent tribalism among health care students [26]. An early integration of interprofessional learning sessions are therefore helpful to reduce professional stereotypes among health care students [27]. Interprofessional education should be implemented through teaching situations in which learners from at least two health care professions actively learn together. In interprofessional courses, learners should be given the opportunity to acquire and develop not only specialist knowledge, but also social skills and beliefs that are conducive to well-coordinated interprofessional collaboration. To this end, a panel of experts from the Interprofessional Education Collaborative has proposed a framework model, whereby four core competence domains are to be counted among interprofessional collaborative practice [28]:

- (1) Values and ethics. Values and ethics are part of the professional identity of both practitioners and learners. Older approaches to professional identity have been criticized for being selfish and thus tending to create barriers between professions, which is seen as an obstacle to improving health care [29]. Therefore, new patient-oriented and society-centered values are proposed, based on the common goal of improving health care overall. The associated professional ethics thus reflect the shared commitment of different professions to creating safer, more efficient and effective health

care systems. This is accompanied by a consistent demonstration of mutual trust and respect in the communication among various professionals [30], whose establishment we already consider to be particularly important for training health care professionals.

- (2) Awareness of profession-specific roles, competences, and responsibilities. The roles and responsibilities of the individual professions are defined by legal requirements, but this can vary depending on the specific care situation. Therefore, a concrete understanding of the boundaries of expertise between the professions and knowledge of competences of the professions is crucial and should be practiced and refined in continuous interprofessional education as well as in practice [31,32].
- (3) Ability for interprofessional communication. A study by Suter et al. identified the ability of interprofessional communication as a core aspect of interprofessional collaboration [33]. This often faces the challenge that different professions often use different terms, thus preventing effective interprofessional care. In order to guarantee this care, the aim of interprofessional education should be to establish a common interprofessional language, which is trained through appropriate training and practice opportunities.
- (4) Ability for interprofessional teamwork. Wherever members of different health care professions work together to achieve common goals for the care of patients, they must demonstrate teamwork skills. Accordingly, they must learn to bring their own expertise into a complex system that achieves better results through individual contributions. Focusing on patient care and dealing openly and constructively with conflicts within the team through effective interprofessional communication and joint problem solving strengthens the ability to work together and form a more effective team.

Even though interprofessional training approaches have a great potential for the acquisition of relevant competences of interprofessional collaboration, their implementation in practice is very costly and often fails because the necessary structures have not yet been established across the board. In addition, most health-related training and study courses already have a high time load, which makes it extremely difficult to implement further content in studies and training [34,35]. This results in the challenge of integrating interprofessional teaching concepts into existing curricula across training and institution boundaries.

It must be critically noted that all the demands to strengthen interprofessional teaching are only supported by mixed empirical evidence. For example, the introduction of interprofessional learning methods has led to better treatment results and greater patient satisfaction in several meta studies [36,37]. However, a Cochrane Review of nine studies reports that there is no or at best only a very weak correlation between better interprofessional competence and better clinical results [38]. It is therefore questionable whether a far-reaching investment, such as the creation of cross-organizational training units for the implementation of interactive interprofessional learning scenarios in medical education, will actually lead to better interprofessional communication and collaboration in clinical practice in the long term. One possibility would initially be to integrate interprofessional teaching in medical education with less investment-intensive and low-threshold offerings. To promote interprofessional teaching, digitalization offers a number of possibilities, which are presented in the following section.

3. Didactical Approaches

3.1. Digital Interprofessional Teaching: The Application of Learning Platforms

A potentially effective strategy to overcome the challenges mentioned in the previous section and to address the four core competence dimensions described by the Interprofessional Education Collaborative is the implementation of digital teaching concepts. These concepts use digital, online-based resources to structure and deliver learning content and provide learners with networking and interactive exchange opportunities. [39]. A corresponding possibility is offered by digital platforms, as they are known from the context of social media on the Internet [40–43]. These enable users to access digital media, exchange

and share information, and discuss profession-specific approaches, independent of time and location. The use of social media platforms is very common among students [44], and these platforms are often also used for educational purposes [45]. This also applies to medical educational contexts [46], where social platforms are a widely used tool for professionalization [47]. Social media platforms could enable future doctors to develop an awareness of the responsibilities and limitations of their own and other professions, and provide an easy way to apply interprofessional learning into medical education [48]. Nevertheless, these social media platforms are rarely used for such interprofessional applications [44,49].

Therefore, learning management systems were explicitly designed to support such university teaching scenarios. Various forms of online learning have been shown to be effective for the transfer of knowledge and the development of interprofessional competences. They enable learners to gather their own knowledge and exchange opinions and experiences regardless of place, time, educational progress, or profession [50]. Learning platforms that involve users more actively are also increasingly popular [51,52].

The analysis of the learning behavior of a large sample of medical students on the digital learning platform Amboss has shown that active engagement with the learning material is also key to knowledge acquisition on digital platforms, such that learners acquired more knowledge when they actively supplemented their learning material with additional information [53]. For interprofessional education, opportunities for the social integration of learners are in the foreground, such as commenting and chat functions, microblogging, forums, and surveys [54–56]. An example of low-threshold chat-based learning platforms are electronic communities of practice, in which different medical professions can exchange information via a web-based chat [57]. These self-organized, voluntary associations of different health care providers work in a problem-focused manner and are suitable for different professions to exchange information at eye level. Although such unmoderated exchange platforms often do not show any significant increase in knowledge, they encourage learners to critically reflect on their own level of knowledge [58].

These findings suggest that the design of effective digital learning platforms should be theory-based. Hean, Craddock, and O'Halloran give an overview of the different learning theories from behaviorism to constructivism that can be used to describe online-based processes of interprofessional learning [59]. The approach of Hughes et al. should be emphasized here, who, with reference to the concept of enquiry-based learning, present the ways in which online environments can be conducive to inter-professional medical education [60]. Enquiry-based learning is the term used to describe learning processes that contribute to the discovery of new causal relationships through active, self-directed action by the learner [61]. Central to this is the active participation and exchange among learners and the responsibility of learners for their own learning progress [62,63]. Accordingly, it is assumed that learning takes place as an iterative process in which deeper levels of understanding are gradually reached. As a result, in heterogeneous groups typical of interprofessional training, those with more prior knowledge progress faster in learning and communicate their findings better. This shared knowledge content can then serve as orientation and impetus for the knowledge construction process of learners with less prior knowledge. [60]. Thus, asynchronous online platforms focus on the learners themselves, and allow them to determine the speed of their learning processes themselves.

Although asynchronous digital learning platforms in particular are well suited for conveying knowledge content, they quickly reach their limits when it comes to conveying social forms of interaction or values that need to be negotiated in an interactive process among learners, and are therefore less suitable for conveying interprofessional collaboration [64,65]. Accordingly, digital learning formats that are designed for interprofessional purposes should encourage interaction in the learning group [66]. One way to do this is to use synchronous digital formats (see Figure 1 for an overview). An advantage of these teaching formats is that they can also be used informally, and thus stimulate social exchange [45,67]. This can contribute to the development of interprofessional competences and to the development of a positive attitude toward other professions.

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| <p>Synchronous learning platforms. Learning takes place simultaneously. Platforms enable an interactive exchange among the learners. They are especially useful for similar levels of knowledge.</p> <p>Advantages:</p> <ul style="list-style-type: none"> - Promotes active exchange and discussion - Knowledge can be negotiated among learners - Questions can be addressed directly <p>Disadvantages:</p> <ul style="list-style-type: none"> - High organizational and technological demands - Inflexible in terms of time - Learners have little individual influence on the learning process - Limited opportunities to work on acquired knowledge <p>Examples: Chats, digital live events</p> | <p>Asynchronous learning platforms. Platforms make learning content available independent of time and location. They are particularly suitable for different levels of prior knowledge.</p> <p>Advantages:</p> <ul style="list-style-type: none"> - Learners determine their own learning speed - Contents can be repeated as often as required - The knowledge content is in the foreground <p>Disadvantages:</p> <ul style="list-style-type: none"> - Direct social exchange hardly possible - Complex social issues cannot be negotiated <p>Examples: Forums, educational videos.</p> |
|--|--|

Figure 1. Advantages and disadvantages of synchronous and asynchronous digital teaching aids.

In sum, digital learning platforms are able to address the four core competence domains of interprofessional collaboration. Regarding the development of values and ethics it is important to note that the active interaction on digital learning platforms enables students to share their views and treatment suggestions from their own point of view. Using a digital learning platform allows students to reflect upon their treatment ideas and integrate other people's ideas in order to provide coordinated health care [68]. Using asynchronous platforms allows learners to spend more time integrating different views, while synchronous platforms allow learners a more direct and vivid discussion [69], which helps to establish mutual trust among various professions [30]. Digital learning platforms can also help learners to raise awareness of profession-specific roles, competencies, and responsibilities by providing reflective questions. Digital learning platforms with students' active participation can help them to learn about the roles of others and reflect their own role [70]. Learning platforms may strengthen learners' ability for interprofessional communication. Supportive environments help learners to build trust and encourage active participation and discourse [71]. Synchronous digital learning platforms are particularly suitable for that purpose, as they allow for clarifying misunderstandings immediately. Inconsistencies, in terminology for example, can also directly be addressed by moderators, which would support the establishment of a shared language [72]. Learners' ability for interprofessional teamwork could be strengthened by the opportunity to cooperate in planning, conceptualization, and coordination of treatments. As a counter model to many hierarchical structures in health care organizations [73], digital learning platforms can be used to establish teamwork of learners on eye-level. This can reduce stereotypes and strengthen the ability to work together and form more effective teams [74]. For synchronous digital formats, there is a danger that the reception of relevant knowledge will be neglected due to lively social exchange. Therefore, they should be complemented with tools

and materials that are more suitable for the teaching of specialist knowledge. An appealing and entertaining way of doing this is the use of videos.

3.2. Digital Interprofessional Teaching: The Application of Videos

Videos are already widely used in medical education and are very popular with learners, especially because they have established themselves as efficient and clear teaching aids [75]. Numerous studies have shown that watching videos is particularly suitable for acquiring procedural knowledge and, for example, leads to better surgical skills of learners compared to learning in traditional textbook settings [76–79].

Positive effects on knowledge acquisition from multimedia resources such as videos can be explained by the Cognitive Theory of Multimedia Learning [80]. A basic assumption of the theory is that learners process visual and auditory information separately and that learning can be enhanced by presenting on both channels simultaneously. Since working memory capacity is limited [81,82], the ability to pause and jump forward and backward in videos can help to regulate working memory requirements and thus the learning process [83]. With regard to the acquisition of interprofessional competences, the basic assumptions of Bandura's social-cognitive learning theory are of particular interest, according to which the learning of new behavior is possible by observing a model and anticipating their behavior [84,85]. Thus, through observation, while observing experts performing a complex task, learners can construct an adequate cognitive representation of that action, mentally imitate that action accordingly, and thereby refine their original mental representation. The observation of successful interprofessional collaboration should therefore have an influence on both the acquisition of procedural knowledge and the attitude toward interprofessional work. These assumptions could be confirmed in a study in which learners from two different professions watched the same video on interprofessional care of a shoulder trauma [86]. This improved the attitudes of physiotherapy students as well as medical students toward interprofessional learning (measured with the learning subscale of the University of the West of England Interprofessional Questionnaire [87,88]) and developed a better knowledge of the competences of the other profession.

Videos also offer some advantages in terms of conveying knowledge content. They are particularly suitable for the teaching of procedural knowledge, since the time reference allows dynamic actions to be better represented, and thus better understood by learners. Video-based formats therefore clearly stand out from classical text-based teaching [89,90]. This is an advantage in interprofessional teaching settings, where the coordinated action of various protagonists plays a key role. However, as learners often have different levels of prior knowledge, there is a risk that they may quickly be under- or overchallenged when watching videos. Underchallenge tends to lead to passive viewing and is accompanied by the fact that the content conveyed is not elaborated more deeply and thus does not lead to further knowledge acquisition. This is particularly problematic with regard to illusions of knowledge, which can arise in particular with learning videos [91]. On the other hand, overchallenge due to a lack of prior knowledge when watching videos quickly leads to a loss of motivation to deal with the content. One way to reduce this strain is to use navigation options in the video, such as pausing or fast forward and rewinding, to promote individual knowledge acquisition [83].

Another way of supporting knowledge acquisition is the structured description of individual steps in complex problem-solving processes by experts (e.g., during a medical examination and diagnosis); when using worked examples, learners can focus better on the problem and the necessary solution steps than without this support (see also worked-examples effect [92,93]). The video used in the study described above showed the step-by-step approach of different professions in the interprofessional treatment of shoulder trauma [86]. The knowledge acquisition of the different professions while watching the video was also examined. It was shown that the different professions received content differently. Students of physiotherapy acquired knowledge relevant to medicine, which was presented in the video. For example, after watching the video they were able to understand the concrete anatomical course of various muscle strands in the shoulder better than before. Medical students,

on the other hand, showed an increase in knowledge of physiotherapeutic topics, for example how to proceed in the physiotherapeutic follow-up treatment of shoulder trauma.

Taken together, the presentation of videos is also an option for addressing the four core competence domains of interprofessional collaboration. Interprofessional videos can be used for the development of values and ethics. Observational learning is particularly suitable for the acquisition of social behavior [85]. A video of a discussion on how an optimal treatment should be done could address different professional ethics and values. Students are more prone to adopt values when they follow a discussion where values are negotiated enthusiastically [94]. Instructional videos also offer the opportunity to raise awareness of profession-specific roles, competencies, and responsibilities. Videos can point out typical challenges of responsibilities and boundaries. Role problems are well known in interprofessional collaboration [14], and learners tend to overidentify with their own profession [95]. These issues can be explicitly addressed through role models that show appropriate interprofessional behavior, in particular when an optimal interprofessional collaboration is presented [96]. To improve the ability for interprofessional communication, videos can be used to present an ideal conversation among interprofessional role models. Common misunderstandings can be addressed directly by the role models in a video, which may support the establishment of a shared interprofessional language. Finally, videos may strengthen learners' ability for interprofessional teamwork. For this purpose, videos need to be well scripted and include all professions that are relevant for a given medical case.

4. Conclusions

As explained above, social platforms and the use of videos offer great potential for interprofessional teaching in terms of supporting the four core competence dimensions. However, these approaches also have weaknesses that can be mutually compensated for. Accordingly, it is obvious to combine interprofessional videos with online-based interaction possibilities. This gives learners the opportunity to actively participate and exchange information with each other. A prerequisite for the active involvement of learners in digital interprofessional education are synchronous learning platforms where videos are streamed live at a specified time [97].

Through the use of audience response systems, learners can be given the opportunity to respond immediately to the questions asked in a live streamed video, which is perceived by learners as entertaining [98] and educational [99]. This may have a positive impact on the learning experience [98,100,101]. If the questions in the video are asked by representatives of different professions, active engagement with the questions of other professions can increase awareness of one's own professional role, competences, and abilities. It can also improve awareness of one's own limitations and the competence areas of the other professions [102,103]. A further advantage of a live broadcast is the possibility of a synchronous exchange among the learners about the content they have seen, for which chat tools can be used. According to contact theory [104], direct informal contact among learners offers the potential to learn from each other and to reduce existing negative stereotypes about other professions, resulting in a more positive image and appreciation of other professions [105,106]. This is particularly relevant for training in health-related professions, as the field is certainly prone to tribalism and traditional professional stereotypes that prevent an optimal treatment [14,15]. Different professions involved in patient care sometimes pursue different therapeutic approaches [107]. An appreciation of other professions can contribute to greater interprofessional tolerance that help to establish shared values that ultimately lead to more diverse approaches to solutions [108].

Promising approaches already exist, such as the interactive live format of the Sectio chirurgica platform (www.sectio-chirurgica.de). This is an online service that can be used by various medical professions. Depending on the respective clinical case, the interprofessional collaboration among various professions relevant to the case is presented in addition to anatomical content. Thus, learners have the opportunity to observe professional role models that discuss their opinions and treatment options in order to provide a shared best treatment idea. Learners can also observe how professionals

deal with the challenges of differing terminology. Via a chat function, learners can actively contribute questions and comments to the event and exchange information with each other [109–111]. Originally, the platform was designed primarily for medical students, but students and trainees from various health care professions also use this course offer. Research on this format with a group of medical students showed that they had a higher increase in clinical knowledge when they watched a video showing interprofessional collaboration compared to students who received the same content from a representative of only one profession [111]. This platform serves as an optional supplementary instructional offer for health care students. Although students' curriculum is quite dense, this offer is widely used, and it has been shown to improve their course performance [110]. In another study on interprofessional disaster management, the use of videos showing interprofessional collaboration contributed to a better understanding of the roles of learners from different professions [112].

Synchronous video-based teaching formats are disadvantageous with regard to the large organizational, technical, and financial effort involved, especially in direct comparison to classical text-based teaching material (Table 1). In particular, the creation of surgical or anatomical video material is associated with high costs. Only when the material is used repeatedly does a cost advantage arise in comparison to classical teaching. In order to enable an adequate interprofessional exchange, it must be guaranteed that a sufficient number of representatives of different professions view the educational material at the same time and exchange information about it, which requires a high level of organizational effort in preparation. Since synchronous chat activities are often used to discuss informal content among learners, knowledge transfer can suffer, which is why chat moderation is considered useful [113]. Also, frequently offered navigation options, such as fast forward, rewind, and pause for videos, have to be reconsidered when using a video on a synchronous learning platform, as they can make it difficult for learners to synchronously exchange interprofessional information about the contents of the video. However, not offering these navigation options is a challenge for individual learning. Nevertheless, we consider such synchronous video-based teaching formats to be extremely useful, especially in terms of promoting interprofessional understanding and collaboration among learners.

Table 1. Comparison of synchronous and asynchronous text- and video-based teaching formats.

| Assessment Criteria | | Social Interaction | Individual Knowledge Acquisition | Entertainment | Vividness of the Material | Organizational Effort | Flexibility | Costs |
|---------------------|--------------|--------------------|----------------------------------|---------------|---------------------------|-----------------------|-------------|-------|
| Text-based | Asynchronous | – | + | ~ | – | – | + | – |
| | Synchronous | + | – | ~ | – | – | – | ~ |
| Video-based | Asynchronous | – | + | + | + | + | + | ~ |
| | Synchronous | + | – | + | + | + | – | + |

+ high|~ medium|– low.

5. Outlook

Further research and theory-based developments are needed to explore the potential and limitations of digital media for the acquisition of skills relevant for interprofessional collaboration in the health sector. To this end, didactic teaching scenarios should be developed that combine established digital media (such as videos) suitable for knowledge transfer with digital synchronous tools that enable exchange among learners (e.g., via chat) or the joint processing of a task (e.g., via wikis, quizzes). Adequate formats would be synchronous, case-based webinars in which experts from different professions interact with each other using video-supported worked examples and for which tasks are set that learners from different professions must actively deal with. An example of such an interprofessional task would be the creation of a care plan that integrates all professions involved in the case. Promising approaches are currently being developed in which chats are offered synchronously with live videos and moderated in an interprofessional way. However, it should be noted that the possibilities for digitalization presented here make only small contributions to meeting the demand

to implement interprofessional training approaches more firmly in medical education. Accordingly, they should rather be understood as a supplement to be used in combination with real interprofessional education. It is important to design such open learning formats in such a way that they can support interprofessional learning and interprofessional collaboration not only during medical education but also in later professional life in a clinical context.

The extent to which the technologies described and assessed here are actually capable of addressing the time and cost problems mentioned above remains to be critically examined. It is quite clear that the solution cannot be to simply add these digital approaches to the existing curriculum. This would only increase the time pressure for health care students. Teachers and curriculum designers must therefore ask themselves first and foremost how these offers can be integrated into the course of study in such a way that the problem is not made worse. This includes the possibility of adding interprofessional aspects to existing content or replacing current content with interprofessional topics. In this review, we have explained in detail under which circumstances this can be particularly successful and which technologies are suitable for which didactic goals. In this way, practitioners are given a guide on how they can integrate interprofessional approaches into medical training in a cost-effective way without overburdening their students.

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Acquiring Clinical Knowledge from an Online Video Platform: A Randomized Controlled Experiment on the Relevance of Integrating Anatomical Information and Clinical Practice

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Basic subjects in medical education, such as anatomy, are often taught through teaching formats that do not always sufficiently demonstrate the relevance of this basic information for clinical practice. Accordingly, it is a recent trend in anatomy education to link anatomical information more explicitly to clinical practice. This article presents an online video platform (Tuebingen's *Sectio Chirurgica* [TSC]) as one means of explicitly integrating pre-clinical anatomical knowledge and clinical application. The purpose of the study presented here was to examine the effects of videos through which medical students were educated about Anterior Cruciate Ligament reconstruction. A TSC video about this surgical procedure was compared to a video with a traditional lecture providing the identical information. Participants ($n = 114$) perceived the TSC video to be superior in comprehensibility of the presentation ($P = 0.003$) and conceivability of the surgical procedure ($P = 0.027$), and to be more entertaining ($P < 0.001$). Moreover, participants in the TSC condition acquired more clinical knowledge than in the lecture condition ($P = 0.043$) but did not differ in their acquisition of anatomical knowledge. Mediation analyses indicated that the effect on the acquisition of clinical knowledge was mediated by comprehensibility, conceivability, and entertainment. These findings are discussed regarding their implications for medical education in terms of contributing to the general trend of linking preclinical anatomical knowledge to clinical application. A discussion about the limitations of the study and suggestions for future research are also provided. *Anat Sci Educ* 12: 478–484. © 2018 American Association of Anatomists.

Key words: gross anatomy education; anatomical knowledge; clinical knowledge; prosection; video; randomized controlled study

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INTRODUCTION

Acquiring anatomical knowledge is an essential part of medical education. Studying the basics, such as medical terminology for anatomical structures, is very important, and anatomical knowledge is key to successful clinical outcomes (Dahle et al., 2002; Woods, 2007; Smith and Mathias, 2010; Bergman et al., 2011; Malik and Malik, 2011). So, being able to transfer anatomical knowledge into clinical settings is imperative for medical students (Evans and Watt, 2005; Waterston and Stewart, 2005; Singh et al., 2015). Human anatomy is usually taught quite early in medical studies, on the pedagogical principle that students should be provided with basic information before they deal with issues of application. This is the case in particular in Germany, where medical education must abide by the Federal Medical Licensure Act (ÄappO, 2002), which

specifies that medical education be split into two parts: a pre-clinical and a clinical phase. Both phases are completed with a State examination. Traditionally, anatomy in Germany is taught to all medical students during the preclinical phase in order to provide a foundation for further clinical subjects that are taught after passing the first state examination at the end of the second year. Anatomy courses usually consist of lectures and dissection courses in which students perform dissections under the supervision of peer tutors (see Alvarez et al., 2017). The German tradition of teaching through gross anatomy dissection courses is considered to be a very powerful approach that is important for the development of professional competencies (Böckers et al., 2010). At the same time, anatomy is rarely taught with a clinical perspective (Rafai et al., 2016), even though it has been recently postulated that anatomy educators should also consider “the applicability, transportability, and relevance” of anatomical information for clinical practice (Pawlina and Drake, 2017). As a consequence, studies show that students’ abilities to apply knowledge from the lecture hall to real clinical situations is rather low (Norman, 2009). Students often fail to make connections between their anatomical knowledge and clinical application (Fitzgerald et al., 2008; Ahmed et al., 2010; Lazarus et al., 2012; Böckers et al., 2014). These findings suggest that providing an explicit link between anatomical information and clinical practice would be desirable at an early stage in medical education. In the last several years it has become a general trend in many courses to aim at bridging this gap (Drake, 2007; Wilson and Nava, 2010).

Common approaches to teaching anatomical information involve lectures, books, prosection courses, and many other teaching practices (Turney, 2007; Böckers et al., 2010, 2014). In addition, videos have become a popular tool for anatomical sciences education, in particular recordings of lectures in an auditorium (Nieder and Nagy, 2002; Nieder and Borges, 2012). It has already been shown that videos can be a useful format for learning (Romanov and Nevgi, 2007; Shiozawa et al., 2017). Students may benefit especially from watching videos repeatedly, resulting in better performance (Nieder and Borges, 2012; Autry et al., 2013; Topping, 2014; Choi-Lundberg et al., 2016; Phillips et al., 2016; Alameddine et al., 2018). However, these findings are largely based on a range of quasi-experimental results that are not always consistent. There is also evidence that dissection videos do not improve medical learning *per se* (Mahmud et al., 2011), even though they still lead to higher levels of satisfaction with the learning format (DiLullo et al., 2006). In general, video learning is liked by students and enhances their learning satisfaction and attitude toward the learning material (Autry et al., 2013; Chen and Wu, 2015; Choi-Lundberg et al., 2016; Alameddine et al., 2018). The provision of anatomical videos alone does not improve students’ learning outcomes, as it represents a passive learning mode, suggesting that students using video learning formats need to be involved in active learning processes (Langfield et al., 2018). So far, however, there has been little research about how videos should be designed to link anatomical knowledge to clinical practice (Swinnerton et al., 2017; Yeung et al., 2017).

A video-based anatomical education format that explicitly aims to connect anatomical information with clinical practice is offered by the Department of Anatomy at the University of Tuebingen, Germany, Tuebingen’s *Sectio Chirurgica* (TSC; Hirt et al., 2010; Shiozawa et al., 2017). The TSC was inspired by the classical approach of offering prosection courses to present and study the human body for anatomical sciences education. The TSC aims to link anatomical knowledge with surgery as

one typical example of clinical practice. Each TSC episode is based on a patient case and shows an operation being performed by experienced surgeons. An anatomist presents and chairs each session, discusses the case, and provides basic anatomical background information. In this way, several medical perspectives, including radiological, anatomical, pathological, and surgical perspectives, are highlighted. In particular, anatomical and clinical perspectives are combined by showing not only anatomical structures but also surgical procedures based on information about these structures (Shiozawa et al., 2017). The TSC is not a compulsory course in medical studies, but is freely available to all medical students and health professionals who are interested in deepening their knowledge about anatomy and clinical practice. The TSC was designed explicitly to bridge the gap between anatomical information and its clinical application.

It has already been shown that medical students who used the TSC in addition to traditional lectures and the dissection curriculum benefitted from watching the TSC, in particular with respect to the clinical application of knowledge (Shiozawa et al., 2017). Though it shows a promising result, this previous study only compared students who watched the TSC as an addition to the traditional curriculum to a control group of students who did not. Moreover, the control group consisted of different types of students (dental students), so that it is unclear whether the benefits of the TSC group resulted from the additional information presented in the TSC or from pre-existing group differences. Therefore, the aim of the study presented here was to use a randomized controlled experimental research design to examine the educational impact of the TSC’s video-based format. The authors compared the impact of two video formats used in anatomical science education: the classical online lecture (here a lecturer gives a lecture on a surgical procedure presenting a sequence of slides) and the TSC (dealing with the identical content).

Hypotheses and Research Questions

In the TSC, the surgical procedure is explained using real human body specimens. Therefore, the hypothesis was that the TSC condition would be perceived to be superior in *comprehensibility* of the presentation compared to the lecture condition (Hypothesis 1).

In the TSC, a human body provides an example for the surgical procedure and its sequences. This allows users to develop a step by step understanding of what is required to perform real surgeries. So, it was further hypothesized that the TSC condition would be perceived to be superior in *conceivability* of the surgical procedure compared to the lecture condition (Hypothesis 2).

The TSC format shows protagonists from different medical disciplines, offers different perspectives on a patient case, and alternates its visual representation between anatomical images and the surgery. Judging from this variety of material, it was hypothesized that the TSC video would be perceived to be more *entertaining* than a lecture video (Hypothesis 3).

The didactical concept of the TSC is to link anatomical to clinical information. Based on this approach and in line with the findings by Shiozawa et al. (2017) it was assumed that watching the TSC would result in higher levels of clinical knowledge for the participants. The hypothesis was that students who watched a video in the TSC format would gain more *clinical knowledge* than students who received the same information in a classical lecture video (Hypothesis 4). No

differences between the formats regarding *anatomical knowledge* were assumed, since both videos explicitly provided identical anatomical information.

It was also examined whether the evaluation variables—*comprehensibility*, *conceivability*, and *entertaining character*—would serve as mediators of the effect on the acquisition of *clinical knowledge*.

MATERIALS AND METHODS

To test the hypotheses, a randomized controlled between-group online experiment was conducted. This study was approved by the Commission of Ethics of the Leibniz-Institut fuer Wissensmedien (Approval code: LEK 2017/035).

Procedure

Users from the TSC-database were recruited as participants via e-mail. By clicking on the link in the e-mail, participants were redirected to the online study that was conducted using Qualtrics™ web-based questionnaire software (Qualtrics, Provo, UT). The minimum age for participation was 18 years; users could only participate if they indicated that they had reached this age. After receiving general information about the study, all of the participants provided written informed consent. Participants were randomly assigned to one of the two conditions (TSC format vs. lecture format) by Qualtrics. Following a demographic questionnaire asking for gender, age, year of study, and prior medical experience (former medical education, experience of community service, or voluntary work in the medical field) the educational video was shown. Participants were able to interact with the video; they could restart it or navigate to certain points in the video.

Directly after the video presentation, participants indicated whether or not they had watched the entire video. In order to control whether they had paid a minimum level of attention, they were also asked what kind of surgery was shown in the video: knee surgery (correct answer) vs. stomach surgery (wrong answer). As a manipulation check they were asked for the format of the video they had watched. Then participants replied to three evaluation scales, that is, they were given questionnaires that asked them to evaluate the comprehensibility of the presentation, the conceivability of the surgical procedure, and the entertaining character of the video (see Measures7 section for details). Finally, they performed a knowledge test asking for both clinical and anatomical knowledge (see below).

Sample Characterization

Due to ethical and privacy policies, it was not possible to preselect the sample that was invited, so an undifferentiated group of TSC users was invited via email. Initially, $n = 273$ participants clicked on the link provided in the e-mail. Participants were excluded from further analysis if they provided incomplete data, indicated that they had not watched the entire video, did not know the kind of surgery that was shown in the video, failed to answer the manipulation check item correctly, or were not students ($n = 159$). This sampling procedure led to the final sample size of 114 valid student participants (Figure 1).

The mean age of the participants was $M = 24.32$ ($SD = \pm 7.38$), 51% were female, and 57% were in the clinical phase of their studies (fifth semester or higher). Across the

Clicking the link on the study site

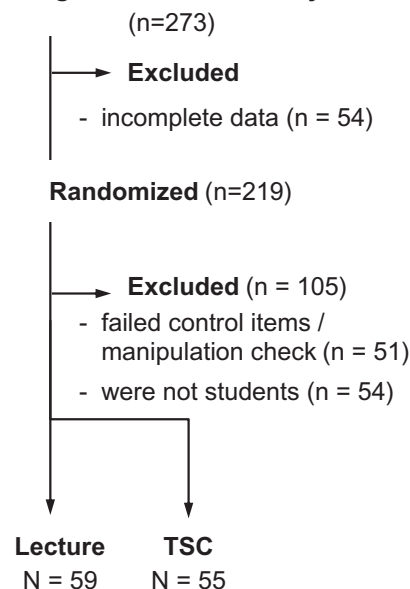


Figure 1.

Sampling procedure. Participants were excluded if they provided incomplete data, had not watched the entire video (control 1), did not know the kind of surgery that was shown in the video (control 2), failed to answer the manipulation check item correctly, or were not students. TSC, online video platform (Tuebingen's *Sectio Chirurgica*).

two experimental conditions participants did not differ regarding age, $t(112) = -0.132$; $P = 0.895$, distribution of gender, $\chi^2 = 0.140$; $P = 0.708$; $n = 114$, or level of education (preclinical vs. clinical phase), $\chi^2 = 2.246$; $P = 0.134$; $n = 114$.

Videos

Participants in both conditions watched a video about Anterior Cruciate Ligament (ACL) reconstruction. Both videos were of equal length and presented the same information about this procedure. The TSC video was produced using an already existing TSC episode that was shortened to a 15 minutes video focusing on the main procedures: (1) the surgeon introduced his team and described the upcoming steps. (2) The second part showed how to open the knee and insert the apertures into it. The following parts displayed (3) the extraction of the semitendinosus muscle (4) the preparation of the tendon as a graft, (5) the installation of the graft, and (6) the completion of the procedure. For about 10 minutes, the video dealt with the actual surgery, while 5 minutes of the video showed a professor providing anatomical background information.

The lecture video was produced about the same topic, an ACL reconstruction. All of the topics, the spoken words, and the duration of the individual segments of the video that was used for the TSC condition were analyzed. A script for the lecture video was written on the basis of this analysis. Based on this script, the same professor who hosted the TSC video gave in this video a classical lecture in a lecture hall, using exactly the same time for each topic, illustrating the procedures with pictures that were taken from the TSC. Whereas in the TSC video activities and interactions among the members of the operation team were directly visible to the audience, in the lecture video

these activities were only described and illustrated with visual aids that the professor presented on PowerPoint slides.

Measures

To measure participants' evaluation, a questionnaire was constructed based on the items of Kuo et al., (2009). All of the evaluation measures were based on five-point Likert scales and showed good internal consistency, as indicated by Cronbach's α . The endpoints of the Likert scales ranged from 1 = I don't agree at all to 5 = I completely agree. *Comprehensibility* of the presentation was measured by five items: "The video was understandable," "The video was instructive," "The content was well structured," "The professor appeared to be competent," and "It was easy to follow the professor with regard to content." The internal consistency of this scale was $\alpha = 0.884$.

Conceivability of the surgical procedure was measured by four items: "I understand the procedure of this surgery," "Through the video I have got a good insight into the procedures and activities during a surgery," "Through the video I can better imagine the procedure in the OR," and "I am able to judge the skills needed by the surgeon of this operation." For this scale, internal consistency was $\alpha = 0.804$.

Entertainment of the video was measured by three items asking for how "entertaining," "exciting," and "informative" the video was perceived to be. For this scale internal consistency was $\alpha = 0.837$.

Finally, participants performed a knowledge test, consisting of four questions asking for *clinical knowledge* and five questions asking for *anatomical knowledge* (see Supplementary Material Appendix S1). These questions were based on questions of former preclinical final examinations and were approved by professional anatomy instructors. The questions were not intended to capture a complete understanding of human anatomy but merely aimed to test explicitly whether participants remembered particular content from the video they had watched. According to Bloom's taxonomy, the anatomical knowledge items covered the *remembering* and *understanding* levels, while the clinical knowledge questions covered the *understanding* and *applying* levels. (Bloom, 1956; Anderson and Krathwohl, 2000).

Four questions were asked to assess clinical knowledge. One question was asked in a fill-in-the-gap-format: Participants were shown an MRI scan of the knee with a brightened area and were asked about the meaning of this elucidation. Participants received one point for correctly identifying a hemorrhage. Three questions were multiple choice items about the graft and the drilling procedures. For each of the multiple choice questions several options were correct; if participants answered all options correctly (identified all correct options as correct and all wrong options as wrong), they received two points; if they answered one option incorrectly, they received one point; if they made more than one mistake, they received no point. Participants could score a maximum of seven points in the clinical knowledge test.

In assessing anatomical knowledge, two of the questions were in a fill-in-the-gap format. Participants had to identify anatomical structures, for which they could receive up to three points in total. Three questions were multiple choice items about anatomical structures, for which the same scoring procedure was applied as for the multiple choice items in the clinical test. Participants could score a maximum of nine points in the anatomical knowledge test.

Analysis Methods

Data analysis was performed using the SPSS statistical package, version 22 for Windows (IBM Corp., Armonk, NY). Analyses of variance (ANOVAs) were performed for group comparisons (TSC vs. lecture condition), controlling for students' level of education (indicated by preclinical vs. clinical term of study). All data were reported as means (M) and standard deviations ($\pm SD$). The level of significance was set at $P < 0.05$, and partial eta-squared (η_p^2) was calculated as the effect size of mean differences. Mediation analyses were conducted for testing whether the effect of increased clinical knowledge was driven by participants' evaluations of the videos (comprehensibility, conceivability, and entertainment). Mediation analyses seek to identify and explain mechanisms that underlie an observed relationship between an independent and a dependent variable by including a third hypothetical variable, here the evaluations of videos (MacKinnon, 2008). The idea is that instead of a direct relationship between a dependent and an independent variable, there is the assumption of a mediator variable that is influenced by the independent variable and in turn influences the dependent variable. The analysis was performed using Model 4 of the PROCESS macro for SPSS by Hayes (2017).

RESULTS

Evaluation of the Video Format

In Hypothesis 1 it was argued that the comprehensibility of the TSC video would be superior to that of a classical lecture in a video, as the surgical procedure was explained using real human body specimens. In line with the expectations, participants in the TSC condition perceived the presentation to be more comprehensible ($M = 4.20$, $SD = \pm 0.85$) than in the lecture condition ($M = 3.75$, $SD = \pm 0.78$), $F(1, 111) = 9.027$; $P = 0.003$, $\eta_p^2 = 0.075$.

In addition, it was assumed that students who watched the TSC video would develop a better understanding of what is required to perform real surgeries. Thus, Hypothesis 2 stated that the TSC condition would be perceived to be superior in conceivability of the surgical procedure compared to the lecture condition. Indeed, participants in the TSC condition perceived the surgical procedure to be more conceivable ($M = 3.42$, $SD = \pm 0.76$) than in the lecture condition ($M = 3.11$, $SD = \pm 0.71$), $F(1, 112) = 5.009$; $P = 0.027$, $\eta_p^2 = 0.044$.

Finally, Hypothesis 3 had assumed that participants would consider the TSC video to be more entertaining. There was also evidence in the data for this assumption, as the participants in the TSC condition perceived the video to be more entertaining ($M = 4.13$, $SD = \pm 0.85$) than in the lecture condition ($M = 3.17$, $SD = \pm 0.83$), $F(1, 112) = 38.126$; $P < 0.001$, $\eta_p^2 = 0.257$. The data of all of the three evaluation criteria are shown in Figure 2.

Knowledge Performance

There were no differences between preclinical and clinical students regarding their knowledge performance, either for clinical knowledge, $t(112) = -1.615$; $P = 0.109$, or for anatomical knowledge, $t(112) = -0.511$; $P = 0.610$. Hypothesis 4 stated assumptions about the effects the videos would have on knowledge outcomes, hypothesizing that the participants who watched the TSC video would benefit more strongly in

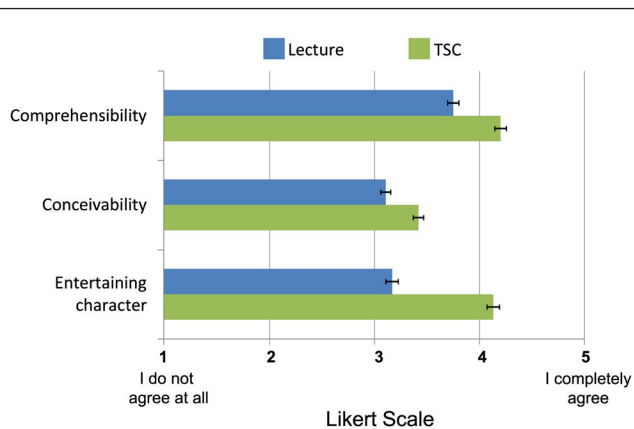


Figure 2.

Evaluation of the Tuebingen's *Sectio Chirurgica* (TSC) video in comparison to the lecture video. Participants in the TSC video condition evaluated the video better regarding *comprehensibility*, *conceivability*, and *entertaining character* on five-point Likert scales ranging from 1 = I don't agree at all to 5 = I completely agree. Error bars present standard errors. Total number of participants $n = 114$.

their acquisition of clinical knowledge. The data supported this hypothesis. The participants in the TSC condition had significantly higher scores in clinical knowledge, $M = 4.76$ (68.0%), $SD = \pm 2.01$ (28.7%), than participants in the lecture condition, $M = 4.06$ (58.0%), $SD = \pm 1.85$ (26.4%), $F(1, 111) = 4.187$; $P = 0.043$, $\eta_p^2 = 0.036$, as shown in Figure 3. No effect on anatomical knowledge was found, $F(1, 111) = 0.001$, $P = 0.989$.

Mediation Analysis

The evaluation variables (i.e., comprehensibility, conceivability, and entertainment) were each entered as mediators into simple mediation analyses, again controlling for students' level of education as covariate. The analyses revealed that

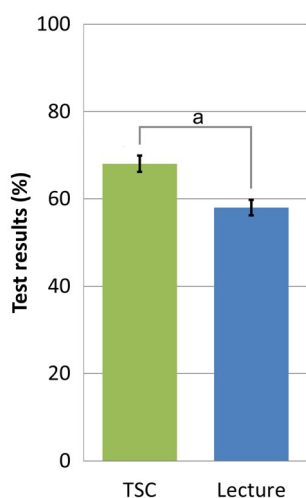


Figure 3.

Clinical knowledge in the Tuebingen's *Sectio Chirurgica* (TSC) video condition in comparison to the lecture video. Participants who watched the TSC video performed better in a clinical knowledge test: ^a $P = 0.043$. Error bars present standard errors. Total number of participants $n = 114$.

entertainment had a significant mediating effect, $\beta = 0.36$, $SE = 0.10$, 95% CI [0.162; 0.555]. This mediation effect is shown in Figure 4. Likewise, the other two analyses also showed significant mediation effects for comprehensibility, $\beta = 0.15$, $SE = 0.06$, 95% CI [0.033; 0.282], as well as for conceivability, $\beta = 0.09$, $SE = 0.05$, 95% CI [0.002; 0.210]. The critical confidence intervals of all mediations did not contain zero. This indicates that the effect of the video format on the acquisition of clinical knowledge was mediated by participants' evaluation of the video, in particular by its entertaining character.

DISCUSSION

The research presented here aimed to investigate the usability of a video-based anatomical education format, TSC for connecting more immediately anatomical information with clinical practice. How TSC videos are applicable for medical education was examined in a randomized, controlled experiment. In line with the hypotheses, the results indicated that participants evaluated the TSC video significantly more favorably than the classical lecture video in all of the evaluation criteria. Moreover, TSC participants also delivered better performances in the clinical knowledge test, which is in line with former research on this topic (Shiozawa et al., 2017).

The higher levels of comprehensibility and conceivability could be a result of the fact that classical lectures have clear limitations in presenting graphically real enough clinical procedures and activities. In lectures, actions are limited most of the time to descriptions based on key words and motionless pictures, while interactions among professionals that are highly relevant for the surgery are either not discussed at all or taken very little into account (Garside, 1996). The TSC video, in contrast, illustrated these interactions explicitly, portraying a surgical procedure from different professional points of view, using real examples. Also, the context and overall setting play an important role in understanding the surgical procedure (Choi and Johnson, 2005). While in a lecture, activities are described in an abstract way in a lecture hall setting, active interactions in the TSC took place in the context of a simulated operation room, leading to a higher level of comprehensibility and conceivability. This is in line with previous research that better comprehensibility of knowledge material is related to more knowledge (Parker et al., 2012; Hadar and Sood, 2014). This appears also to be true of knowledge about the activities involved in a surgical procedure.

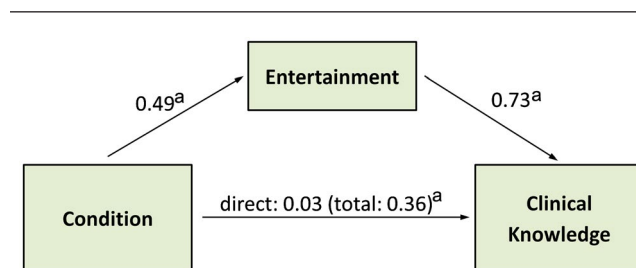


Figure 4.

Mediation diagram with entertainment as mediator. While there is no direct effect of condition on clinical knowledge ($\beta = 0.03$, n.s.), a significant mediation between condition and clinical knowledge was found with entertainment as mediator ($\beta = 0.36$). ^aStatistical significance.

The analysis showed that the positive effect of the TSC video on the acquisition of clinical knowledge was further triggered by the entertaining character of the TSC. This is reminiscent of recent studies which have shown that positive enjoyment of watching a video may support the acquisition of personal knowledge (Mattheiß et al., 2013; Weinmann et al., 2013). Moreover, more positive affective state elicited by watching a video helps in the encoding and storing of information and thus may in turn facilitate knowledge acquisition (Fredrickson, 1998; Isen, 2009). Our findings lead to the conclusion that it is important for teachers to design course material that is entertaining and attractive for students in order to transfer knowledge.

Participants in the TSC group not only assigned higher ratings in the evaluation scales, they also showed better performance in the clinical knowledge test as a result of this positive evaluation. The social cognitive learning theory (Bandura, 2001) offers an explanation for this relationship. When participants pay attention to direct interactions of real professionals who act in more or less realistic clinical setting, this leads to a direct learning process, as the data presented here also indicates. In this spirit, the TSC may represent an important and interesting format to link anatomical to clinical knowledge directly. Classical lecture videos, which many universities mainly use as supplemental online education, often result in a lack of applicability, since these lectures mainly focus on transmitting basic anatomical knowledge. As the study presented here has shown, combining basic anatomical knowledge with clinical application can be viewed as a very promising didactical approach—even for and perhaps especially for students in the preclinical phase.

Limitations of the Study

A limitation of this study is that a bias may have occurred regarding the participants. Only participants of the TSC platform were recruited who had already been motivated to create an account for the platform and so were interested to participate in the study. This sample may already have had a higher commitment and level of motivation than other medical students who did not have a TSC account. Therefore, all of the participants can be considered as having been highly motivated to deal with anatomical knowledge and interested in its clinical application. Before any recommendation about integrating this learning format into regular medical education can be made, a replication of these results with another sample of students who are not enrolled in the TSC platform needs to be done to generalize these results. Moreover, it is possible that a video format that does not allow direct communication with the teacher is not suitable for all learners.

Another critical point could be the knowledge test. The knowledge test was designed for covering clinical and anatomical knowledge. In order not to over-challenge the participants and to keep the participation time as short as possible, only a total of nine knowledge questions could be asked. Accordingly, only a small, albeit representative, part of the knowledge imparted in the videos could be addressed. Furthermore, the prior knowledge of the participants and possible differences in prior knowledge were not explicitly measured but only inferred from their phase of study (preclinical vs. clinical phase). However, due to the randomized allocation of participants to the two test conditions, it need not be assumed that there were any differences in advance prior knowledge. Finally, the generalizability of the results is limited insofar as only one medical topic (ACL reconstruction) was studied. The knee joint is not

very complex anatomically. It is possible that studying more complex anatomical region (like the face or the hand) could overwhelm learners if they had to deal with anatomical and clinical information at the same time.

CONCLUSIONS

In summary, it seems appropriate to provide the TSC format as an add-on to classical lectures. Since the TSC is perceived to be more comprehensible and conceivable, and also quite entertaining, it appears to be a motivating learning tool. The learning experience it facilitated also resulted in substantial clinical knowledge gains. These findings can be considered as a key contribution to strengthen the link between anatomical and clinical knowledge. These findings are consistent with the general current trend that anatomical knowledge can be taught through digital resources.

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Observing Interprofessional Collaboration: Impact on Attitude and Knowledge Acquisition

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Interprofessional collaboration (IPC) in the medical field is an important factor for good clinical outcomes and should be taught as early as in undergraduate medical education. Since implementing IPC training is an organizational challenge, students are often limited in their opportunities to experience real-life IPC. Therefore, an approach where students observe successful IPC activities of role models in an applied anatomical format was proposed. It was studied whether observing IPC activities in undergraduate anatomical education has an impact on both students' attitude toward IPC and on knowledge acquisition. Further, it was examined whether the attitudes and knowledge of students from different medical disciplines were influenced in different ways. Therefore, 75 medical students and thirty-eight physiotherapy students participated in a study with the task of observing a live broadcast of an interprofessional teaching session. Participants were asked about their attitudes toward interprofessional learning, their evaluation of professional responsibilities, and their profession-specific knowledge before and after observing the IPC session. The participants' attitude toward interprofessional learning improved for both groups of students. Moreover, students of physiotherapy adjusted their evaluation of their own and others' professional responsibilities after observing IPC. In both student groups, knowledge increased, in particular, with respect to the field of knowledge in other professions. So, observing IPC can modify students' attitudes and support knowledge acquisition. The implementation of IPC observations provides students from various healthcare disciplines with a clearer impression of professionals' responsibilities and gives learners the opportunity to acquire knowledge from healthcare fields unfamiliar to them. *Anat Sci Educ* 0: 1–8. © 2020 American Association for Anatomy.

Key words: gross anatomy education; medical education; physiotherapy education; undergraduate education; e-learning; computers in anatomy education; teaching of anatomy

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INTRODUCTION

Interprofessional collaboration (IPC) among representatives of different healthcare professions is a principle essential to successful healthcare in everyday clinical practice (WHO, 1978; Morgan et al., 2015). Here, groups of different healthcare professionals work together to provide medical care in a favorable manner. Ideally, IPC proceeds in a way that values the expertise and contributions of the various healthcare professionals involved. Common interprofessional interactions include interprofessional ward rounds, case meetings, and consultations as well as other forms of communicative exchange among different groups of healthcare professionals (Reeves et al., 2009, 2017). This process is considered a key approach

to improving the quality and safety of patient care (Custers et al., 1999; Kohn et al., 1999; Clancy et al., 2013; Cuff, 2013; Martinez et al., 2013). As a consequence, IPC received considerable attention in the literature, which in turn has led to policy and regulatory actions (Reeves et al., 2013, 2017; Bianchi and Bressan, 2019). Medical training that involves interprofessional interaction has advantages over traditional clinical education regarding collaboration-skill development (McGaghie et al., 2011). Interprofessional education (IPE) in clinical settings and exposure to the achievements of other healthcare professionals have been shown to facilitate awareness and appreciation for the relevance of different interprofessional roles (Hayden et al., 2005; Hirt et al., 2010; Thistlethwaite, 2012, 2015; Grosser et al., 2019). Nowadays, various universities offer programs for healthcare students that include IPC and IPE elements (Cortes, 2015; Grosser et al., 2020).

It is often difficult, however, to organize IPE due to medical students' tight schedules and the diversity of professions that would need to be involved (for example see Fernandes et al., 2015). Besides these institutional barriers, there are also challenges posed by professional cultures, in particular the culture of academic medicine that, according to Kirch and Ast (2015) "has traditionally valued autonomous individuals, competing in a hierarchical manner and focused on expert status" (p. 297). This self-image may establish barriers for the future requirements of an increasingly complex healthcare system and undermine the establishment of an interprofessional culture. Professional conceits may even have a negative impact on medical students (Gilbert, 2008). Morison et al. (2004), for instance, found that most medical students agreed to the statement, "I do not want to waste my time learning with other healthcare students." Findings like this point out that successful IPE requires well-designed interprofessional role model behavior early in medical education. Shared learning in clinical settings is successful and learners are more likely to develop mutual trust if they are aware of diverse professionals' responsibilities and recognize their abilities (Wilhelmsson et al., 2009; Friberg et al., 2016).

Much research about outcomes of IPE was conducted with students in advanced phases of their education (Birk, 2017; Lee et al., 2020). But there are also some studies that have applied IPE to classroom-based programs for students in early phases of their studies and have found positive IPC outcomes (Lapkin et al., 2013; Barr et al., 2014; Burgess et al., 2020; Huebner et al., 2020). Anatomy courses, for example, that provide basic knowledge for many clinical interventions are highly suitable for IPE, since virtually all health professionals (like surgeons or physiotherapists) build on anatomical information. Therefore, curriculum modifications that include IPE elements in pre-clinical courses, such as anatomy education, may result in important experiences for students of different healthcare professions.

A Swiss university, for example, combined nursing topics and anatomy lectures for medical students and nurses and implemented it in an IPE program that was highly appreciated by students regarding collaborative training and the belief that IPE is an important experience for future professional behavior and understanding of other health professionals' practice (Herrmann et al., 2015). Similar effects were shown in a combined gross anatomy course for medicine and physiotherapy students, where participants reported a better understanding of the other professions' scope (Hamilton et al., 2008). A longitudinal observation that was executed in several interprofessional gross anatomy dissection courses and that assigned

students from medicine, midwifery, nursing, physician's assistants, physiotherapy, and occupational therapy courses to interprofessional teams revealed improvements in professional identity, competency and autonomy, role clarity and attitudes toward other health professions (Fernandes et al., 2015). Also long-term effects, even of short IPE interventions, are reported (Sytsma et al., 2015). While students often report high satisfaction with and positive attitude toward IPE and IPC, participants with clinical experience report decrease in their attitude toward collaboration with other professions. However, these practitioners report a significant improvement in role clarity and responsibilities (Zheng et al., 2019).

Unfortunately, students are often limited in their opportunities to experience real-life IPC. Therefore, an approach was proposed where students have the opportunity at least to observe successful IPC activities in an applied anatomy course and learn from role models of different professions through observation. One research question was whether the mere observation of IPC activities and role models in medical education would have an impact on students' attitude toward IPC and on their own knowledge acquisition. It was also aimed to answer the question as to whether the attitudes and knowledge of students from different medical disciplines would be influenced differently by observing IPC activities.

Learning by example is a well-studied and effective method for acquiring knowledge and social behavior (Van Gog and Rummel, 2010; Renkl, 2014). According to social learning theory and social cognitive theory (Bandura, 1986, 2002; Cook and Artino, 2016), individuals do not learn new behavior only by trying it themselves and experiencing success or failure. Learning is also a social process of observing the behavior of others and the consequences of that behavior for those role models. Social learning has been examined in previous medical education research (Mann, 2011; Keren et al., 2017). For example, the observation of a simple surgical task performed by a professional role model improved learners' ability to perform the task themselves. Learners who watched the procedure performed better, faster, and more accurately than participants who only received verbal instructions (Custers et al., 1999). In another study, medical trainees acquired skills in central line insertion from video-based observational practice activities (Domuracki et al., 2015). Besides learning how to carry out a specific task, it is also possible to learn social behavior and to support the development of professionals' values and attitudes by observing role models. Especially in medical education, role modeling is used to support medical students' professional identity formation (Kenny et al., 2003; Wahyuni et al., 2020).

Bringing together these approaches, it was proposed that observing healthcare professionals in an IPC context like applied clinical anatomy may affect students' learning processes. There is evidence that the direct observation of IPC supports the understanding of IPC (Morgan et al., 2015). But it has been unclear so far in what way students from different healthcare disciplines (e.g., physiotherapy students and medical students) may benefit differently from observing healthcare professionals in an IPC context. This study investigated the impact of IPC observation on attitude and knowledge acquisition in a controlled quasi-experiment. Physiotherapy and medical students were exposed to a live broadcast of an interprofessional educational video about the treatment of shoulder trauma that was presented from a clinical and anatomical perspective. The video featured a comprehensive presentation of collaboration among anatomists, surgeons, radiologists, and physiotherapists. This study was designed to examine the

following hypotheses and research questions about the educational impact of observing IPC:

It was hypothesized that both physiotherapy students and medical students would benefit from observing an episode of effective IPC, resulting in a more positive general attitude toward IPC (Hypothesis 1).

An open research question was whether physiotherapy students and medical students would differ in their evaluation of physiotherapists' and physicians' professional responsibilities (Research Question 1).

Profession-specific knowledge from various medical fields is presented in IPC education. Accordingly, students have the opportunity to acquire knowledge from their own and from other professions. Another open research question was whether physiotherapy students and medical students would differ in their knowledge acquisition from different fields of knowledge (physiotherapeutic knowledge, medical knowledge, clinical knowledge; Research Question 2).

MATERIALS AND METHODS

Students of a medical school and students of a physiotherapy school watched a complete live episode of *Sectio Chirurgica*, an online-based applied anatomy video learning platform (Hirt et al., 2010; Shiozawa et al., 2017; Grosser et al., 2019). This episode dealt with the surgical treatment of shoulder trauma and its physiotherapeutic follow-up treatment. The study authors were already involved in the planning and scripting of the episode to ensure that interprofessional aspects were sufficiently considered. The study was approved by the Commission of Ethics of the Leibniz-Institut fuer Wissensmedien (Approval-Code LEK 2017/035).

Experimental Design

The study had a quasi-experimental design with two student groups (physiotherapy students vs. medical students). Attitude toward IPC, professional responsibilities evaluation, and knowledge acquisition (physiotherapeutic knowledge, medical knowledge, clinical knowledge) served as dependent variables.

Participants

The study was carried out with a total of 113 participants; 75 were medical students (52 females, 23 males), and 38 physiotherapy students (28 females, 10 males). These different sample sizes resulted from the respective sizes of the two courses included. Students participated voluntarily and anonymously. There were no disadvantages for students who did not want to participate. They provided written informed consent and received 15.00 Euros (approximately 17.00 US dollars) for participation. The medical students were at the beginning of the second year of their training. Their mean age was 21.55 years old ($SD \pm 3.74$). Twenty-four of the physiotherapy students were at the beginning of the second year, 14 were at the beginning of the third year of training. Their mean age was 21.92 years old ($SD \pm 2.94$). The second- and third-year physiotherapy students did not differ in their knowledge in the pre-test ($P = 0.073$) and were, therefore, combined into one condition.

Procedure

The study was conducted in two different lecture halls simultaneously. The medical students were in one, the physiotherapy

students were in the other lecture hall. First, the participants were informed about the procedure of the study. Then they completed a pre-test questionnaire that asked for demographic data and measured their attitude toward IPC, their evaluation of the professional responsibilities of physiotherapists and physicians, and their physiotherapeutic, medical, and clinical knowledge (see below). In the next step, the participants watched a complete live stream of an episode about the treatment of shoulder trauma. The episode's length was 112 minutes and showed protagonists from four professions who interacted with each other to provide the treatment: a surgeon, a physiotherapist, an anatomist, and a radiologist. The protagonists were interviewed by a host, who was also an anatomist. The episode included a case report with scans showing a fracture of the tuberculum majus. Arthroscopy was performed on an anatomical specimen with corresponding pathology. Then a biceps tenodesis was performed to fix the labrum. In the meantime, a physiotherapist discussed the case with the surgeons and showed follow-up physiotherapeutic treatments. After watching the full episode, participants completed the post-test questionnaire that asked them for their evaluation of the video and once again measured their attitude toward IPC, their evaluation of professional responsibilities, and their physiotherapeutic, medical, and clinical knowledge with the same items as in the pre-test. All measurements were performed as paper-and-pencil tests.

Measurements

Evaluation of the video. Participants were asked how interesting, entertaining, and suitable for the provision of IPC the video was. The scale was adapted from the scale used by Grosser et al. (2019) and comprised eight items that were measured on five-point Likert scales (1 = disagree at all, 5 = totally agree).

Attitude toward interprofessional collaboration. The attitude toward IPC was measured by the IP-learning subscale (Pollard et al., 2004, 2005; Mahler et al., 2017) from the University of the West of England Interprofessional Questionnaire (UWE-IP). It comprised nine items that were measured on five-point Likert scales (1 = disagree at all, 5 = totally agree).

Professional responsibilities. When healthcare students are asked for the responsibilities of their profession, it turns out that professional boundaries are often quite unclear (Rushmer, 2005; Sims et al., 2015). Unfortunately, there is a lack of instruments to measure this issue (Oates and Davidson, 2015). Thus, participants were asked explicitly about their evaluation of physiotherapists' and physicians' professional responsibilities. This was measured by two items where participants assessed how important they felt it was to distinguish between medical and physiotherapeutic responsibilities: "For good treatment success, a physician should instruct patients in physiotherapeutic exercises" and "For good treatment success, a physiotherapist should perform parts of the medical diagnosis." These items were measured on five-point Likert scales (1 = disagree at all, 5 = totally agree).

Knowledge acquisition. In the knowledge test, the participants had to judge 13 statements as correct or incorrect. These questions were taken from examinations of previous years and reviewed by the course instructors (see Supplementary Material Knowledge Questions File). Participants' *physiotherapeutic knowledge* was measured with four items (test difficulty in the pre-test was 41.81%). *Medical knowledge*

was measured with five items (test difficulty in the pre-test was 41.42%). Finally, *clinical knowledge* was measured with four items (test difficulty in the pre-test was 45.80%). To measure knowledge acquisition, the difference between performance in the pre-test and post-test was calculated. For each question, it was also asked for the level of confidence for each answer on a scale ranging from 1 (very unconfident) to 6 (very confident). To reduce the probability of guessing, a balanced negative marking method was used (Gardner-Medwin and Gahan, 2003) where each answer was analyzed for correctness (+1 = correct answer; -1 = wrong answer) and multiplied with the confidence score. The resulting values were converted into percentages.

Statistical Analysis

Internal consistency of the UWE IP-learning scale was determined by calculating Cronbach's alpha (α). To test Hypothesis 1, a paired samples t-test for all of the participants on their pre- and post-IP-learning scores was calculated. For testing the open research questions about professional responsibilities and knowledge acquisition, a mixed-design (M)ANOVA with student group as the between-group factor and the pre/post-comparison as the within-group factor was calculated. To test whether both groups acquired clinical knowledge in a comparable way, two one-sided equivalence tests (TOST; Schuirmann, 1987; Lakens, 2017; Lakens et al., 2018) was used. For further explanation see Supplementary Material Appendix File. All data are reported as means (M) \pm standard deviations (\pm SD), unless otherwise noted. The level of significance was set at $P < 0.05$. Cohen's d and partial eta squared (η^2_p) were reported as indicators of effect size. Statistical data analysis was performed using the SPSS statistical package, version 22 (IBM Corp., Armonk, NY).

RESULTS

Equivalence of Student Groups

Age and gender distribution of the two student groups was examined. The physiotherapy students and medical students did not differ from each other regarding their age ($t_{(111)} = -0.54$; $P = 0.591$) or gender distribution $\chi^2(1) = 0.231$, $P = 0.631$.

Evaluation of the Video

The evaluation scale showed a good internal consistency of $\alpha = 0.80$. Participants evaluated the episode positively (mean \pm SD: 3.86 ± 0.63). Participants did not differ regarding student group, $t_{(110)} = -1.54$; $P = 0.127$. The item with the highest approval rating of 4.22 ± 0.96 was: "This episode of Sectio Chirurgica gave a good insight into the processes and action steps during the surgery."

Attitude Toward Interprofessional Collaboration

The measurement of attitude toward IPC showed an acceptable internal consistency of $\alpha = 0.77$ in the pre-test and an excellent internal consistency of $\alpha = 0.91$ in the post-test.

Hypothesis 1 assumed that the students' attitude toward IPC would be more positive after observing IPC. The data supported this hypothesis. Even though quite high initial values were indicated for all of the participants in the pre-test, a significant increase in the post-test was found ($t_{(111)} =$

-3.83 , $P < 0.001$, $d = 0.21$; mean \pm SD pre: 3.68 ± 0.63 ; post: 3.83 ± 0.77).

Professional Responsibilities

The interaction between student group and the pre/post-comparison regarding participants' evaluation of physicians' professional responsibilities was significant, $F_{(1, 111)} = 4.56$, $P = 0.035$, $\eta^2_p = 0.04$. In the pre-test, medical students felt more strongly that a physician should instruct patients in physiotherapeutic exercises than physiotherapy students (mean \pm SD: medical students: 2.67 ± 1.13 ; physiotherapy students: 1.47 ± 0.69), $t_{(111)} = 7.03$, $P < 0.001$, $d = -1.05$). Observing IPC changed physiotherapy students' evaluation (mean \pm SD: 1.95 ± 1.38 , $t_{(37)} = -3.67$, $P < 0.001$, $d = 0.44$), while it did not change for medical students (mean \pm SD: 2.74 ± 0.97 , $t_{(74)} = -5.75$, $P = 0.567$).

Moreover, it was found in the pre-test that physiotherapy students felt more strongly that a physiotherapist should perform parts of the medical diagnosis than medical students ($t_{(111)} = -5.85$, $P < 0.001$, $d = -1.15$; mean \pm SD physiotherapy students: 3.55 ± 0.76 ; medical students: 2.52 ± 1.01). Observing IPC decreased physiotherapy students' agreement with this conviction (mean \pm SD: 3.24 ± 0.94 ; $t_{(37)} = 2.23$, $P = 0.032$, $d = 1.128$), while medical students did not change in their agreement (mean \pm SD: 2.49 ± 1.09 ; $t_{(74)} = 0.39$, $P = 0.694$).

Knowledge Acquisition

There was an increase in knowledge for participants in both student groups. Regarding total knowledge performance, participants of both groups showed an increase from pre-test to post-test (mean \pm SD pre-test: $72.30\% \pm 11.65$, post-test: $81.86\% \pm 11.77$; $t_{(111)} = -8.46$, $P < 0.001$, $d = 0.82$). But regarding the three fields of knowledge, medical and physiotherapy students differed from each other:

Medical students showed low initial performance in physiotherapeutic knowledge but improved their performance by observing IPC. This knowledge gain was higher than for physiotherapy students who had higher initial knowledge scores but did not improve; $F_{(1,111)} = 21.54$, $P < 0.001$, $d = 0.91$ (Fig. 1; means, standard deviations, t , P , and d values are shown in Table 1).

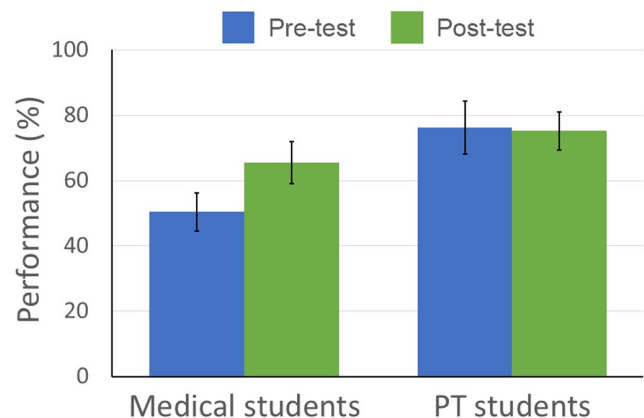


Figure 1.

Physiotherapeutic knowledge of medical students ($n = 75$) and physiotherapy students ($n = 38$). Standard errors are represented by the error bars attached to each column.

Table 1.

Knowledge Performance Comparisons for Physiotherapeutic, Medical, and Clinical Knowledge

| Student Group | Pre-test Mean (±SD) | Post-test Mean (±SD) | Comparison Pre-/Post-Test | P-value | Cohen's <i>d</i> |
|------------------------------------|---------------------|----------------------|---------------------------|---------|------------------|
| Physiotherapeutic knowledge | | | | | |
| Medical students | 50.39% (±11.76) | 65.43% (±12.91) | $t_{(74)} = -7.53$ | <0.001 | 1.215 |
| PT students | 76.21% (±16.33) | 75.22% (±11.85) | $t_{(37)} = 0.32$ | 0.75 | (-) |
| Comparison of student group | $t_{(111)} = -9.64$ | $t_{(111)} = -4.02$ | | | |
| P-value | <0.001 | <0.001 | | | |
| Cohen's <i>d</i> | 1.810 | 0.789 | | | |
| Medical knowledge | | | | | |
| Medical students | 79.09% (±14.43) | 87.26% (±12.85) | $t_{(74)} = -4.65$ | <0.001 | 0.555 |
| PT students | 52.19% (±7.39) | 65.22% (±12.08) | $t_{(37)} = -5.94$ | <0.001 | 1.299 |
| Comparison of student group | $t_{(111)} = 10.78$ | $t_{(111)} = 8.92$ | | | |
| P-value | <0.001 | <0.001 | | | |
| Cohen's <i>d</i> | 2.496 | 1.768 | | | |
| Clinical knowledge | | | | | |
| Medical students | 52.82% (±8.54) | 64.41% (±12.17) | $t_{(74)} = -6.47$ | <0.001 | 1.104 |
| PT students | 54.33% (±12.80) | 68.64% (±15.91) | $t_{(37)} = -4.77$ | <0.001 | 0.991 |
| Comparison of student group | $t_{(111)} = -0.75$ | $t_{(111)} = -1.56$ | | | |
| P-value | 0.457 | 0.121 | | | |
| Cohen's <i>d</i> | (-) | (-) | | | |

PT, Physiotherapy.

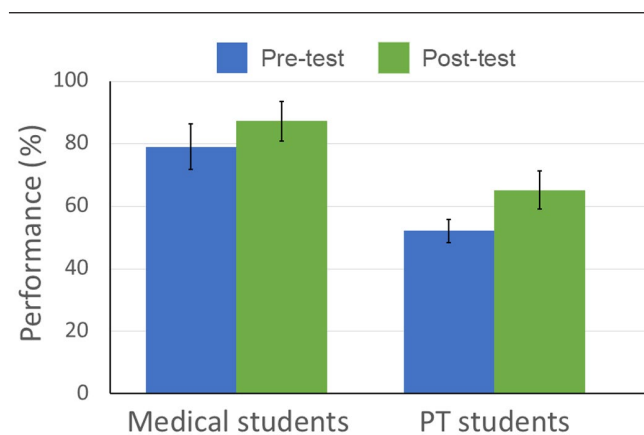


Figure 2.

Medical knowledge of medical students (n = 75) and physiotherapy students (n = 38). Standard errors are represented by the error bars attached to each column.

Medical students also improved their medical knowledge by observing IPC. But this improvement was less than that of physiotherapy students who showed a significantly higher gain from the initial knowledge performance in the pre-test to the post-test, $F_{(1,111)} = 4.30$, $P = 0.040$, $d = 0.41$ (Fig. 2).

Initially, both student groups had low measures of clinical knowledge. Both groups increased their knowledge by watching the video, $F_{(1,111)} = 83.01$, $P < 0.001$, $d = 0.43$. The TOST procedure indicated that the student groups did not differ in their acquisition of clinical knowledge (Fig. 3).

DISCUSSION

Interprofessional learning programs have become a major topic in medical education with the goal of fostering IPC (Kirch and Ast, 2015). Most of those programs are aimed at clinical courses. So, they primarily address advanced students, which was shown to be effective in terms of acquiring knowledge, skills, and competences (Hayden et al., 2005). Only a few courses have addressed students in the early phases of their studies. Therefore, an approach was tested in the present study where students from different professions

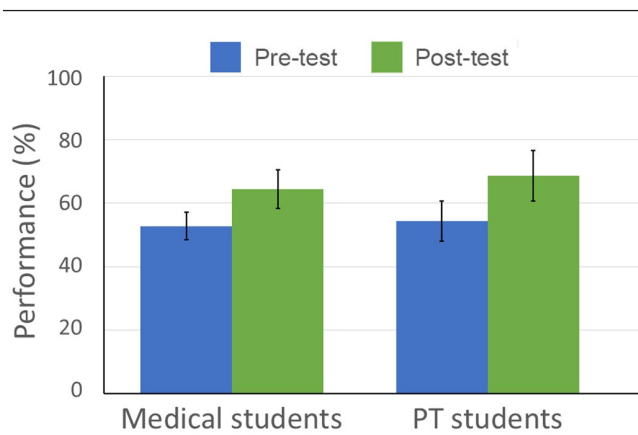


Figure 3.

Clinical knowledge of medical students ($n = 75$) and physiotherapy students ($n = 38$). Standard errors are represented by the error bars attached to each column.

who were in the early phases of their training observed inter-professional role models performing IPC. In line with theories on example-based learning (Kenny et al., 2003; Van Gog and Rummel, 2010; Renkl, 2014), the findings demonstrate that students acquired physiotherapeutic, medical, and clinical knowledge when they watched a live episode of inter-professional medical treatment. At the same time, students of diverse study courses differed in their profession-specific prior knowledge and perception of professional roles. As seen in this study, the specific expertise of the different professions can make different valuable contributions to inter-professional learning material. Learners benefited in general but especially acquired knowledge outside their own field. Those students show more acquisition of knowledge in a field for which they have little prior knowledge compared to a field where they already know a lot is in contrast to previous assumptions that prior knowledge in a specific field would support knowledge acquisition and lead to better knowledge test results (Tedman et al., 2011; Oza and Nesbit, 2018). Reasons might be that there are few possibilities for medical students for gaining insight into other medical professions, learners may be more motivated to learn from the content of an IPC. These results are in line with findings of Shields et al. (2015) and Herrmann et al. (2015) who asked medical and physiotherapy students after an IPE lesson about their satisfaction with the interprofessional experience. Students of both groups stated an interest in deeper insights into the other profession's approach. Providing examples of IPC to learners might also be helpful to prevent professional barriers or conceits, particularly in early phases of students' education when they strongly identify themselves with their profession (Coster et al., 2008). It also was found that observing IPC in a video promoted openness toward interprofessional learning. For both physiotherapy and medical students, there was an increase in positive attitude toward IPC after observing an interprofessional video. This effect could be interpreted as an indicator that an interprofessional video is sufficient to foster positive attitudes toward interprofessional learning. Courses with an applied perspective on anatomy might be helpful in this respect as they provide basic knowledge that is relevant for almost all healthcare disciplines and is usually taught in an early stage of education.

Limitations of the Study

The presented findings have several limitations. Only the learners' attitude toward IPC as represented by the video was measured, but there were no measurements of inter-professional behavior in actual clinical practice. However, a positive attitude increases the probability of good quality IPC (Ajzen and Fishbein, 1977; Fernandes et al., 2015; Sytsma et al., 2015). To get an understanding of inter-professional communication processes during online-based IPC videos, we propose to collect qualitative data (e.g., by analysis of chats or collaborative exercises) in addition to quantitative data. Moreover, post-measurements were conducted shortly after participants followed the video. Sytsma et al. (2015) showed that inter-professional courses of healthcare students improved attitudes toward IPC in the long run, but it is unclear if this also applies to students who only observed an inter-professional video. Furthermore, it cannot be excluded that the participants in this lecture hall setting tended to give socially desirable answers.

The effect of professional responsibility should be treated with caution. Since there was no established scale for this construct, evaluation of professional responsibilities was measured with only two self-created items. Despite a high level of face validity, the construct validity of these items is not assured. It would be interesting for future studies to investigate if a direct realistic learning experience of IPC has additional advantages or disadvantages compared to observational learning.

Finally, in the learning material that was presented, an IPC without any conflicts and misunderstandings was shown. This is not necessarily a realistic picture of clinical everyday life. Successful realistic inter-professional teamwork is characterized by the capability of inter-professional teams to solve arising problems, which further consolidates their inter-professional behavior (Paletz et al., 2011, 2013). The observation of this material helped physiotherapy students to alter their previously very critical assessment of physicians' ability to instruct patients in physiotherapeutic exercises. One reason for the physiotherapy students' initial skepticism could be that they were already in their clinical phase of training, where they had experienced both good and poor IPC, while medical students had not yet had this experience.

CONCLUSIONS

Overall, it seems that observing inter-professional collaboration in an educational video is a promising and relatively easy to use approach to raise awareness toward inter-professional working situations and to gain relevant knowledge from other medical professions. For students from the health-care sector, material that provides anatomical information can be suitable since virtually all students in this sector need to gain basic anatomical knowledge. Moreover, applied anatomy courses provide the opportunity for the early integration of such inter-professional collaborative material.

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Observing Inter-Professional Videos: Impact of Collaboration Between Physicians and Psychologists on Attitude and Knowledge Acquisition

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ABSTRACT

BACKGROUND: Inter-professional collaboration (IPC) is an important prerequisite for successful patient care. Even though inter-professional education (IPE) is increasingly common in undergraduate medical education, few IPE approaches explicitly address the IPC among medical students and students of psychology. IPE videos can be used to give learners the opportunity to gather relevant knowledge from different professional perspectives. So far it has been unclear whether it is enough when the topic of the video itself is inter-professional or if it is necessary for experts from different professions explicitly to appear in the video.

METHODS: In an online experiment, medical students watched 1 of 2 videos about Parkinson's disease (PD) and the care of PD patients. The information was either provided by protagonists from only 1 profession (ie, physicians; mono-professional condition) or provided by protagonists from 2 different professions (ie, physicians and a psychologist; inter-professional condition). Attitude toward inter-professional interaction and learning, evaluation of the entertaining and illustrative character of the video, attitude toward physicians and psychologists, importance of IPC, evaluation of psychological treatment support, and knowledge acquisition served as dependent variables.

RESULTS: The analysis was based on 140 participants (74 in the mono-, 66 in the inter-professional condition). We found that the inter-professional video was perceived to be more entertaining than the mono-professional video ($t_{(138)} = -2.227$; $P = .028$; $d = 0.38$). The inter-professional video was also considered to be more illustrative ($t_{(138)} = -6.269$; $P < .001$; $d = 1.06$). Moreover, participants improved their attitude toward physicians by watching the video ($F_{(1,138)} = 4.860$, $P < .001$, $\eta_p^2 = 0.11$), but they did not change their attitude toward psychologists ($P = .146$). Participants who watched the inter-professional video considered IPC to be more important than participants who watched the mono-professional video ($t_{(138)} = -7.954$; $P < .001$; $d = 1.354$). Finally, the inter-professional video led to better performance in the knowledge test ($t_{(138)} = -2.285$; $P = .024$; $d = 0.04$).

CONCLUSION: Inter-professional videos showing explicitly the appearance of experts from different professions come along with several advantages. We discuss the implications of their application in educational practice.

TRIAL REGISTRATION: The study was pre-registered on the pre-registration platform AsPredicted (aspredicted.org) before we began data collection (registration number: #33143). The pre-registration document can be accessed via the following link: <https://aspredicted.org/blind.php?x=gd5hd8>.

KEYWORDS: Inter-professional collaboration, inter-professional education, medical students, video, experimental study, deep brain stimulation, Parkinson's disease

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Background

In the health-care sector, inter-professional collaboration (IPC) is an important requirement for patient safety¹ and for a high quality of patient care.^{2,3} Therefore, the implementation of inter-professional training in medical education is continually more in demand.^{4–6} Many patients are in contact with representatives from several health professions, and especially many chronic patients have a need for both medical and psychological support. Patients with chronic diseases have often co-morbid illnesses—as is the case for patients with Parkinson's disease (PD). PD “is associated with

substantial physical and mental co-morbidity” (p. 1).⁷ The cardinal symptoms in PD are motor symptoms (tremor, bradykinesia, rigidity, and postural instability).⁸ In addition, PD is often associated with non-motor symptoms like autonomic dysfunctions⁹ and/or psychiatric conditions like dementia, depression, and anxiety.^{7,10} Some treatment options, like deep brain stimulation (DBS), are very sophisticated and should be accompanied by an inter-professional team. DBS is a neurosurgical procedure used to alleviate symptoms of PD that involves the implantation of remote-controlled electrodes into certain brain areas.¹¹ Since this surgery often comes



along with strong anxiety¹² and alterations of affect,¹³ inter-professional treatment, including psychologists for example, is recommended.¹⁴ This example illustrates the importance of smooth IPC between medical doctors and psychologists in clinical practice.

Ward et al¹⁵ have requested that “Psychologists must embrace their identity as health professionals and engage their learners in IPE [interprofessional education] so that the emerging cognitive schemata of healthcare that is developed includes the profession of psychology” (p. 250). These authors are concerned that otherwise “healthcare teams and health professionals will not understand the value, roles, or potential contributions of psychologists in enhancing patient care outcomes.” (p. 250). At first glance, this concern seems rather surprising, as the medical and psychological professions are already somewhat associated. Psychologists have been working in medical schools in clinical (eg, clinical intervention, diagnosis) as well as non-clinical fields (eg, research, teaching) for more than 100 years.¹⁶ However, psychologists are not necessarily directly involved in IPE activities. The *Interprofessional Education Collaborative*, for example, developed their first report about the core competencies for collaborative practice in 2011 without involving psychologists at all. Only the updated version from 2016 integrated input from the American Psychological Association.¹⁷ Even though IPE settings are more and more common in undergraduate medical education, only a few IPE programs¹⁷⁻²⁰ explicitly address the IPC among medical students and students of psychology. But there is great demand for IPE settings that integrate psychological and medical perspectives.²¹

Videos in medical education

One approach toward integrating psychological and medical perspectives in an IPE context is the provision of educational videos. Videos are already widely used in health communication^{22,23} and medical education, because they are an illustrative teaching format^{24,25} and are effective for teaching procedural knowledge.^{26,27} Recent findings indicate that video formats show great potential for the acquisition of inter-professional competences²⁸ and are considered to be relevant for inter-professional learning. This can be explained on the basis of Bandura’s social learning theory, especially with regard to the fact that observational learning is suitable for the acquisition of social behavior.^{29,30} The observation of successful communication among professionals from different fields could therefore have an impact on both the acquisition of knowledge and the attitude toward interprofessional work. Furthermore, videos provide learners with the opportunity to capture the big picture³¹ and therefore to develop metacognitive competences that are relevant for IPC.³² At the same time, the protagonists’ professional identity influences how information is processed by the viewers.³³ Videos are relatively easy to implement and could provide the opportunity for students to experience medical and

psychological role models in related clinical settings. In a previous study,²⁸ medical and physiotherapy students watched the same video that was interprofessional in 2 ways: The topic truly required an interprofessional approach, and protagonists from 2 different health professions appeared as role models. So far it has been unclear whether it is sufficient for making viewers learn about IPC and improving their attitude toward IPC and the collaborating professions simply to have the topic of the video be interprofessional, or if it is additionally necessary to have experts from multiple different professions explicitly appear in the video. To answer this research question, we investigated the impact of 2 different presentation formats in a medical video that dealt with a highly interprofessional topic: The procedures and treatments for DBS surgery³⁴ for patients with PD.³⁵ The 2 conditions differed only in the video’s presentation format: While 1 video presented a surgical procedure and discussion about this surgery among physicians only (mono-professional condition), the other video used the same material but additionally included a psychologist in the discussion (inter-professional condition).

Hypotheses

Based on social learning theory^{29,30} we hypothesized that presentation format (mono-professional vs inter-professional) would have an impact on people’s attitudes toward IPC. We hypothesized that the attitude of participants in the inter-professional condition toward inter-professional interaction (Hypothesis 1a) and inter-professional learning (Hypothesis 1b) would improve more than that of participants in the mono-professional condition.

Furthermore, we hypothesized that the presentation format would have an impact on the evaluation of the videos. The mono-professional presentation is more consistent with medical students’ previous perspective and requires less mental effort.³⁶ An inter-professional video, in contrast, provides different perspectives, and explicitly observing role-models from different professions might therefore be considered more vivid and concrete. Thus, we hypothesized that the video in the inter-professional condition would be evaluated as more entertaining (Hypothesis 2a) and more illustrative of inter-professional collaboration (Hypothesis 2b) than in the mono-professional condition.

DBS is pertinent for psychologist as well as for physicians. In both videos psychological as well as medical perspectives were explicitly presented (if only by physicians in the mono-professional condition). Thus, we hypothesized that the attitude of participants in both conditions would improve toward psychologists and toward physicians by watching the video (Hypothesis 3a). As the viewers in the inter-professional condition were more clearly and more obviously confronted with both perspectives by observing role-models from both professions, we also hypothesized that this improvement would be

stronger in the inter-professional condition than in the mono-professional condition (Hypothesis 3b).

Moreover, we assumed that the presentation format would have an impact on the evaluation of the importance of IPC. Since the participants explicitly observed experts from different professions, we hypothesized that participants in the inter-professional condition would assess IPC's importance to be greater than participants in the mono-professional condition (Hypothesis 4).

Finally, we hypothesized that the presentation format would have an impact on the evaluation of psychological support during treatment. According to Xiao and Bavel,³⁷ even implicit devaluation of a social outgroup disappeared when 2 groups were presented as being cooperative (instead of competitive). The inter-professional video format made the relevance of cooperation more evident than the mono-professional video. We hypothesized that participants in the inter-professional condition would evaluate psychological support during treatment more positively than participants in the mono-professional condition (Hypothesis 5) after watching the video.

The perception of a video as entertaining might foster knowledge acquisition.³⁸ A positive affective state helps encoding and storing information^{39,40} and thus may in turn facilitate knowledge acquisition. Based on these assumptions, we posed an open research question to examine whether there is an impact of presentation format on knowledge acquisition.

Methods

Study design

The study had a mixed design with presentation format (mono- vs inter-professional) as between-group factor and pre/post-comparison as within-group factor. Attitude toward interprofessional interaction and learning, evaluation of the entertaining and illustrative character of the video, attitude toward physicians and psychologists, importance of IPC, evaluation of psychological treatment support, and knowledge acquisition served as dependent variables.

Participants

A total of 288 participants were recruited from the mailing list of the online video platform *Sectio chirurgica* (www.sectio-chirurgica.de).⁴¹ They followed a link that was addressed specifically to medical students, pointing out that participation was voluntary and anonymous. About 202 participants completed the questionnaire, but 60 failed the manipulation check that asked which professions were represented in the video that the participants had seen. This relatively high number of people who failed the manipulation check is quite typical for online studies that use videos as stimulus material⁴² as some

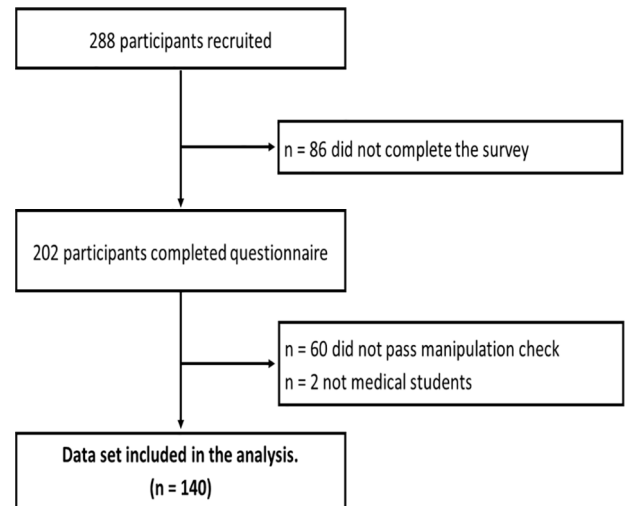


Figure 1. Flow diagram.

participants lack the necessary motivation to concentrate sufficiently on the contents. Two participants were excluded from the analysis as they were not medical students. Data of 140 participants thus remained for analysis (see Figure 1): 74 participants were in the mono-professional condition (40 females, 34 males) and 66 (41 females, 25 males) in the inter-professional condition. The participants' medical training ranged between the first and the tenth semesters, with most of the participants in earlier semesters ($M = 4.15$; $SD = 2.64$). Their mean age was 23.13 years old ($SD = 3.53$). Participants could win vouchers for an online shop.

Procedure

The study was conducted online in January 2020. Prior to the video presentation participants completed a demographic questionnaire that asked for their education history, age, and gender. Participants' professional identification, attitude toward psychological and medical treatment, and rating of interprofessional learning and interaction³⁶⁻³⁸ were also measured. Participants then watched a shortened episode from the medical online video platform *Sectio chirurgica* about a DBS surgical procedure, but the video differed in the 2 conditions. In the *mono-professional* condition the video showed the essential elements of the procedure and 2 physicians talking about DBS for PD. The *inter-professional* condition was identical to the mono-professional condition, but with additional comments by a psychologist. All of the professionals shown in the videos were male professors from the local university. They were all well known for their scientific reputation so that both professions were presented with the same level of status, power, and expertise.

After watching the video, participants again filled in questionnaires on their attitude toward psychological and medical treatment and their rating of inter-professional learning and interaction. They were also asked to evaluate the video's entertainment value and its illustration of IPC. Then participants

Table 1. Video evaluation scale.

| ENTERTAINMENT | 1 (I DON'T AGREE AT ALL) | 2 | 3 | 4 | 5 (I FULLY AGREE) |
|--|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| I thought the video was entertaining. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found the video exciting. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The video was thrilling. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I found the video diverting. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I had fun watching this video. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I was fascinated by this video. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Illustrative character. | | | | | |
| The video provided good insight into the cooperation of different professions. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Watching the video prepared me for an interprofessional cooperation with psychologists. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| I think the video gave me a better understanding of the actions and thinking of other professionals. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Table 2. Attitude toward the professions.

| I THINK THAT IN THE IN THE CONTEXT OF DBS, THE SUPPORT OF THE PATIENT BY A DOCTOR/A PSYCHOLOGIST IS. . . | | | | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Useless | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Useful |
| Harmful | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Beneficial |
| Unimportant | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Important |
| A bad thing | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | A good thing |

took a knowledge test. Finally, participants were informed about the aim of the study and the manipulation that was applied.

Material and measurements

The videos were shortened versions of a full episode, edited to 8:22 min videos. The inter-professional condition additionally presented an interview with a psychologist conducted by a medical doctor, which provided a psychological position to DBS treatment. The interview video had been cut in between at various to the topic relevant points in the other film (4:44 min in total).

Attitude toward IPC. Attitudes toward IPC interaction and learning were measured by the IP-interaction and IP-learning subscales⁴³⁻⁴⁵ from the University of the West of England Interprofessional Questionnaire (UWE-IP). Both subscales comprised 9 items each that were measured on 5-point Likert scales. Reliability of these scales were Cronbach's alpha=0.712 (IP-interaction) and Cronbach's alpha=0.823 (IP-learning), respectively.

Evaluation of the video. The participants' evaluation of the video was measured by 2 scales. The first scale rated the

entertainment value of the video with 6 items. Reliability of this scale was Cronbach's alpha=0.824. The second scale rated how well the video illustrated IPC with 3 items with a reliability of Cronbach's alpha=0.889. All items were measured on 5-point Likert scales (Table 1).

Attitude toward the professions. Participants' attitudes toward the medical and psychological professions was measured with an adapted version of Marteau et al scale⁴⁶ with 4 items on 7-point Likert scales, with a separate assessment of the medical and the psychological professions (see Table 2). Reliability of this scale was Cronbach's alpha=0.948.

Evaluation of the importance of IPC. A scale was created to evaluate the importance of IPC for DBS. This scale contained 6 items on a 5-point Likert scale (see Table 3). Reliability of this scale was Cronbach's alpha=0.815.

Evaluation of psychological support during treatment. A scale with 4 items was created to evaluate the psychological support during treatment. Reliability of these scales were Cronbach's alpha=0.675. Due to this low level of reliability,^{47,48} we did not include this scale in the analysis. Hypothesis 5 could therefore not be tested.

Table 3. Evaluation of the importance of IPC.

| (I DON'T AGREE AT ALL) | 1 | 2 | 3 | 4 | 5 (I FULLY AGREE) |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| The patient's preparation for a neurosurgical intervention should be carried out both by physicians and psychologists. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| A close cooperation between psychologists and doctors is important for patient's complete information. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Inter-professional cooperation between psychologists and doctors is beneficial for an ideal therapeutic outcome. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The involvement of psychological specialists to care for patients during treatment makes sense for patients. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The involvement of psychological specialists to care for patients during treatment is helpful for patients. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Patients who have received DBS should be monitored afterwards by psychologists. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Knowledge acquisition. In the knowledge test the participants had to judge 7 statements as correct or incorrect. In addition, they were asked 2 multiple choice questions (see Table 4). For each question the level of confidence for each answer was also rated on a scale ranging from 1 (very unconfident) to 6 (very confident). To reduce the probability of guessing, a balanced negative marking method was used⁴⁹ where each answer was analyzed for correctness (+1 = correct answer; -1 = wrong answer) and multiplied with the confidence score. The questions of the knowledge test included only content that was shown in identical form in both videos.

Statistical analysis

We performed data analysis using IBM SPSS 22 for Windows (IBM Corp., Armonk, NY). Internal consistency of all scales was determined by calculating Cronbach's alpha (α). We tested age distribution with a *t*-test and gender distribution with a chi-squared test. To test the assumptions of Hypotheses 1 and 3, mixed-design ANOVAs with condition as between-group factor and the pre/post-comparison as within-group factor were calculated. To test Hypotheses 2 and 4, as well as for the open research question, independent samples *t*-tests were used.

All data are reported as means (M) \pm standard deviations (SD), unless otherwise noted. The level of significance was set at $P < .050$. Cohen's *d* and partial eta squared (η^2_p) are reported as indicators of effect size.

Results

Equivalence of student groups

We controlled the age and gender distributions of the 2 conditions. They did not differ from each other in age ($t_{(138)} = 0.406$; $P = .686$) or gender ($\chi^2 = 3.457$; $P = .063$).

Attitude toward IPC

Hypothesis 1a stated that the attitude of participants in the inter-professional condition toward inter-professional

interaction would improve more than that of participants in the mono-professional condition. The data did not support this hypothesis. We found only a significant main effect for time (Pre: M = 3.48, SD = 0.56; Post: M = 3.59, SD = 0.51; $F_{(1,137)} = 5.176$, $P < .024$; $\eta^2_p = 0.036$), but no significant interaction effect between time and condition ($P = .223$).

Hypothesis 1b assumed that the students' attitudes toward IPC learning would improve by observing the inter-professional video. Again, there was a significant effect for time (Pre: M = 3.79, SD = 0.87; Post: M = 3.91, SD = 0.80; $F_{(1,137)} = 6.482$, $P = .012$, $\eta^2_p = 0.045$), but no significant interaction effect for time x condition ($F_{(1,137)} = 0.364$, $P = .547$).

Evaluation of the video

We hypothesized that the video in the inter-professional condition would be evaluated as more entertaining (Hypothesis 2a) and more illustrative of IPC (Hypothesis 2b) than in the mono-professional condition. Hypothesis 2a was supported by the data; participants of the inter-professional condition evaluated the video as more entertaining (M = 2.65; SD = 0.45) than participants of the mono-professional condition (M = 2.47; SD = 0.49; $t_{(138)} = -2.227$; $P = .028$; $d = 0.38$).

Hypothesis 2b was supported by the data as well. The inter-professional video was reported to be more illustrative of IPC (M = 3.20; SD = 1.03) than the mono-professional video (M = 2.17; SD = 0.92; $t_{(138)} = -6.269$; $P < .001$; $d = 1.06$).

Attitude toward the professions

We hypothesized that the attitudes of participants in both conditions would improve toward psychologists and toward physicians by watching the video (Hypothesis 3a). We also assumed that this improvement would be stronger in the inter-professional condition than in the mono-professional condition (Hypothesis 3b).

The data partly supported Hypothesis 3a. The attitudes of participants did improve toward physicians by watching the

Table 4. Knowledge test.

| MULTIPLE CHOICE | MULTIPLE ANSWERS CAN BE CORRECT | | CONFIDENCE RATING | | | | | |
|--|---------------------------------|--------------------------|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | | | VERY UNCONFIDENT ——— VERY CONFIDENT | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 |
| As imaging techniques are not sufficient for optimal trajectories planning, additional methods need to be applied. Which ones? | Electrophysiological methods | <input type="checkbox"/> | | | | | | |
| | Audiometric methods | <input type="checkbox"/> | | | | | | |
| | Electroneurographic methods | <input type="checkbox"/> | | | | | | |
| | Transcranial Doppler methods | <input type="checkbox"/> | | | | | | |
| The cardinal symptoms of Parkinson's disease are called the triad. These include: | Amnesia | <input type="checkbox"/> | | | | | | |
| | Akinesia | <input type="checkbox"/> | | | | | | |
| | Aphasia | <input type="checkbox"/> | | | | | | |
| | Mutism | <input type="checkbox"/> | | | | | | |
| | Rigor | <input type="checkbox"/> | | | | | | |
| | Tremor | <input type="checkbox"/> | | | | | | |
| FORCED CHOICE | PLEASE CHOOSE | | CONFIDENCE RATING | | | | | |
| | CORRECT | WRONG | NOT AT ALL ——— ABSOLUTELY | | | | | |
| | | | | | | | | |
| About 80% of patients suffering from Parkinson's disease are treated with DBS. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| About 80% of deep brain stimulation surgeries are performed on patients with Parkinson's disease. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| To avoid cerebral damage, gyri should be avoided in trajectory planning. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| The symptoms of akinesia and rigor can easily be reduced by stimulating fibrous tracts in the zona incerta. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Depression in Parkinson's disease is caused by cerebral cell death. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Tremor can be reduced by stimulating the anterior subthalamic nucleus. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

video (Pre: $M=6.48$, $SD=0.75$; Post: $M=6.75$, $SD=0.55$; $F_{(1,138)}=4.860$, $P<.001$, $\eta^2_p=0.11$), but their attitudes toward psychologists did not change significantly (Pre: $M=2.22$, $SD=0.55$; Post: $M=2.41$, $SD=1.66$; $F_{(1,138)}=2.135$, $P=.146$). The assumptions of Hypothesis 3b were not supported by the data: Participants' positive attitudes toward physicians increased more strongly in the mono-professional condition ($F_{(1,138)}=4.151$, $P=.044$, $\eta^2_p=0.03$) than in the inter-professional condition (see Figure 2). No interaction-effect was found for attitude toward psychologists ($F_{(1,138)}=0.392$, $P=.532$).

Evaluation of the importance of IPC

We hypothesized that participants in the inter-professional condition would assess the importance of IPC for DBS to be greater than participants in the mono-professional condition

(Hypothesis 4). The data supported this hypothesis. Participants who watched the inter-professional video considered IPC to be more important ($M=4.18$; $SD=0.48$) than participants who watched the mono-professional video ($M=3.53$; $SD=0.48$; $t_{(138)}=-7.954$; $P<.001$; $d=1.35$).

Knowledge acquisition

After watching the video, participants in the inter-professional condition performed better in the knowledge test ($M=8.32$; $SD=10.45$) than those in the mono-professional condition ($M=4.25$; $SD=10.54$; $t_{(138)}=-2.285$; $P=.024$; $d=0.04$).

Discussion

Medical IPE videos can be used independently of time and location to give learners the opportunity to gather relevant knowledge from different professional perspectives.⁵⁰ We

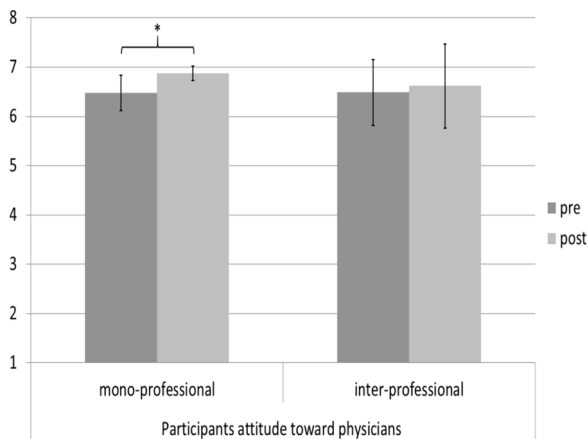


Figure 2. Participants' attitudes toward physicians before and after watching the video.

investigated whether it is sufficient if the *topic* of the video itself is inter-professional (though being presented by representatives of only 1 profession), or if it is necessary for experts from different professions explicitly to appear in the video. The data collected in this study supported some but not all of our hypotheses. We therefore cannot provide final answers to the research questions, though some of our findings are valuable. On the one hand, our findings support the idea that the explicit appearance of experts from different professions is superior to a mono-professional presentation. We found that the inter-professional video was perceived to be more entertaining and more illustrative. This finding is in line with other studies that found that students perceived learning under the supervision of experts from professions other than their own to be rewarding and beneficial.⁵¹ Such experiences also open new perspectives for learners at all levels.⁵² A previous study³⁸ found that the acquisition of clinical knowledge was mediated by the entertainment aspect of a video. In the study presented here we also found that participants in the inter-professional condition learned more than the participants in the mono-professional condition. In addition, we found that participants in the inter-professional condition perceived IPC in the clinical context of DBS to be more important than participants in the mono-professional condition. This is an encouraging finding, as the main aim of IPE interventions is to foster IPC in clinical practice. However, based on this result, we cannot go so far as to say that the students' attitudes would actually result in more inter-professional behavior in clinical practice.

On the other hand, we have findings that did not support the idea that inter-professional videos are better for teaching inter-professional perspectives. Regarding the participants' attitudes toward IPC learning and IPC interaction, we found no superiority of the inter-professional video compared to the mono-professional video. Both videos were equally effective in fostering positive attitudes toward IPC learning and IPC interaction. Based on this finding, it seems that for fostering positive attitudes toward IPE, the most important

aspect is that the topic of the video itself is inter-professional. This was the case in the present investigation using the topic DBS for patients with PD. However, according to our results, the additional explicit appearance of a representative of a second profession does not seem to be necessary to improve the attitude.

In the inter-professional condition, participants' attitudes toward physicians improved less than in the mono-professional condition. In addition, we found that the video presentation only affected participants' attitude toward physicians, but not toward psychologists. One reason for this could be that, due to the fact that in the mono-professional condition, the physicians appeared as the only responsible actors, the impression was created that they, and only they, perform particularly great medical services. Especially medical students as prospective doctors could be susceptible to this perception. In the inter-professional condition, however, the physicians had to share part of their fame with the psychologists. Since all the participants were medical students, these findings must be interpreted with caution. We do not know to what extent their own professional identity had an impact on the findings. Research has shown that members of one's own social group are often rated more favorably than members of other groups.⁵³ In future studies, medical as well as psychological students should participate to control for the influence of participants' own professional identity.

Limitations

Although we consider our study to be a contribution to the development and use of IPE videos in medical education, we need to discuss some limitations. First, all of the participants were medical students, and most of them were at an early stage of their training. Thus, we cannot generalize these results to other healthcare-education populations. Moreover, although the videos showed experts from different professions contributing their profession-specific knowledge and perspectives, they did not really interact with each other. Future studies should make use of other topics that display a more obvious interaction among different healthcare professions.

Also, the protagonists in our videos were exclusively men. Further studies could investigate the extent to which the gender of the health professionals involved has an impact on the perceptions of the viewers. In addition, the videos in both conditions differed regarding their length. Even though the knowledge test only asked for content that was identical in both videos, participants in the inter-professional condition had more time to deal with the topic in general.

Finally, it is still unclear how well these effects on inter-professional learning would transfer to inter-professional everyday practice. Findings which are reported about this question are based on active IPE programs and show rather low or inconsistent results.^{2,3,54-56} For future research,

long-term studies are required to investigate to what extent IPE videos can affect real clinical outcomes.

Conclusion

This experimental study compared 2 possible IPE video formats to foster inter-professional learning in healthcare education. To represent IPC, we used the example of collaboration among physicians and psychologists. An advantage of IPE videos is that they are easy to implement in existing curricula, or they can be used as add-ons to curricular training, to illustrate and foster IPC. Although the data did not support all of the hypotheses, we may conclude that the explicit appearance of experts from different professions in an educational video had a positive influence on how medical students perceived the video and how they evaluated IPC. The inter-professional video also led to better performance on a knowledge test of the medical students in this study.

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Authors' Contributions

JG: Conceptualization (equal), Data curation (lead), Formal analysis (lead), Investigation (lead), Methodology (equal), Resources (equal), Software (equal), Validation (equal), Visualization (lead), Writing-original draft (equal), Writing review & editing (equal).

JK: Conceptualization (equal), Formal analysis (supporting), Funding acquisition (lead), Investigation (supporting), Methodology (supporting), Project administration (lead), Supervision (lead), Validation (lead), Writing-original draft (supporting), Writing-review & editing (supporting).

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Ethics Approval and Consent to Participate

This research was performed in accordance with the Declaration of Helsinki. This study had full approval by the ethics

committee of *Leibniz-Institut für Wissenmedien* (approval number: 16DHL1030). All participants took part voluntarily and anonymously. They gave written informed consent and were informed about privacy protection, their right to terminate participation at any time without disadvantages, and about the general purpose of the study.

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