Geschlechterunterschiede bei Schülerinnen und Schülern: Der Zusammenhang von traditionellen Geschlechterrollen und Geschlechterstereotypen mit Kompetenzen und Interessen

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INHALTSVERZEICHNIS

1 EINLEITUNG

In unserer Gesellschaft sind auch heutzutage immer noch Einstellungen darüber verbreitet wie sich Jungen und Mädchen zu verhalten haben und welche Interessen und welche Fähigkeiten sie besitzen beziehungsweise besitzen sollen. Diese Einstellungen werden in Form von traditionellen Geschlechterrollen und Stereotypen ausgedrückt. Neben diesen Einstellungen zeigen empirische Studien auch immer wieder, dass im Kindes- und Jugendalter Interessens- und Kompetenzunterschiede zwischen Jungen und Mädchen existieren (PISA: OECD, 2016, 2019; Reiss, Weis, Klieme, & Köller, 2019; IGLU: Hußmann et al., 2017; Mullis, Martin, Foy, & Hopper, 2017, TIMSS: Mullis, Martin, Foy, & Hooper, 2016; Interesse: Su, Rounds, & Armstrong, 2009). Vor diesem Hintergrund behandelt die vorliegende Arbeit die Frage, ob traditionelle Geschlechterrollen und Stereotype mit Geschlechterunterschieden in Interessen und Kompetenzen im schulischen Bereich in Beziehung stehen.

Vor allem in der Schule werden Grundlagen geschaffen und Schlüsselkompetenzen erlernt auf die Menschen ihr Leben lang zurückgreifen (Europäische Kommision, 2018). Die Zeit zwischen Schuleintritt und –austritt ist für Kinder und Jugendliche extrem prägend. In diese Zeit fällt auch die Entwicklung des Verständnisses von Geschlechterrollen und Stereotypen (Ruble, Martin, & Berenbaum, 2006), welche eine geschlechtersegregierte Welt aufrechterhalten. Diese Segregation wird vor allem beim Betrachten der Studienfach- und Berufswahl deutlich, wenn Frauen sich mit großer Mehrheit für soziale, humanwissenschaftliche und im Dienstleistungssektor angesiedelte Berufe entscheiden, während mathematische, informatische, naturwissenschaftliche und technische Berufe (sogenannte MINT-Berufe), welche häufig auch mit höherer Prestige und Entlohnung verbunden sind, immer noch mit Mehrheit von Männern gewählt werden (Bechmann et al., 2013; Hausmann & Kleinert, 2014).

In den folgenden Kapiteln wird zunächst der theoretische Hintergrund erläutert, auf den sich die späteren Annahmen aus drei Beiträgen stützen. Im weiteren Verlauf wird auf die einzelnen Konstrukte, die für diese Arbeit relevant sind, eingegangen und der bisherige Forschungsstand aufgearbeitet. Basierend auf diesen Erkenntnissen werden drei Forschungsfragen aufgezeigt, welche aufgrund der Ergebnisse der durchgeführten Studien beantwortet werden. Im Abschluss werden die Ergebnisse diskutiert, Limitationen dieser Arbeit aufgeführt und weiterführende Forschungsfragen erläutert.

Am Ende soll durch diese Dissertationsschrift aufgezeigt werden, welche Einflüsse von Geschlechterrollen und Geschlechterstereotypen auf schulische Outcomes wie Kompetenzen und Interessen von Schülerinnen und Schülern ausgehen können.

2 THEORETISCHER RAHMEN

Traditionelle Geschlechterrollen und Stereotype über Jungen und Mädchen, beziehungsweise Männer und Frauen, sind für das gesellschaftliche Zusammenleben relevante Konzepte, sie weisen Menschen bestimmte Aufgaben zu, verringern Unsicherheiten, führen aber auch zu Vorurteilen und Diskriminierungen (Eagly & Wood, 2012; Ellemers, 2018). Gegenstand dieser Arbeit sind solche negativen Auswirkungen in Bezug auf Schülerinnen und Schüler.

In Abbildung 1 wird schematisch dargestellt auf welchen Annahmen die Fragestellungen dieser Arbeit beruhen. Zunächst wird implizit angenommen, dass bestehende Geschlechterrollen und Geschlechterstereotype in der Gesellschaft die individuellen Einstellungen von Schülerinnen und Schülern sowie auch die Einstellungen der Lehrkraft, beeinflussen. Diese Einstellungen sollten sich wiederum auf schulische Outcomes, im Fall dieser Arbeit auf die Kompetenzen und Interessen von Schülerinnen und Schülern auswirken und so einen Beitrag zu Geschlechterunterschieden leisten. Während die Wirkmechanismen in den durchgeführten

Studien nicht untersucht werden konnten, bestehen dennoch Annahmen darüber, auf die in den nächsten Abschnitten eingegangen wird.
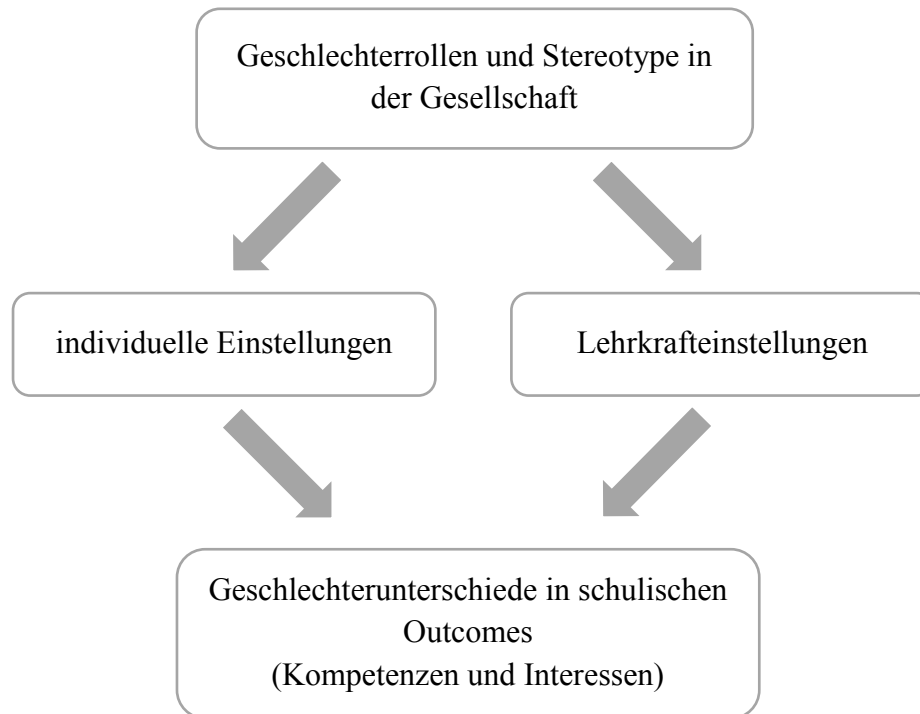
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┌─────────────────────────────────┐
│  Geschlechterrollen und Stereotype in │
│        der Gesellschaft          │
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┌──────────────────────┐      ┌──────────────────────┐
│ individuelle Einstellungen │      │  Lehrkrafteinstellungen │
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┌─────────────────────────────────┐
│ Geschlechterunterschiede in schulischen │
│           Outcomes              │
│    (Kompetenzen und Interessen) │
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Abbildung 1. *Schematische Darstellung der angenommenen Wirkungsrichtung von Geschlechterrollen- und stereotypen.*

Konkret wird durch diese Dissertationsarbeit unter anderem untersucht, ob auf der individuellen Ebene Einstellungen gegenüber Geschlechterrollen von Schülerinnen und Schülern mit Geschlechterunterschieden in deren Kompetenzen und Interessen zusammenhängen. Außerdem beschäftigt sich eine weitere Fragestellung damit, ob auf der Kontextebene stereotype Überzeugungen der Lehrkraft mit Geschlechterunterschieden in den Kompetenzen von Schülerinnen und Schülern zusammenhängen.

2.1 GESCHLECHTERROLLEN UND STEREOTYPE IN DER GESELLSCHAFT

Eine grundlegende Theorie, die Geschlechterrollen und deren Entwicklung in der Gesellschaft beschreibt, wurde von Alice Eagly als die soziale Rollentheorie formuliert (1987). Die Theorie erklärt die Entstehung und Weitergabe von Geschlechterrollen und findet seit ihrer Entstehung

ein breites Anwendungsfeld in der Sozialpsychologie. Die aktuelle Version der sozialen Rollentheorie (Eagly & Wood, 2012; Eagly, Wood, & Diekman, 2000) basiert auf der Annahme, dass biologische Bedingungen von Frauen und Männern, wie Körperbau und die Fähigkeit Kinder zu gebären und zu stillen, im Zusammenspiel mit gesellschaftlichen Bedingungen, die Arbeitsteilung zwischen den Geschlechtern[1] ursprünglich festigten. Diese Arbeitsteilung ändert sich in dem Maße, in dem sich die Ansprüche der Arbeit oder die gesellschaftlichen Gegebenheiten ändern. So können körperlich anspruchsvolle Arbeiten zum Beispiel durch Maschinen ersetzt und Kinderbetreuung vergesellschaftlicht werden. Durch die Arbeitsteilung zwischen den Geschlechtern formen sich, laut sozialer Rollentheorie, bestimmte Geschlechterrollen. Diese Geschlechterrollen bilden Annahmen darüber, welche sozialen Rollen Männer und Frauen in der Gesellschaft einnehmen sollen. Eine traditionelle Frauenrolle wäre zum Beispiel die der Mutter und der Hausfrau, während eine traditionelle Männerrolle die des Versorgers der Familie darstellt. Durch Geschlechterrollen werden Verhalten, Emotionen und Kognitionen beeinflusst und durch Sozialisation werden die Arbeitsteilung und das Rollenverständnis aufrechterhalten. Die Einstellungen gegenüber Geschlechterrollen können zum einen egalitär sein, das heißt die Gleichstellung der Geschlechter befürworten, oder traditionell sein, das heißt die Geschlechtertrennung befürworten.

Während Einstellungen gegenüber Geschlechterrollen die gesamtgesellschaftliche Rolle von Frauen und Männern beinhalten, ergeben sich Geschlechterstereotype aus Annahmen darüber welche konkreten Verhaltensweisen und Fähigkeiten Männer und Frauen beziehungsweise Jungen und Mädchen zeigen sollten oder auch tatsächlich zeigen (Prentice & Carranza, 2002). Stereotype sind dabei oft negativ einer bestimmten Gruppe gegenüber besetzt, korrelieren meistens zumindest mit tatsächlichen Verhalten, stellen aber in jeder Hinsicht eine

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[1] Die Autorin ist sich darüber bewusst, dass Geschlecht nicht binär ist und dass das biologische Geschlecht und die Geschlechtsidentität nicht übereinstimmen müssen. Die meisten Studien zu diesem Thema zum derzeitigen Zeitpunkt untersuchen Geschlecht nur binär.

Übergeneralisierung des Verhaltens dar (Stangor, 2009). Stereotype beinhalten sowohl deskriptive, wie auch präskriptive Elemente (Burgess & Borgida, 1999; Gill, 2004; Koenig, 2018; Rudman & Glick, 2008). Nach Rudman und Glick (2018) beinhalten Stereotype immer deskriptive Elemente (z. B. Jungen sind größer als Mädchen), einige Stereotype beinhalten allerdings auch präskriptive Elemente (z. B. Jungen sollten sich für Technik interessieren). Die Verletzung von deskriptiven Stereotypen führt normalerweise nur zu Überraschung bei anderen Menschen und einer Neubewertung der erhaltenen Information, bindet also kognitive Ressourcen, während die Verletzung eines präskriptiven Stereotyps zu Vorurteilen führen und soziale Bestrafungen nach sich ziehen kann (Gill, 2004; Rudman & Glick, 2008). Menschen sollten also vor allem daran interessiert sein präskriptive Stereotype nicht zu verletzen, wenn sie in ihrer Umgebung mit Sanktionen dafür rechnen müssen.

Kinder entwickeln schon früh mit etwa zwei bis drei Jahren ein Bewusstsein über Stereotype, welches sich zum konkreten Wissen über Stereotype bis zum Beginn der Grundschule entwickelt (Ruble et al., 2006), auch eigene erste Vorstellungen über Geschlechterrollen entwickeln sich in der Vorschulzeit (Baker, Tisak, & Tisak, 2016). Während dieses Wissen und auch die Anwendung von Stereotypen während der Grundschulzeit zunehmen, nimmt auch das Wissen darüber zu, dass Stereotype nicht immer der Wahrheit entsprechen (Ruble et al., 2006). Kinder und Erwachsene sehen Rollenverletzungen bei Männern beziehungsweise Jungen als schwerwiegender an als bei Frauen beziehungsweise Mädchen, außerdem präferieren Jungen stärker als Mädchen gleichgeschlechtliche und geschlechtertypische Aktivitäten (Ruble et al., 2006). Zudem werden Stereotype von Kindern und Erwachsenen stärker auf Kinder angewendet als auf Erwachsene (Ruble et al., 2006), Kinder sind also besonders durch zu Diskriminierung führende Stereotype gefährdet. Da in dieser Arbeit Kinder zwischen der vierten und siebten Klasse untersucht werden, wird aus dieser Entwicklungsperspektive ersichtlich, dass Schülerinnen und Schüler zu diesen Zeitpunkten ein breites Wissen über Stereotype und eigene Einstellungen gegenüber Stereotypen und Geschlechterrollen entwickelt

haben sollten, sehr empfänglich für Stereotype sind und Stereotype oft auf sie angewendet werden.

Die Messung von Stereotypen und Geschlechterrollen erfolgt über verschiedene Instrumente. Während die Messung von Einstellungen gegenüber traditionellen Geschlechterrollen meistens explizit durch Fragebögen erfolgt, wird die Zustimmung zu Stereotypen auch implizit erfasst (z. B. Steffens & Jelenec, 2011). Das heißt, es wird angenommen, dass bestimmte Einstellungen explizit nicht ausgedrückt werden, weil diese zum Beispiel nicht der sozialen Norm entsprechen oder nicht im unmittelbaren Bewusstsein sind. Durch implizite Messung, zum Beispiel über Reaktionszeiten, können solche Einstellungen jedoch sichtbar gemacht werden, zeigen aber nicht immer die gleichen Muster und Korrelate wie explizit gemessene Stereotype (Stangor, 2009; Steffens & Jelenec, 2011; Steffens, Jelenec, & Noack, 2010). In den durchgeführten Studien dieser Dissertationsarbeit wurden sowohl Geschlechterrolleneinstellungen von Schülerinnen und Schülern sowie Geschlechterstereotype von Lehrerinnen und Lehrern explizit erfasst.

Geschlechterstereotype und traditionelle Geschlechterrollen befinden sich in westlichen Gesellschaften seit einigen Jahrzehnten im Wandel. Eagly und Kolleginnen und Kollegen (Eagly, Nater, Miller, Kaufmann, & Sczesny, 2020) untersuchten die Veränderung von Geschlechterstereotypen in den letzten Jahrzehnten in den USA. Während sich die stereotyp männliche Zuweisung agentischen Handelns in Bezug auf Männer und Frauen kaum veränderte, verstärkte sich das Stereotyp, dass Frauen kommunale Eigenschaften besitzen. Auch die stereotype Zuweisung von Kompetenz zeigte eine Veränderung von der Zuschreibung auf Männer hin zu einer weiblichen Zuschreibung. Bezüglich Einstellungen gegenüber Geschlechterrollen zeigte eine Studie von Dotti Sani und Quaranta (2017), dass in Ländern mit höherer sozialer Gleichheit Einstellungen von Schülerinnen und Schülern egalitärer sind als in anderen Ländern, wobei hierbei gefunden wurde, dass Mädchen egalitärer eingestellt sind als

Jungen und der Unterschied zwischen Jungen und Mädchen in egalitären Ländern größer ist als in traditionellen. An diesen Studien zeigt sich, dass einerseits eine Veränderung in den Einstellungen vorhanden ist, anderseits aber immer noch Stereotype feste Bestandteile der Gesellschaft sind und vor allem Jungen noch immer traditionelle Einstellungen vertreten.

In der Forschung werden verschiedene Korrelate von Geschlechterrollen und Geschlechterstereotypen diskutiert. Während sich Stereotype und Geschlechterrollen auch auf Freizeitverhalten, auf Lebensentscheidungen und auf die Berufswelt auswirken können (Athenstaedt, Mikula, & Bredt, 2009; Goble, Martin, Hanish, & Fabes, 2012; Heilman, Wallen, Fuchs, & Tamkins, 2004; Lamprecht, Wagner, & Lang, 2008; Vella, 1994; Weisgram, Bigler, & Liben, 2010), liegt der weitere Fokus dieser Arbeit auf den schulischen Bereich. Hierbei werden Zusammenhänge mit Kompetenzen und Interessen besondere Beachtung finden.

2.2 Geschlechterunterschiede in Kompetenzen und Interessen

In dieser Arbeit wird zum einen untersucht wie sich Stereotype und Geschlechterrollen auf Kompetenzen auswirken sowie auch wie sie sich auf Interessen von Schülerinnen und Schülern auswirken. Eine wichtige Frage im weiteren Verlauf dieser Dissertationsschrift wird sein, ob Geschlechterrolleneinstellungen und Stereotype nicht nur im Allgemeinen mit der Ausprägung von Kompetenzen und Interessen zusammenhängen, sondern ob diese auch im Besonderen Geschlechterunterschiede bedingen. Aus diesem Grund wird im Folgenden über Ergebnisse zu Geschlechterunterschieden in den Kompetenzen und Interessen von Schülerinnen und Schülern berichtet werden.

2.2.1 Geschlechterunterschiede in den Kompetenzen der Domänen Lesen und Mathematik

Kompetenzen in Mathematik und Lesen beziehungsweise sprachlichen Fähigkeiten während der Schulzeit sind wichtige Prädiktoren für den Bildungserfolg und die Teilhabe am

gesellschaftlichen Leben. Kompetenzen zu messen bedeutet nach Klieme und Hartig (2008) Fähigkeiten und die Bereitschaft diese anzuwenden im Blick auf konkrete spezifische Situationen und Aufgaben und im Hinblick auf den Transfer und Verallgemeinerung auf andere vergleichbare Situationen zu betrachten.

Schon in der letzten Hälfte des 20. Jahrhunderts befassten sich wissenschaftliche Studien mit unterschiedlichen Leistungen von Jungen und Mädchen in schulischen Kompetenzen (z. B. Felson & Trudeau, 1991; Skaalvik & Rankin, 1994; Wentzel, 1988). Besondere Aufmerksamkeit erhielten Geschlechterunterschiede aber vor allem durch internationale Vergleichsstudien ab Beginn des 21. Jahrhunderts. Im Folgenden werden Ergebnisse drei internationaler Large Scale Assessments vorgestellt: der PISA-, TIMS- und IGLU-Studien.

Die PISA-Studie (Programme for International Student Assessment) der OECD wird seit dem Jahr 2000 im drei Jahresturnus mit 15-jährigen Schülerinnen und Schülern in den OECD-Mitgliedsstaaten durchgeführt. Innerhalb dieser Studien werden in jeder Erhebung unter anderem die mathematischen und Lesekompetenzen der Jugendlichen erfasst.

Die TIMS-Studie (Trends in International Mathematics and Science) sowie die IGLU-Studie (Internationale Grundschul-Lese-Untersuchung) untersuchen Mathematik- und Lesekompetenzen zum Ende der Grundschulzeit.

Die PISA-Studie zeigt kontinuierlich international sowie auf Deutschland beschränkt, Geschlechterunterschiede zugunsten von Mädchen in den Lesekompetenzen von 15-jährigen Schülerinnen und Schülern. Der Unterschied bei PISA 2015 zwischen Jungen und Mädchen betrug 27 Punkte im internationalen Durchschnitt, in Deutschland war der Unterschied mit 21 Punkten etwas geringer (Weis, Zehner, Strohmaier, Artelt, & Pfost, 2016). Im Jahr 2018 stieg der Unterschied zwischen Jungen und Mädchen wieder etwas an mit international durchschnittlich 30 Punkten Unterschied und in Deutschland 26 Punkten (Weis et al., 2019). Im Vergleich zu früheren Studien (z. B. 2009 in Deutschland 40 Punkte) nahm die Differenz

zwischen Jungen und Mädchen im Lesen allerdings in den letzten Erhebungen durch einen Zuwachs der Lesekompetenz bei Jungen ab (Weis et al., 2016).

Der Geschlechterunterschied in der Mathematikkompetenz in den PISA-Studien besteht zwar zugunsten von Jungen, zeichnet sich aber nicht so klar ab wie im Lesen. Im Jahr 2015 lag der Unterschied zwischen Jungen und Mädchen international bei lediglich 8 Punkten, in Deutschland bei 17 Punkten (Hammer et al., 2016). In der Untersuchung im Jahr 2018 verringerte sich dieser Unterschied nochmal international auf 5 Punkte und in Deutschland auf 7 Punkte (Reinhold, Reiss, Diedrich, Hofer, & Heinze, 2019).

Die Betrachtung der Geschlechterdifferenz bei Viertklässlerinnen und Viertklässlern mithilfe der IGLU- und TIMS- Studien fällt ähnlich aus. Die IGLU-Studie 2011 berichtete international über eine Differenz zwischen Jungen und Mädchen im Lesen von 16 Punkten und in Deutschland von 8 Punkten (Bos, Bremerich-Vos, Tarelli, & Valtin, 2012), dieser Unterschied erhöhte sich im Jahr 2016 leicht international auf 18 Punkte und in Deutschland auf 11 Punkte (McElvany, Kessels, Schwabe, & Kasper, 2017).

In der TIMS-Studie 2011 wurden international keine Unterschiede zwischen Jungen und Mädchen in ihrer Mathematikkompetenz gefunden, in Deutschland allerdings eine signifikante Differenz von 8 Punkten zugunsten von Jungen (Brehl, Wendt, & Bos, 2012). Im Jahr 2015 lag der Unterschied international im Durchschnitt erneut bei einem Punkt und war damit nicht signifikant, in Deutschland verringerte sich die Geschlechterdifferenz auf 5 Punkte, was weiterhin einen signifikanten Unterschied zwischen Jungen und Mädchen darstellte (Wendt, Steinmayr, & Kasper, 2016).

An diesen Ergebnissen von internationalen Vergleichsstudien ist erkennbar, dass Geschlechterunterschiede bei Schülerinnen und Schülern in den Kompetenzen Lesen und Mathematik in verschiedenen Altersstufen, auch in der letzten Dekade, trotz einer Annäherung der Leistungen, weiterhin Bestand haben. Außerdem wird deutlich, dass die Unterschiede in

Deutschland häufig vom internationalen Mittelwert abweichen. Auch wenn die TIMS- und PISA-Studien nicht direkt miteinander vergleichbar sind, scheinen sich die Geschlechterunterschiede erst in der Sekundarstufe voll zu entwickeln.

Diese Geschlechterunterschiede in den Kompetenzen von Jugendlichen haben Auswirkungen auf Fächerwahl, Studienfachwahl und spätere Berufswahl, wie eine Reihe von Studien zeigen konnte (z. B. Trusty, Robinson, Plata, & Ng, 2000; Wang, Degol, & Ye, 2015; Wang, Eccles, & Kenny, 2013). Wang, Degol und Ye (2015) zeigten zum Beispiel, dass die Mathematikleistung in der zwölften Klasse teilweise den Geschlechterunterschied erklärt mit 30 Jahren einen Beruf im MINT-Bereich innezuhaben. Viele Studien in diesem Bereich konzentrieren sich allerdings vor allem auf den Zusammenhang von Mathematik und den MINT-Bereichen und weniger auf den Zusammenhang von Lesekompetenzen und Bildungsentscheidungen für soziale Berufe oder Berufe im Dienstleistungssektor. Eine Studie von Wang, Eccles und Kenny (2013) zeigte jedoch auch, dass hohe Fähigkeiten im Lesen sowie Mathematik eher mit einer Entscheidung gegen MINT-Berufe zusammenhängt, während eine hohe Fähigkeit in Mathematik und eine moderate Fähigkeit im Lesen mit einer Entscheidung für MINT-Berufe zusammenhängt.

2.2.2 Geschlechterunterschiede in den Interessen

Interessen sind im Gegensatz zu Kompetenzen eine motivationale Komponente und ebenso wichtig für akademisches Lernen und schulischen Erfolg (Wigfield & Cambria, 2010). Von Eccles und Wigfield (2002) werden Interessen als langüberdauernde affektive Orientierungen gegenüber einem Objekt beschrieben.

Im akademischen Bereich bestehen Geschlechterunterschiede analog zu Geschlechterunterschieden in den Kompetenzen. Mädchen haben demnach ein höheres Interesse in sprachlichen Domänen wie Lesen und Jungen haben ein höheres Interesse in

Mathematik (Chow, Eccles, & Salmela-Aro, 2012; Evans, Schweingruber, & Stevenson, 2002; Plante, O'Keefe, Aronson, Fréchette-Simard, & Goulet, 2019; Su et al., 2009).

In einem weiteren Interessensbereich der für diese Arbeit relevant ist, den beruflichen Interessen, können ebenso Geschlechterunterschiede beobachtet werden. Berufliche Interessen werden oft nach Hollands (1997) RIASEC-Einteilung erfasst. Interessen im beruflichen Bereich werden demnach in praktische (realistic), forschende (investigative), künstlerische (artistic), soziale (social), unternehmerische (enterprising) und konventionelle (conventional) Interessen unterteilt. In diesen Bereichen werden bei Frauen beziehungsweise Mädchen höhere Interessen als bei Männern in künstlerischen, sozialen und konventionellen Bereichen gefunden. Männer beziehungsweise Jungen zeigen höheres Interesse als Frauen in praktischen, forschenden und unternehmerischen Bereichen (Su et al., 2009).

Interessen wirken sich als motivationaler Faktor vor allem auf Aspirationen und Bildungsentscheidungen von Jugendlichen aus (Köller, Baumert, & Schnabel, 2001; Korhonen, Tapola, Linnanmäki, & Aunio, 2016; Wang et al., 2015), akademische Interessen stehen allerdings auch im Zusammenhang mit Kompetenzen (Köller et al., 2001). So fanden Köller und Kollegen (2001) zum Beispiel in einer Studie, dass Mathematikinteresse im Zusammenhang mit einerseits Fachkurswahl stand, andererseits aber auch mit Mathematikleistung in der Sekundarstufe II.

2.3 EINFLÜSSE AUF GESCHLECHTERUNTERSCHIEDE

In den vorangegangen Kapiteln wurde anhand von Studienergebnissen aufgezeigt, in welchem Ausmaß Geschlechterunterschiede in Kompetenzen und Interessen existieren, es wurde außerdem knapp dargestellt, dass Zusammenhänge von Kompetenzen und Interessen mit Bildungsentscheidungen bestehen. In den folgenden Abschnitten wird anhand von vorliegenden Forschungsergebnissen erläutert welche verschiedenen Einflüsse sich auf die

dargestellten Geschlechterunterschiede auswirken können, wobei ein Fokus auf Untersuchungen zu Geschlechterstereotypen und Geschlechterrollen liegt. Die Lücken, die in diesem Forschungsgebiet bestehen, sind Hauptbestandteil der Fragestellungen dieser Arbeit.

Um zu verstehen wie Einstellungen gegenüber Geschlechterrollen und Stereotype sich auf schulische Outcomes auswirken, dient das Erwartungs-Wert-Modell von Eccles und ihren Kolleginnen und Kollegen als hilfreicher Ansatzpunkt (Eccles, 1987; Eccles et al., 1998; Eccles & Wigfield, 2002).

Das Modell (Eccles & Wigfield, 2002) erklärt wie verschiedene Merkmale des Kindes und seiner Umwelt zusammenwirken um Erfolgserwartungen des Kindes sowie subjektive Werte von Aufgaben zu beeinflussen, welche laut Modell im Endeffekt Leistungen und leistungsbezogene Entscheidungen bedingen. Im Modell wird deutlich wie Geschlechterrollen als Einflussfaktor weit am Anfang dieser Wirkungskette stehen und über mediierende Faktoren, wie affektive und kognitive Einflüsse, einen Effekt auf schulische Outcomes bewirken können. Eccles und ihre Kolleginnen und Kollegen zeigen in einer Reihe von Arbeiten wie sich das Geschlecht des Kindes, Geschlechterrollen, Stereotype und Sozialisationseinflüsse auf subjektive Werte, Erfolgserwartungen und Leistungen auswirken (z. B. Eccles, 1987; Fredricks & Eccles, 2002; Jacobs et al., 2002). Zum Beispiel zeigte eine Studie von Dicke, Safavian und Eccles (2019), dass traditionelle Geschlechterrollen während der Jugendzeit für Frauen später in Verbindung mit geringerem Bildungsstand und einem Beruf im nicht-MINT Bereich stehen.

Zum einen soll in dieser Arbeit untersucht werden wie Einstellungen bezüglich Geschlechterstereotypen beziehungsweise Geschlechterrollen wirken, die Kinder selbst innehaben, zum anderen wie Einstellungen wirken, die eine Person aus dem Lernumwelt, konkret die Lehrkraft, innehat. Die Annahmen des Eccles' Modells (Eccles & Wigfield, 2002) zeigen dazu, dass sich Einstellungen der Kinder auf kognitive Merkmale wie Ziele und Selbstkonzepte auswirken, welche wiederum Erfolgserwartungen und subjektive

Aufgabenwerte im Sinne von Interessen, Kosten oder Nutzen beeinflussen und somit Leistungen und Bildungsentscheiden bedingen. Sozialisationseinflüsse zum Beispiel würden durch die Lehrkraft laut Modell noch einen Schritt vorher ansetzen und sich zum einen direkt auf Ziele, Selbstkonzepte und Affekte von Schülerinnen und Schülern auswirken, zum anderen aber auch vermittelt durch die Wahrnehmung der Schülerinnen und Schüler wirken. Basierend auf den Annahmen des Erwartungs-Wert-Modells wird erwartet, dass sich sowohl individuelle Einstellungen der Schülerinnen und Schüler sowie Einstellungen ihrer Lehrkräfte auf die Kompetenzen beziehungsweise Interessen von Schülerinnen und Schülern auswirken.

2.3.1 Individuelle Einflüsse auf Kompetenzen und Interessen

Individuelle Einflüsse auf Geschlechterunterschiede in Kompetenzen und Interessen von Schülerinnen und Schülern lassen sich zum Beispiel in der Motivation (z. B. Baker & Wigfield, 1999; Kriegbaum, Jansen, & Spinath, 2015), den Emotionen (z. B. Frenzel, Pekrun, & Goetz, 2007; Pekrun, Lichtenfeld, Marsh, Murayama, & Goetz, 2017) oder den Einstellungen von Jungen und Mädchen gegenüber bestimmten Domänen finden. Im Folgenden werden die Zusammenhänge von Einstellungen beziehungsweise Stereotypen von Schülerinnen und Schülern und Schulleistungen näher beleuchtet.

Steffens und Jelenec (2011) fanden in einer Stichprobe von Neuntklässlern, dass implizite Stereotype bezüglich Mathematik mit Leistung und Selbstkonzept zusammenhängen. Starke Stereotype in Mathe waren für Mädchen mit einem niedrigen Selbstkonzept und niedriger Leistung in Mathematik assoziiert, für Jungen mit einem hohen Selbstkonzept und hoher Leistung. Diese Assoziationen fanden sich nicht für Stereotype bezüglich Sprache. In einer Stichprobe von Sechst- und Achtklässlern beschrieben Plante, La Sablonnière, Aronson und Théorêt (2013), dass die Zustimmung zu Stereotypen in Mathematik und Lesen mit den Noten in den entsprechenden Domänen einherging, dies geschah mediiert über Kompetenzüberzeugungen und Aufgabenwerte, wie im Erwartungs-Wert-Modell beschrieben.

Eine weitere Studie (Yu et al., 2020) fand in einer Untersuchung von Jugendlichen verschiedene Profile zur Konformität der Geschlechterrollen. Es zeigte sich, dass Jungen und Mädchen, die traditionelle Normen vertreten, akademisch weniger erfolgreich im Sinne von geringerer Motivation, geringerem Engagement und Leistung in Mathematik und Englisch waren. Hadjar, Grünewald-Huber, Gysin, Lupatsch und Braun (2012) zeigten außerdem in einer Gruppe von Schülerinnen und Schülern der achten Klasse, dass traditionelle Geschlechterrolleneinstellungen bei Jungen und Mädchen gleichermaßen zu allgemein schlechteren Schulnoten führen.

Zusammengenommen kann man an den Ergebnissen der vorgelegten Studien erkennen, dass Einstellungen und Stereotype, die Schülerinnen und Schüler innehaben, sich auf akademische Variablen, wie Leistung und Motivation, auswirken können.

Studien über die Zusammenhänge von Interessen und Einstellungen gegenüber Stereotypen und Geschlechterrollen gibt es nur wenige. Allerdings zeigten Bian, Leslie und Cimpian (2017), dass schon bei sechsjährigen Kindern Stereotype in Bezug auf intellektuelle Fähigkeiten bestehen. Diese hingen bei Mädchen wiederum mit einem geringeren Interesse an Spielen, welche als intellektuell anspruchsvoll bezeichnet wurden, zusammen. In einer Studie von Sechst- und Achtklässlern wurde der Zusammenhang zwischen domänenspezifischen Stereotypen über Mathematik und sprachlichen Fähigkeiten und dem Interesse von Schülerinnen und Schülern in diesen Domänen untersucht (Plante et al., 2019). Es zeigte sich, dass Stereotype, die davon ausgehen, dass Mädchen eine höhere Fähigkeit in sprachlichen Bereichen aufweisen als Jungen sich auf ein höheres Interesse von Mädchen in diesem Bereich auswirken. Während bei mathematischen Interessen die Geschlechterdifferenz durch die Wahrnehmung, dass Jungen besser in Mathematik als in sprachlichen Domänen sind, erklärt werden konnte.

Was den Bereich der beruflichen Interessen betrifft, zeigte eine Untersuchung von Tokar und Jome (1998), dass traditionelle Geschlechterrollen bei männlichen Studierenden mit traditionell männlichen beruflichen Interessen und Berufswahl im Zusammenhang stehen. Steele und Barling (1996) berichteten, dass mütterliche Geschlechterrolleneinstellungen, vermittelt über die Einstellungen ihrer Töchter, sich auf deren berufliche Aspirationen auswirken. Genauer gesagt führten traditionelle Einstellungen auf Seiten der Mütter zu traditionelleren Einstellungen und damit auch traditionelleren Aspirationen ihrer Töchter.

Durch die vorgestellten Studien wird deutlich, dass aus der bisherigen Forschung schon bekannt ist, dass Geschlechterrollen beziehungsweise Stereotype in Verbindung mit schulischen Outcomes, im Besonderen mit verschiedenen Leistungsindikatoren und Interessen, stehen können. Lücken in der Forschung bestehen allerdings einerseits beim konkreten Zusammenhang von Einstellungen gegenüber Geschlechterrollen und Kompetenzen im Gegensatz zu anderen Schulleistungen. Außerdem gibt es einen Mangel an Forschung, die sich auf den Zusammenhang zwischen Geschlechterrolleneinstellungen und Interessen fokussiert. In dieser Arbeit werden diese beiden Punkte stärker beleuchtet.

2.3.2 Einflüsse der Lehrkraft auf schulische Outcomes

Die schulischen Lernbedingungen mit Lehrkräften gehören, ebenso wie das familiäre und persönliche Umfeld, zur Lernumwelt von Schülerinnen und Schülern. Lehrerinnen und Lehrer können durch ihr Handeln den Lernerfolg ihrer Schülerinnen und Schüler beeinflussen (z. B. Goh & Fraser, 1998), womit sie möglicherweise auch einen wichtigen Bestandteil in der Entstehung von Geschlechterunterschieden spielen.

Geschlechterstereotype von Lehrkräften und der Einfluss der Schule auf Geschlechterunterschiede in den Kompetenzen werden in verschiedenen Untersuchungen dargelegt. In einer Literaturübersicht zeigten Hannover und Kessels (2011) zum einen, dass Geschlechterunterschiede in den Kompetenzen auffälliger sind, wenn die Messung nicht auf

dem Curriculum basiert. Zum anderen wird in ihrer Darstellung gezeigt, dass Mädchen im Durchschnitt besser benotet werden als Jungen, unter anderem auf Grund von einem besseren beziehungsweise von Lehrkräften positiver eingeschätzten Sozialverhaltens und der höheren Motivation von Mädchen gegenüber Jungen. Die Überrepräsentanz von Frauen im Bildungswesen scheint demnach aber kein Grund für die Bevorzugung von Mädchen zu sein (Hannover & Kessels, 2011). Hierbei wird vor allem deutlich, dass die Passung von typisch weiblichen, das heißt sozialen, ruhigen und einfühlsamen Verhaltens und der Schule besser zu sein scheint, als die von typisch männlichen, das heißt dominanten und aggressiven Verhaltens, und der Schule (für Stereotype siehe Bem, 1974).

Wie man zum Beispiel durch die unterschiedliche Benotung erkennt, können auch Lehrkräfte mit Vorurteilen behaftet sein, die sich auf die Gleichbehandlung von Jungen und Mädchen auswirken können. Tiedemann (2000, 2002) zeigte, dass Lehrkräfte Mädchen und Jungen in Mathematik unterschiedlich einschätzen und diese Einschätzungen für Kinder im niedrigen und mittleren Leistungsspektrum mit den Geschlechterstereotypen der Lehrerinnen und Lehrer in Bezug auf Mathematik zusammenhängen. Weitere Studien demonstrierten, dass stereotype Vorstellungen der Lehrkräfte mit Leistungen in Mathematiktests und mathematischen Selbstkonzept zusammenhängen (Carlana, 2019; Heyder et al., 2019). In Bezug auf Lesen ergaben verschiedene Studien, dass Stereotype beziehungsweise traditionelle Geschlechterrolleneinstellungen das Leseselbstkonzept und die Lesemotivation von Jungen beeinträchtigen können (Retelsdorf et al., 2015; Wolter, Braun, & Hannover, 2015). Muntoni und Retelsdorf (2018) stellten im Hinblick auf Leseleistung fest, dass die höheren Erwartungen, die Lehrkräfte an Mädchen im Lesen haben, den Unterschied zwischen Jungen und Mädchen in der Leseleistung erklären. Höhere Erwartungen an Mädchen waren in der Studie außerdem mit stärkeren Stereotypen der Lehrkräfte verbunden.

Diese Ergebnisse zeigen, dass Stereotype von Lehrerinnen und Lehrern durchaus auch mit schulrelevanten Outcomes, wie Leistungen, Motivation und Selbstkonzept, in den Domänen Lesen und Mathematik zusammenhängen können. Es fehlt allerdings an Studien, die konkrete Stereotype von Lehrkräften erheben und diese in Verbindung mit den Lese- und Mathematikkompetenzen von Schülerinnen und Schülern setzen. Dieser Aspekt von Einflüssen aus der Lernumwelt von Kindern wird in der dritten Studie dieser Dissertationsarbeit weiter beleuchtet.

3   ABLEITUNG DER FORSCHUNGSFRAGEN

In Kapitel zwei wurden zahlreiche Forschungsbefunde zu den Themen Geschlechterunterschiede in Kompetenzen und Interessen sowie Geschlechterrollen und Stereotype vorgestellt. In dieser Arbeit wird untersucht, ob es einen Zusammenhang zwischen der individuellen Geschlechterrolleneinstellungen von Schülerinnen und Schülern beziehungsweise den Geschlechterstereotypen von Lehrkräften und Kompetenzen und Interessen gibt.

Zunächst zeigen Large Scale Assessments und Metaanalysen, dass Geschlechterunterschiede in den Kompetenzen Mathematik und Lesen sowie in verschiedenen Interessen bestehen. Es gilt die Ursprünge diese Geschlechterunterschiede aufzuklären um allen Kindern möglichst die gleichen Chancen bereitzustellen ihre Fähigkeiten zu entwickeln. Über reine Unterschiede in Kompetenzen und Interessen hinaus werden Frauen und Männer weiterhin Geschlechterstereotypen und traditionellen Geschlechterrollen in der Gesellschaft ausgesetzt (Eagly et al., 2020). Die Forschung zu Zusammenhängen zwischen schulischen Outcomes und Geschlechterrollen und Geschlechterstereotypen zeigt in der Übersicht ein unvollständiges Bild. Traditionelle Geschlechterrolleneinstellungen und Geschlechterstereotype von Schülerinnen und Schülern scheinen zu niedrigerer Leistung in der Schule insgesamt und in

einzelnen Domänen zu führen (Hadjar et al., 2012; Plante et al., 2013; Plante et al., 2019). Außer den eigenen Einstellungen, zeigen auch stereotype Überzeugungen der Lehrkraft einen Einfluss auf die Leistungen der Schülerinnen und Schüler (Tiedemann, 2000,2002; Muntoni & Retelsdorf, 2018).

Die vorliegende Forschung lässt allerdings mehrere Fragen offen zu den Zusammenhängen von eigenen Einstellungen beziehungsweise Lehrerstereotypen und den Kompetenzen und Interessen von Schülerinnen und Schülern. Vor allem fehlt es an Studien zu Geschlechterrolleneinstellungen von Schülerinnen und Schülern, die durchaus eine andere Bedeutung innehaben als konkrete Stereotype und sich mehr auf das gesamte Leben beziehen. Zudem fehlt es an Forschung zu explizit erfassten Stereotypen von Lehrkräften und wie diese im Zusammenhang mit Kompetenzen in den zwei Schlüsseldomänen Lesen und Mathematik stehen.

Forschungsfrage 1:

Eine Schlüsselfrage dieser Arbeit ist, wie sich traditionelle Geschlechterrolleneinstellungen von Schülerinnen und Schülern auf schulbezogene Korrelate auswirken. Wie im Theorieteil dargelegt, gibt es Untersuchungen, die die Rolle von Stereotypen und Geschlechterrollen im Zusammenhang mit Leistungen untersuchen (Hadjar et al., 2012; Plante et al., 2013; Plante et al., 2019; Steele & Barling, 1996). Unzureichende Befunde gibt es vor allem im Bereich von domänenspezifischen Kompetenzen im Vergleich zu Noten und einer Untersuchung von beiden Domänen Lesen und Mathematik in einer Studie. Vor allem diese genannten Aspekte sollen bei der Beantwortung der folgenden Fragestellung in den Fokus rücken:

1.1 Gibt es einen Zusammenhang zwischen den Geschlechterrolleneinstellungen von Schülerinnen und Schülern und deren Kompetenzen in Mathematik und Lesen?

1.2 Ist dieser Zusammenhang unterschiedlich für Jungen und Mädchen in den verschiedenen Domänen?

Diese Fragestellungen werden in Beitrag 1 behandelt. Aufgrund der Studien, die Zusammenhänge zwischen Geschlechterrollen und -stereotypen betrachten, wird angenommen, dass Zusammenhänge zwischen den individuellen Geschlechterrolleneinstellungen von Schülerinnen und Schülern gefunden werden. Kinder sollten in ihren Kompetenzen negativ durch eine traditionelle Einstellung beeinträchtigt werden. Für die Fragestellung 1.2 wird angenommen, dass Jungen und Mädchen in unterschiedlicher Weise in den Kompetenzen beeinträchtigt werden. Mathematik wird als stereotyp männliche Domäne von Kindern aufgefasst, während Lesen beziehungsweise Sprachen als stereotyp weibliche Domäne eingestuft wird (z. B. Steffens & Jelenec, 2011). Aufgrund der Stereotype für Mathematik, sollten traditionelle Mädchen, als besonders stereotyp behaftet, eine geringere Mathematikkompetenz zeigen als egalitäre Mädchen. Jungen sollten jedoch nicht von ihren Geschlechterrolleneinstellungen in Mathematik beeinträchtigt sein. Umgekehrt lautet die Annahme für die Lesekompetenz, dass traditionelle Jungen geringere Leistung zeigen sollten als egalitäre Jungen, während Mädchen in der Lesekompetenz nicht durch ihre Geschlechterrolleneinstellungen beeinträchtigt sein sollten.

Forschungsfrage 2:

Analog zu den Zusammenhängen von Kompetenzen, zeigen bisherige Studien auch einen Zusammenhang zwischen Geschlechterstereotypen und Geschlechterrollen und Interessen (Plante et al., 2019; Steele & Barling, 1996). Die Datenlage hierzu erscheint jedoch geringer ausgeprägt zu sein als für direkte Leistungsindikatoren wie Noten. Vor allem im Bereich der beruflichen Interessen gibt es keine Befunde für Jugendliche oder Kinder im Schulalter. Aus diesem Grund sollen die folgenden Fragestellungen in dieser Arbeit betrachtete werden:

2.1 Gibt es einen Zusammenhang zwischen den Geschlechterrolleneinstellungen von Schülerinnen und Schülern und deren akademischen und beruflichen Interessen?

2.2. Ist dieser Zusammenhang unterschiedlich für Jungen und Mädchen?

Antworten auf die Fragen 2.1. und 2.2 liefert Beitrag 2 dieser Arbeit. Um akademische Interessen und berufliche Interessen während der Sekundarschulzeit einheitlicher zu betrachten, werden in Beitrag 2 zunächst Interessensprofile gebildet, welche Schülerinnen und Schüler in ein stereotyp weibliches, männliches, allgemein hohes oder allgemein niedriges Interessensprofil einordnen.

Zu Fragestellung 2.1 ergeben die Annahmen, dass Schülerinnen und Schüler mit traditionellen Geschlechterrolleneinstellungen wahrscheinlicher dem allgemein niedrigen Interessensprofil zugeordnet werden als anderen Profilen, während egalitäre Schülerinnen und Schüler wahrscheinlicher dem allgemein hohen Interessensprofil zugeordnet werden.

Für Fragestellung 2.2 ergeben sich nur für egalitäre Mädchen besondere Annahmen. Diese sollten wahrscheinlicher in ein männliches Interessensprofil eingeordnet werden als in andere Profile. Aufgrund der hohen Sanktionen für Jungen, die vom Stereotyp abweichen, wird dieser Zusammenhang nicht für egalitäre Jungen und das weibliche Interessensprofil erwartet.

Forschungsfrage 3:

Nachdem im vorherigen Teil der Zusammenhang eigener Einstellungen mit schulischen Korrelaten betrachtet wurde, soll durch die letzte Forschungsfrage der Fokus auf die Stereotype der Lehrkräfte gelegt werden. Wie im Theorieteil aufgezeigt wurde, wurden schon Zusammenhänge von stereotypen Überzeugungen von Lehrkräften und schulischen Outcomes von Schülerinnen und Schülern gefunden (Carlana, 2019; Muntoni & Retelsdorf, 2018; Retelsdorf et al., 2015). Da die Erfassung von Stereotypen bei Lehrkräften zwischen den Studien nicht konsistent ist, teilweise Einschätzungen für einzelne Schülerinnen und Schüler,

implizite Stereotype oder auch Geschlechterrollen untersucht wurden, soll hier mit einem expliziten Stereotypenmaß der Zusammenhang zwischen Geschlechterstereotypen in Lesen und Mathematik und Kompetenzen von Schülerinnen und Schülern betrachtet werden. Zudem wird in dieser Arbeit ein besonders sensibler Zeitpunkt, vor dem Übergang der Schülerinnen und Schüler in die Sekundarstufe, untersucht. Die folgenden Forschungsfragen sollen daher in Beitrag 3 beantwortet werden:

3.1 Gibt es einen Zusammenhang zwischen Geschlechterstereotypen von Lehrkräften und den Kompetenzen von Schülerinnen und Schülern in Mathematik und Lesen?

3.2 Ist dieser Zusammenhang unterschiedlich für Jungen und Mädchen in den verschiedenen Domänen?

Für Fragestellung 3.1 wird angenommen, dass ein negativer Zusammenhang zwischen Geschlechterstereotypen von Lehrkräften und den Kompetenzen von Schülerinnen und Schülern gefunden wird. Konkret heißt das für Fragestellung 3.2, dass der Geschlechterunterschied in der Mathematikkompetenz zugunsten von Jungen größer ausfallen sollte, wenn Lehrkräfte Stereotype in Mathematik befürworten. Ebenso sollte der Geschlechterunterschied in Lesen zugunsten von Mädchen stärker ausfallen, wenn Lehrkräfte Stereotype in Lesen befürworten.

4 BEITRÄGE, METHODEN UND DATENGRUNDLAGE

In diesem Abschnitt wird das Nationale Bildungspanel (NEPS, Blossfeld, Roßbach, & von Maurice, 2011), welches die Datengrundlage aller Beiträge bildet, kurz vorgestellt. Weiterhin werden die einzelnen Stichproben, die die Basis der Beiträge stellen, vorgestellt und im letzten Teil dieses Abschnitts werden die Instrumente, die in den einzelnen Beiträgen angewandt werden, präsentiert.

4.1 DATENGRUNDLAGE

Die Datengrundlage bildet das Nationale Bildungspanel NEPS (Blossfeld et al., 2011), eine deutsche Längsschnittstudie, die Bildungsverläufe in bisher sechs Kohorten, von einer Neugeborenenkohorte bis zu einer Erwachsenenkohorte, untersucht. In den einzelnen Erhebungen werden Bildungsverläufe erfasst, sozio-demografische Merkmale, psychologische Konstrukte und auch Kompetenzen in verschiedenen Domänen. In dieser Arbeit wurden Daten aus den Startkohorten zwei und drei verwendet, welche im Jahr 2010 jeweils im Kindergartenalter beziehungsweise in der fünften Klasse ihre Erhebungen begonnen.

Stichproben

Beitrag 1: Beitrag 1 bediente sich aus Daten der ersten, zweiten und dritten Welle der Startkohorte drei, das heißt aus der fünften, sechsten und siebten Klasse. Insgesamt wurden Daten von 3375 (48.4 % weiblich) Schülerinnen und Schülern in den Analysen verwendet. Das Durchschnittsalter in der siebten Klasse lag bei 12.88 Jahren und 22.7 % der Stichprobe hatte einen Migrationshintergrund, das heißt mindestens ein Elternteil oder das Kind selbst war im Ausland geboren.

Beitrag 2: In Beitrag 2 wurden ebenfalls Daten der Startkohorte drei verwendet, aus der ersten und zweiten Welle, das heißt aus der fünften und sechsten Klasse. Insgesamt bestand die Stichprobe aus 4457 (49.2 % weiblich) Schülerinnen und Schülern, die in der sechsten Klasse im Durchschnitt ein Alter von 11.88 Jahren hatten. In dieser Stichprobe lag bei 24.7 % der Schülerinnen und Schüler ein Migrationshintergrund vor.

Beitrag 3: Im dritten Beitrag wurden Daten der Startkohorte zwei, Welle sechs verwendet, die in der vierten Klasse erhoben wurden. Die Stichprobe bestand aus 3669 (51.9 % weiblich) Schülerinnen und Schülern und ihren 591 (88 % weiblich) Lehrerinnen und Lehrern. Die Kinder waren im Durchschnitt 9.75 Jahre alt, 20.3 % der Stichprobe hatte einen Migrationshintergrund.

4.2 METHODEN

Messinstrumente

Geschlechterrolleneinstellungen. Diese Skala wurde in den Beiträgen 1 und 2 verwendet. Geschlechterrolleneinstellungen von Schülerinnen und Schülern wurden in der sechsten Klasse mit vier Items gemessen. Die Items (*Jungen und Mädchen sollten die gleichen Pflichten im Haushalt übernehmen; Mädchen beherrschen technische Geräte genauso gut wie Jungen; Männer sind für manche Berufe besser geeignet als Frauen; Mädchen sollten die gleichen Berufe erlernen können wie Jungen*) wurden auf einer vier-stufigen Skala mit Antworten von *stimme gar nicht zu* bis *stimme völlig zu* beantwortet. In beiden Studien hatte die Skala eine gute Reliabilität ($\alpha = 0.72$). Die Mittelwerte in der Gesamtstichprobe lagen in Beitrag 1 bei $M = 2.80$ ($SD = 0.78$) und in Beitrag 2 bei $M = 2.79$ ($SD = 0.78$), wobei höhere Werte eine egalitärere Einstellung bedeuten. Die geringen Abweichungen zwischen den Studien bestehen aufgrund unterschiedlicher Stichprobenauswahl. Für Jungen lag der Mittelwert jeweils bei $M = 2.45$ ($SD = 0.76$) in Beitrag 1 und $M = 2.44$ ($SD = 0.76$) in Beitrag 2. Für Mädchen bei $M = 3.17$ ($SD = 0.61$) in Beitrag 1 und $M = 3.15$ ($SD = 0.62$) in Beitrag 2.

Geschlechterstereotype von Lehrkräften. Die Geschlechterstereotype von Lehrkräften wurden in der vierten Klasse erhoben und als unabhängige Variable in Beitrag 3 verwendet. Lehrkräfte wurden gefragt: *Was denken Sie, welche Ergebnisse Viertklässler aus folgenden Gruppen (Jungen/Mädchen) im Kompetenzbereich Mathematik/Lesen im Vergleich zu Viertklässlern in Deutschland insgesamt erzielen?* Die Antwortmöglichkeiten reichten auf einer Skala von 1 (*weit unterdurchschnittlich*) bis 10 (*weit überdurchschnittlich*). Dieses Instrument wurde durch eine NEPS-Forschergruppe entwickelt (Wenz, Olczyk, & Lorenz, 2016). Das verwendete Maß ergab sich durch die Differenz in der Einschätzung von Jungen und Mädchen in der gleichen Domäne. Lehrkräfte zeigten demnach durchschnittlich Stereotype bezüglich der Kompetenz

von Jungen und Mädchen im Lesen, $M = 1.39$ ($SD = 1.47$) jedoch nicht in Mathematik, $M = 0.06$ ($SD = 1.56$).

Akademische Interessen. Interesse in Mathematik und Deutsch wurde in der sechsten Klasse gemessen. Diese Skala wurde in Beitrag 1 als Kontrollmaß verwendet sowie in Beitrag 2 als Teil der Interessensprofile. Akademisches Interesse in Mathematik und Deutsch wurde mit jeweils vier Items gemessen (z. B. *Wenn ich in Mathematik etwas Neues dazulernen kann, bin ich bereit, auch Freizeit dafür zu verwenden; Texte zu lesen und selbst zu verfassen, macht mir einfach Spaß*). Das Antwortformat reichte von *trifft gar nicht zu* bis *trifft völlig zu* auf einer vier-stufigen Skala. Die Reliabilität für beide Domänen war gut ($\alpha_{Deutsch} = 0.74$; $\alpha_{Mathematik} = 0.76$). Für Beitrag 2 lagen die Mittelwerte für das akademische Interesse in Mathematik in der Gesamtstichprobe bei $M = 2.21$ ($SD = 0.77$), für Jungen bei $M = 2.32$ ($SD = 0.78$) und für Mädchen bei $M = 2.09$ ($SD = 0.75$). Die Mittelwerte für das akademische Interesse in Deutsch lagen in der Gesamtstichprobe bei $M = 2.32$ ($SD = 0.71$), für Jungen bei $M = 2.21$ ($SD = 0.70$) und für Mädchen bei $M = 2.43$ ($SD = 0.71$).

Berufliche Interessen. Die beruflichen Interessen von Schülerinnen und Schülern wurden in der sechsten Klasse erfasst und dienten dazu, die Interessensprofile in Beitrag 2 zu bilden. Berufliche Interessen wurden im Sinne von Hollands RIASEC-Modell (Holland, 1997) mithilfe einer für das NEPS adaptieren Skala mit jeweils drei Items pro Interessensbereich abgefragt (Wohlkinger, Ditton, Maurice, Haugwitz, & Blossfeld, 2011). Hierbei handelte es sich um praktische, forschende, künstlerische, soziale, unternehmerische und konventionelle Interessen. Die Reliabilitäten der Subskalen schwankten zwischen $\alpha = 0.53$ für konventionelle Interessen und $\alpha = 0.76$ für soziale Interessen. Die Stichprobenmittelwerte in Beitrag 2 lagen für praktische Interessen bei $M = 2.99$ ($SD = 1.08$), für forschende Interessen bei $M = 3.10$ ($SD = 1.01$), für künstlerische Interessen bei $M = 3.14$ ($SD = 1.03$), für soziale Interessen bei $M = 3.40$ ($SD = 0.91$), für unternehmerische Interessen bei $M = 2.84$ ($SD = 0.96$) und für

konventionelle Interessen bei $M = 2.34$ ($SD = 0.87$). Für Jungen und Mädchen lagen die Mittelwerte jeweils bei $M_{Jungen} = 3.42$ ($SD = 1.02$) und $M_{Mädchen} = 2.54$ ($SD = 0.95$) für praktische Interessen, $M_{Jungen} = 3.24$ ($SD = 1.03$) und $M_{Mädchen} = 2.95$ ($SD = 0.97$) für forschende Interessen, $M_{Jungen} = 2.73$ ($SD = 0.98$) und $M_{Mädchen} = 3.56$ ($SD = 0.90$) für künstlerische Interessen, $M_{Jungen} = 3.15$ ($SD = 0.90$) und $M_{Mädchen} = 3.67$ ($SD = 0.84$) für soziale Interessen, $M_{Jungen} = 3.08$ ($SD = 0.96$) und $M_{Mädchen} = 2.59$ ($SD = 0.89$) für unternehmerische Interessen und $M_{Jungen} = 2.22$ ($SD = 0.83$) und $M_{Mädchen} = 2.47$ ($SD = 0.89$) für konventionelle Interessen.

Mathematische Kompetenz. Mathematische Kompetenz wurde als abhängige Variable in Beiträgen 1 und 3 verwendet, dabei fanden die Kompetenzdaten aus der vierten, fünften und siebten Klasse Anwendung. Der Mathematiktest bestand aus 23 Items in der vierten Klasse der Startkohorte zwei und 25 Items in der fünften und siebten Klasse der Startkohorte drei. Dabei hatte der Test eine Bearbeitungszeit von 28 Minuten in allen Klassenstufen. Die Erfassung von mathematischer Kompetenz erfolgt im NEPS mit einem Fokus auf einer Relevanz für realistische Alltagssituationen. Der Test bestand aus vier Inhaltsbereichen (Mengen, Veränderungen und Beziehungen, Form und Raum, Daten und Wahrscheinlichkeiten), in welchen sechs kognitive Komponenten erfasst wurden (Neumann et al., 2013). Die Kompetenzwerte werden vom NEPS als Weighted Maximum Likelihood Estimates (WLE) ausgegeben, welche die Schätzung des Kompetenzwertes einer Person darstellt (Pohl & Carstensen, 2013). Die Mittelwerte in den verschiedenen Klassenstufen betrugen in der Startkohorte zwei $M_{K4} = 0.06$ ($SD = 1.07$) und in der Startkohorte drei $M_{K5} = 0.21$ ($SD = 1.13$) und $M_{K7} = 0.93$ ($SD = 1.23$). Nach Geschlecht aufgeteilt fanden sich folgende Mittelwerte in der vierte Klasse: $M_{Jungen} = 0.11$ ($SD = 1.09$) und $M_{Mädchen} = 0.01$ ($SD = 1.06$); in der fünften Klasse: $M_{Jungen} = 0.35$ ($SD = 1.12$) und $M_{Mädchen} = 0.06$ ($SD = 1.11$); in der siebten Klasse: $M_{Jungen} = 1.10$ ($SD = 1.27$) und $M_{Mädchen} = 0.75$ ($SD = 1.16$).

Lesekompetenz. Lesekompetenz wurde als abhängige Variable in Beiträgen 1 und 3 verwendet. Kompetenzdaten aus der vierten, fünften und siebten Klasse wurden dabei genutzt. Der Lesekompetenztest bestand aus 29 Items in der vierten Klasse der Startkohorte zwei und 33 Items in der fünften und siebten Klasse der Startkohorte drei und hatte eine Bearbeitungszeit von 28 Minuten in allen Klassenstufen. Auch das Rahmenkonzept zur Erfassung der Lesekompetenz legt einen Fokus auf das Verständnis von Texten in alltäglichen Situationen (Gehrer, Zimmermann, Artelt, & Weinert, 2013). Der Test bestand aus fünf Textfunktionen (informierende Texte, Kommentare, literarische Texte, Anleitungen, Werbung), welche verschiedene kognitive Komponenten erfassten. Die Mittelwerte in den verschiedenen Klassenstufen betrugen in der Startkohorte zwei M_{K4} = -0.54 (SD = 1.27) und in der Startkohorte drei M_{K5} = 0.18 (SD = 1.21) und M_{K7} = 0.83 (SD = 1.36). Nach Geschlecht aufgeteilt fanden sich folgende Mittelwerte in der vierte Klasse: M_{Jungen} = -0.66 (SD = 1.28) und $M_{Mädchen}$ = -0.44 (SD = 1.26); in der fünften Klasse: M_{Jungen} = 0.11 (SD = 1.24) und $M_{Mädchen}$ = 0.25 (SD = 1.19); in der siebten Klasse: M_{Jungen} = 0.68 (SD = 1.39) und $M_{Mädchen}$ = 0.99 (SD = 1.31).

4.3 DATENANALYSE

Die Datenaufbereitung und deskriptiven Analysen wurden mit SPSS Version 20 durchgeführt, alle weiteren Analysen wurden mit Mplus Version 8 (Muthén & Muthén, 2017) durchgeführt. Fehlende Werte wurden teilweise ausgeschlossen, wenn keinerlei Informationen über die Teilnehmenden vorhanden waren. Restliche fehlende Werte wurden in Mplus durch das Full Information Maximum Likelihood (FIML) Verfahren geschätzt.

5 DARSTELLUNG DER DURCHGEFÜHRTEN STUDIEN UND BEFUNDE

Im Folgenden werden die einzelnen Beiträge vorgestellt, es werden die Analysemethoden beschrieben und die Forschungsfragen aus Abschnitt 3 werden beantwortet. Die vollständigen Beiträge sind im Anhang zu finden. Tabelle 1 zeigt eine Übersicht über die Beiträge.

Tabelle 1:
Übersicht über die Beiträge dieser Dissertationsarbeit

Autorinnen	Titel	Veröffent-lichungsjahr	Zeitschrift
Ehrtmann, Lisa Wolter, Ilka	The impact of students' gender-role orientation on competence development in mathematics and reading in secondary school	2018	*Learning and Individual Differences*
Ehrtmann, Lisa Wolter, Ilka Hannover, Bettina	The interrelatedness of gender-stereotypical interest profiles and students' gender-role orientation, gender, and reasoning abilities	2019	*Frontiers in Psychology*
Ehrtmann, Lisa Wolter, Ilka	Teachers' stereotypes about gender: Are they relevant to students' competencies in mathematics and reading in elementary school?		eingereicht bei *Social Psychology of Education*

In allen drei Beiträgen wurden zusätzlich zu den dargestellten Forschungsfragen auch Geschlechterunterschiede in Kompetenzen beziehungsweise Interessen untersucht. Diese sollen hier kurz dargestellt werden. Signifikante Kompetenzunterschiede zwischen Jungen und Mädchen im Lesen wurden in allen untersuchten Klassenstufen gefunden, die Effektstärke des Unterschieds betrug in der vierten Klasse Cohens $d = 0.17$, in der fünften Klasse $d = 0.12$ und in der siebten Klasse $d = 0.23$, wobei Mädchen höhere Kompetenzen zeigten als Jungen. Auch für Mathematik ergaben sich signifikante Geschlechterunterschiede zum Vorteil für Jungen in

allen Altersbereichen, in der vierten Klasse $d = 0.10$, in der fünften Klasse $d = 0.26$ und in der siebten Klasse $d = 0.28$.

Weiterhin wurden in den untersuchten akademischen und berufsorientierten Interessen Geschlechterunterschiede in verschiedenen Ausmaßen gefunden. Mädchen hatten ein höheres Interesse in Deutsch, $d = 0.32$, während Jungen ein höheres Interesse in Mathematik zeigten, $d = 0.30$. Bei der Betrachtung der berufsorientierten Interessen wird ersichtlich, dass Jungen höheres Interesse in realistische ($d = 0.89$), forschende ($d = 0.29$) und unternehmerische Bereiche ($d = 0.52$) aufwiesen, während Mädchen höheres Interesse in künstlerische ($d = 0.89$), soziale ($d = 0.60$) und konventionelle Bereiche ($d = 0.29$) zeigten.

5.1 BEITRAG 1

"**The impact of students' gender-role orientation on competence development in mathematics and reading in secondary school**" (Ehrtmann & Wolter, 2018)

Im ersten Beitrag wurde untersucht, ob die Geschlechterrolleneinstellungen von Schülerinnen und Schülern im Zusammenhang mit deren Kompetenzentwicklung in Mathematik und Lesen stehen. Diese Studie nutzte die oben beschriebene Stichprobe der Startkohorte drei des NEPS, somit waren Jugendliche zwischen der fünften und siebten Klasse im Fokus des Beitrags. In diesem Beitrag werden die Fragestellungen 1.1 und 1.2 betrachtet. Im Beitrag wurde durch schrittweise Regressionsmodelle getestet, ob sich die Geschlechterrolleneinstellungen, unter Hinzunahme von Kontrollvariablen, auf die Kompetenzentwicklung zwischen der fünften und siebten Klasse auswirken und ob dieser Einfluss unterschiedlich für Jungen und Mädchen in Mathematik und Lesen ist. Dies wurde durch den Interaktionsterm von Geschlecht und Geschlechterrolleneinstellungen getestet. Im ersten Modell wurde allein der Geschlechtereffekt getestet, im zweiten Modell zusätzlich Einstellungen gegenüber Geschlechterrollen und die Interaktion der Geschlechterrolleneinstellungen und des Geschlechts und in einem letzten

Modell erfolgte die Prüfung der Robustheit des Interaktionseffekts durch Hinzufügen von Kontrollvariablen (Schulform, Migrationshintergrund, akademisches Fachinteresse).

Deskriptiv zeigte sich ein großer Unterschied zwischen Jungen und Mädchen in der sechsten Klasse in den Geschlechterrolleneinstellungen. Mädchen waren demnach sehr viel egalitärer eingestellt als Jungen, $d = 1.05$.

Der signifikante Effekt des Geschlechts auf den Kompetenzzuwachs zwischen der fünften und siebten Klasse blieb in Mathematik in allen Regressionsmodellen auch bei Hinzunahme der Kontrollvariablen bestehen und kann als eher kleiner Effekt eingeordnet werden (Cohen, 1988), $d = -0.26$. Bei der Lesekompetenz verschwand der signifikante Effekt des Geschlechts auf die Kompetenzentwicklung mit der Hinzunahme der Geschlechterrollenorientierung im zweiten Modell.

Beitrag 1 zeigte weiterhin, dass die Geschlechterrolleneinstellungen von Schülerinnen und Schülern einen direkten Effekt auf den Kompetenzzuwachs in Mathematik und Lesen zwischen der fünften und der siebten Klasse haben. Bei der Hinzunahme des Interaktionsterms zwischen Geschlecht und der Geschlechterrolleneinstellungen fand sich für Mathematik ein signifikanter Effekt mit einer kleinen Effektstärke von $d = 0.08$. Konkret bedeutet das, dass in Mathematik Mädchen mit einer traditionellen Einstellung einen geringeren Zuwachs zeigten als Mädchen mit einer egalitären Einstellung, während die Geschlechterrolleneistellung auf den Kompetenzzuwachs von Jungen keinen Effekt hatte. Sowohl traditionelle als auch egalitäre Jungen hatten einen höheren Zuwachs als Mädchen. Im Lesen zeigt sich jedoch nur der Haupteffekt der Geschlechterrolleneinstellungen ($d = 0.18$), nicht jedoch der Interaktionseffekt: Sowohl traditionelle Mädchen wie auch Jungen zeigten einen geringeren Zuwachs als egalitäre Mädchen und Jungen.

5.2 BEITRAG 2

"**The interrelatedness of gender-stereotypical interest profiles and students' gender-role orientation, gender, and reasoning abilities**" (Ehrtmann, Wolter, & Hannover, 2019)

Im Fokus des zweiten Beitrags standen die schulischen und beruflichen Interessen von Schülerinnen und Schülern der sechsten Jahrgangsstufe. In dieser Gruppe wurden Interessensprofile untersucht und überprüft, ob Geschlechterrolleneinstellungen der Schülerinnen und Schüler, ihr Geschlecht und ihre Schlussfolgerungsfähigkeit im Zusammenhang mit den gefundenen Interessensprofilen standen. Dieser Beitrag beantwortet somit Fragestellungen 2.1 und 2.2. Zunächst wurden in einer latenten Profilanalyse vier Interessensprofile gefunden, bestehend aus dem akademischen Interesse in Mathematik und Deutsch sowie dem beruflichen Interesse in praktischen, forschenden, künstlerischen, sozialen, unternehmerischen und konventionellen Bereichen. Gefunden wurden ein Interessensprofil mit allgemein hohen Interessen in allen Bereichen, eines mit allgemein niedrigen Interessen in allen Bereichen und zwei geschlechterstereotype Profile, eines mit hohen Interessen in weiblichen Domänen (Deutsch, künstlerische, soziale, konventionelle Interessen) und eines mit hohen Interessen in männlichen Domänen (Mathematik, praktische, forschende, unternehmerische Interessen). Die Geschlechterverteilung auf die einzelnen Profile zeigte, dass eine deutliche Mehrheit der Jungen einem stereotyp männlichen Profil zugeordnet wurde (42 %) und eine Mehrheit der Mädchen einem stereotyp weiblichen Profil (57 %). Außerdem waren mehr Jungen in dem stereotyp weiblichen Interessensprofil vertreten (17 %), als Mädchen im männlichen Interessensprofil (6 %).

Daraufhin wurde in einer multinomialen logistischen Regression mit den wahrscheinlichsten Gruppenzugehörigkeiten als abhängige Variable untersucht, ob die Geschlechterrolleneinstellungen der Schülerinnen und Schüler, ihr Geschlecht und ihre Schlussfolgerungsfähigkeit die Wahrscheinlichkeit beeinflussen in ein bestimmtes Profil

gegenüber einem anderen Profil eingeordnet zu werden. Auch in dieser Studie wurde die geschlechterdifferenzierte Fragestellung mit Hilfe eines Interaktionsterms zwischen dem Geschlecht und der Geschlechterrolleneinstellung der Schülerinnen und Schüler untersucht.

Die Ergebnisse der logistischen Regression zeigten, dass Schülerinnen und Schüler mit einer traditionellen Geschlechterrolleneinstellung wahrscheinlicher dem niedrigen Interessensprofil zugeordnet wurden als den hohen und weiblich stereotypen Interessensprofilen. Allerdings ergab sich hinsichtlich der Geschlechterrolleneinstellung kein Unterschied zwischen den Schülerinnen und Schülern, die dem niedrigen oder dem männlich stereotypen Profil zugeordnet wurden.

Schülerinnen und Schüler mit einer egalitären Geschlechterrolleneinstellung wurden wahrscheinlicher in das hohe Interessensprofil eingeordnet als in das niedrige oder männlich stereotype Interessensprofil. Allerdings hatte die Geschlechterrolleneinstellung keinen Effekt darauf, ob eine Schülerin oder ein Schüler in das hohe oder in das weiblich stereotype Interessensprofil eingeordnet wurde.

Durch die Ergebnisse wird ersichtlich, dass traditionelle Einstellungen bei Sechstklässlerinnen und Sechstklässlern in Verbindung mit allgemein niedrig ausgeprägten und stereotyp männlichen Interessen stehen, während egalitäre Einstellungen in Verbindung mit allgemein hoch ausgeprägten und stereotyp weiblichen Interessen stehen.

Der erwartete Unterschied zwischen Jungen und Mädchen bei den Zusammenhängen zwischen der Geschlechterrolleneinstellung und dem zugeordneten Interessensprofilen wurde nicht gefunden, das heißt es gab keinen Interaktionseffekt zwischen dem Geschlecht und den Geschlechterrolleneinstellungen der Schülerinnen und Schüler.

5.3 BEITRAG 3

"**Teachers' stereotypes about gender: Are they relevant to students' competencies in mathematics and reading in elementary school?**" (Lisa Ehrtmann & Ilka Wolter, Manuskript eingereicht)

Im dritten Beitrag wurde in einer Stichprobe von Viertklässlerinnen und Viertklässlern und ihren Lehrerinnen und Lehrern betrachtet, ob Geschlechterstereotype der Lehrkräfte über die Fähigkeiten von Jungen und Mädchen in Mathematik und Lesen im Zusammenhang mit Geschlechterunterschieden in diesen Kompetenzen bei Schülerinnen und Schülern stehen. Dieser Beitrag behandelt die Fragestellungen 3.1 und 3.2.

In den Mittelwerten wurden Geschlechterstereotype bei den Lehrkräften, wie schon im Methodenteil beschrieben, nur für Lesekompetenzen gefunden, hier schätzten Lehrkräfte, unabhängig ihres eigenen Geschlechts, Mädchen als kompetenter ein als Jungen, $d = 1.89$. Jungen und Mädchen wurden hingegen von Lehrkräften keine unterschiedlichen Kompetenzen in ihrer Mathematikkompetenz zugeschrieben. Die weiterführenden Fragestellungen wurden mittels schrittweisen Mehrebenenregressionsmodellen für Mathematik und Lesen separat betrachtet. Als unabhängige Variablen wurden der Effekt des Geschlechts der Schülerinnen und Schüler und der Effekt der Stereotype der Lehrkräfte auf die Kompetenzen der Schülerinnen und Schüler in der vierten Klasse untersucht. Um die geschlechterdifferenzierte Fragestellung zu beantwortet wurde auch in diesem Beitrag zudem der Effekt der Interaktion aus Geschlecht und Stereotypen getestet. Die Modelle kontrollierten zusätzlich für das kategorisierte Alter der Lehrerinnen und Lehrer, das Geschlecht der Lehrerinnen und Lehrer sowie den Migrationsstatus des Schülerinnen und Schüler und die Anzahl der Bücher zu Hause, um so den sozioökonomischen Hintergrund zu erfassen (Watermann & Baumert, 2006).

Die Ergebnisse der Mehrebenenregressionen zeigten keinen signifikanten Zusammenhang zwischen Geschlechterstereotypen von Lehrerinnen und Lehrern und den Kompetenzen von Viertklässlerinnen und Viertklässlern in Mathematik und Lesen.

Ebenso wurde der Interaktionsterm zwischen dem Geschlecht der Schülerinnen und Schüler und den Stereotypen der Lehrkräfte nicht signifikant. Lehrkraftstereotype standen in dieser Untersuchung nicht im Zusammenhang mit Geschlechterunterschieden in Mathematik und Lesen in der vierten Klasse.

Die Ergebnisse zeigten weiterhin, dass der Klassenkontext sich in der untersuchten Gruppe von Schülerinnen und Schülern der vierten Klasse nicht mit den Geschlechterunterschieden in den Kompetenzen Mathematik und Lesen zusammenhängt. Geschlechterunterschiede in dieser Stichprobe waren demnach nicht auf unterschiedliche Klassenmerkmale zurückzuführen.

6 GESAMTDISKUSSION UND AUSBLICK

Im Rahmen dieser Dissertationsarbeit wurden die Zusammenhänge zwischen Geschlechterrolleneinstellungen und Geschlechterstereotypen und Kompetenzen sowie Interessen von Schülerinnen und Schülern aus verschiedenen Klassenstufen zwischen der vierten und siebten Klasse untersucht.

Das Ziel war mithilfe von Daten eines Large Scale Assessments, dem NEPS (Blossfeld et al., 2011), den Zusammenhang von Geschlechterstereotypen und Geschlechterrollen mit Geschlechterunterschieden in Kompetenzen und Interessen in der Schule aufzudecken. Die Betrachtung des Themas dieser Arbeit erfolgte anhand von drei übergeordneten Fragestellungen.

6.1 GESCHLECHTERROLLENEINSTELLUNGEN, GESCHLECHTERSTEREOTYPE UND GESCHLECHTERUNTERSCHIEDE

Die deskriptiven Ergebnisse zeigten zunächst, dass Geschlechterrollen in der untersuchten Stichprobe im Mittel bei Sechstklässlerinnen und Sechstklässlern in eine egalitäre Richtung neigen (Ehrtmann et al., 2019; Ehrtmann & Wolter, 2018). Vor allem ist deutlich zu erkennen, dass Jungen sehr viel traditioneller eingestellt sind als Mädchen. Dieser Befund deckt sich auch mit anderen Studien. Zum einen sind westliche Gesellschaften im Mittel relativ egalitär eingestellt, zum anderen zeigt sich trotzdem eine große Lücke zwischen Männern und Frauen in ihren Einstellungen und auch Geschlechterstereotype bleiben zum Teil weiterhin bestehen (Dotti Sani & Quaranta, 2017; Eagly et al., 2020; Lueptow, Garovich-Szabo, & Lueptow, 2001).

Bei der Betrachtung von Geschlechterstereotypen von Lehrerinnen und Lehrern ergaben sich im Beitrag 3 nur Stereotype bezüglich der geringeren Lesekompetenz von Jungen im Vergleich zu Mädchen, nicht jedoch bezüglich der Kompetenz von Mädchen in Mathematik (Ehrtmann & Wolter, Manuskript eingereicht). Das heißt, Lehrerinnen und Lehrer schätzten die Kompetenzen von Mädchen im Lesen höher ein, als die von Jungen. Die Mathematikkompetenzen von Jungen und Mädchen wurden allerdings als gleich hoch eingeschätzt. Man kann bei diesem Ergebnis annehmen, dass die Aufklärung der letzten Jahre hinsichtlich der Wirkung von Stereotypen auf die Leistung von Mädchen in mathematischen und technischen Fächern bei Lehrkräften Wirkung gezeigt hat und Lehrerinnen und Lehrer gezielt dem Stereotyp der schlechteren Mathematikleistung von Mädchen entgegentreten. In diesem Rahmen könnte die intensive Forschung zur Wirkung des sogenannten Stereotype Threats auch bei Lehrkräften Wirkung gezeigt haben. Das Wissen um ein negatives Stereotyp über die eigene Gruppe kann die Leistung in der stereotyp besetzten Domäne verringern, das heißt zum Beispiel, dass Mädchen schlechter in Mathematiktests abschneiden, wenn sie die

Botschaft erhalten, dass sie normalerweise schlechtere Leistungen in Mathematik vorweisen als Jungen (Flore & Wicherts, 2015; Spencer, Steele, & Quinn, 1999). Andererseits scheint das gleiche Bewusstsein nicht im Hinblick auf die Lesekompetenzen von Jungen vorhanden zu sein, obwohl es auch hier Evidenz dafür gibt, dass sich Stereotype im Sinne des Stereotype Threat auf die Leistungen von Jungen auswirken können (Hartley & Sutton, 2013; Pansu et al., 2016).

Des Weiteren werden in der Forschung die Auswirkungen von Mathematikkompetenzen für die spätere Bildung stärker diskutiert und Geschlechterunterschiede werden in Mathematikkompetenzen bis ins Erwachsenenalter gefunden, während dies bei der Lesekompetenz nicht der Fall ist (Hyde & Linn, 1988; Ing, 2014; Wang et al., 2015). Auch aus diesem Grund könnten Lehrkräfte gezielt versuchen gegen Geschlechterunterschiede in Mathematik anzugehen.

Auch die Förderungen von Mädchen in MINT-Bereichen ist schon seit längerer Zeit ein Thema in Schulen, als die Förderung von Jungen in sozialen Bereichen oder im Dienstleistungssektor. So gibt es den „Girls' Day" (www.girls-day.de) in Deutschland seit dem Jahr 2001. An diesem Tag können Mädchen Berufe kennenlernen, die im MINT-Bereich anzusiedeln sind. Das Äquivalent für Jungen, der „Boys' Day" (www.boys-day.de), der Tag an dem Jungen Berufe aus dem Dienstleistungs- und sozialen Bereich kennenlernen können, gibt es jedoch erst seit 2011. Auch hier könnte die Priorität für Lehrerinnen und Lehrer, Stereotype zum Nachteil von Mädchen abzubauen, schon länger im Bewusstsein sein, als für Jungen nachteilige Stereotype abzubauen.

Unabhängig von den Ursachen, über die hier nur gemutmaßt werden kann, sollte es zu denken geben, dass ein Großteil der Grundschullehrkräfte, Männer in gleichem Maße wie Frauen, nicht frei von domänenspezifischen Geschlechterstereotypen ihren Schülerinnen und Schülern gegenüber sind.

Während traditionelle Einstellungen und Stereotype nur teilweise vorlagen, zeigten sich kleine, aber konsistente Geschlechterunterschiede in den Mathematik- und Lesekompetenzen von Schülerinnen und Schülern in allen untersuchten Klassenstufen. Im Lesen hatten Mädchen in der vierten, fünften und siebten Klasse höhere Kompetenzen als Jungen und auch in Mathematik verfügten Jungen in allen Klassenstufen über höhere Kompetenzen als Mädchen (Ehrtmann & Wolter, 2018; Ehrtmann & Wolter, Manuskript eingereicht). Dies deckt sich teilweise mit anderen Large Scale Assessment wie PISA, TIMSS und IGLU, auch wenn die Altersgruppen nicht genau übereinstimmen und die Geschlechterunterschiede in hier untersuchten Stichproben deutlicher ausfielen. Bei Betrachtung der gefundenen Geschlechterunterschiede in der NEPS-Studie sowie den anderen vorgestellten Large Scale Assessments kann man sich sicher die Frage stellen, ob diese kleinen Effekte nicht einfach vernachlässigbar sind. Diese These vertritt vor allem Hyde (Hyde, 2005, 2014). Andererseits findet man diese signifikanten Geschlechterunterschiede in lebensnahen Kompetenzen konstant immer wieder und insbesondere nicht nur unter Laborbedingungen bei einzelnen Subgruppen, sondern gemittelt über repräsentative Stichproben. Zum einen sind Kompetenzen in Mathematik und Lesen wichtig, um gleichberechtigt am gesellschaftlichen Leben teilzunehmen, zum anderen können auch ursprünglich kleine Unterschiede eine große Wirkung erzielen (Martell, Lane, & Emrich, 1996). Aus diesen Gründen sollten auch diese relativ geringen Geschlechterunterschiede nicht ignoriert werden.

Die Geschlechterunterschiede in Interessen waren im Vergleich zu den Kompetenzen teilweise stärker ausgeprägt (Ehrtmann et al., 2019). Dies stimmt auch mit anderen Studien überein (Su et al., 2009). Außerdem ergaben sich durch den vorliegenden Beitrag klare geschlechterstereotype Interessensprofile. Jungen wurden am Häufigsten einem Interessenprofil zugeordnet, dass sich durch hohe Interessen in praktischen, forschenden, unternehmerischen und mathematischen Bereichen auszeichnet, während Mädchen am häufigsten einem Profil zugeordnet wurden, welches sich durch hohes Interesse in soziale,

künstlerische, konventionelle Bereiche sowie Deutsch auszeichnet. Diese gefundenen Geschlechterunterschiede in den Interessen sind nicht nur relevant weil Interessen mit Kompetenzen im Zusammenhang stehen (Korhonen et al., 2016; Warwas, Nagy, Watermann, & Hasselhorn, 2009), sondern auch, weil Interessen besondere Relevanz für Bildungsaspirationen und Berufsaspirationen aufweisen (Korhonen et al., 2016; Lee, Lawson, & McHale, 2015). Geschlechterunterschiede in berufsorientierten und akademischen Interessen während der Schulzeit können somit dazu beitragen, dass sich nur wenige Frauen für einen Beruf im MINT-Bereich entscheiden und nur wenige Männer für einen Beruf im sozialen oder Dienstleistungsbereich. In diesem Zusammenhang zeigte auch ein Beitrag von Wolter, Ehrtmann, Seidel und Drechsel (2019), dass sich Frauen im Studium eher einem Zielorientierungsprofil zugehörig fühlen, das soziale Ziele im Beruf priorisiert, während Männer mehr Wert auf ökonomische Ziele legen, welche wiederum auch im Zusammenhang damit stehen, ein MINT-Studienfach zu studieren.

6.2 ZUM ZUSAMMENHANG VON GESCHLECHTERROLLENEINSTELLUNGEN UND STEREOTYPEN MIT KOMPETENZEN UND INTERESSEN

Die zentralen Fragestellungen der Arbeit fokussieren auf die Zusammenhänge von Geschlechterrolleneinstellungen und Geschlechterstereotypen mit Kompetenzen und Interessen. Die drei Beiträge dieser Arbeit beleuchten dieses Thema aus unterschiedlichen Blickwinkeln und mit unterschiedlichen Fragestellungen.

Beitrag 1 und 2 zeigten robuste Effekte der individuellen Einstellungen gegenüber Geschlechterrollen von Schülerinnen und Schülern auf Kompetenzen und Interessen. Beitrag 3 fand allerdings keinen Effekt der Lehrkraftstereotype auf die Kompetenzen von Schülerinnen und Schülern.

Zu den Ergebnissen der Geschlechterrolleneinstellungen von Schülerinnen und Schülern lässt sich zusammenfassen, dass generell eine egalitäre Einstellung förderlich für höhere Interessen und Kompetenzen zu sein scheint, während traditionelle Einstellungen eher mit niedrigeren Interessen und Kompetenzen in Verbindung zu setzen sind (Ehrtmann et al., 2019; Ehrtmann & Wolter, 2018).

Konkret zeigte Beitrag 1, dass traditionelle Einstellungen für Mädchen in den Domänen Lesen und Mathematik nachteilig sind, während diese für Jungen jedoch nur in der Domäne Lesen einen Nachteil im Vergleich zu egalitären Einstellungen bewirken. Wie Beitrag 2 verdeutlichte, stehen egalitäre Einstellungen außerdem in Verbindung mit hohen und weiblich konnotierten Interessen, während traditionelle Einstellungen eher mit niedrigen und männlich konnotierten Interessen zusammenhängen.

Die Bedeutung für Jungen und Mädchen von traditionellen gegenüber egalitären Geschlechterrollen ist eine andere und spielt eine Rolle bei der Erklärung der Ergebnisse. Traditionelle Geschlechterrollen benachteiligen im besonderen Maße Mädchen, während Jungen im Allgemeinen eher durch traditionelle Geschlechterrollen bevorteilt werden. Nach dem Verständnis von traditionellen Geschlechterrollen sind Mädchen zum Beispiel für die Arbeit in statushohen Bereichen weniger geeignet als Männer. Schon Kinder teilen stereotyp männlichen Berufe (z. B. Feuerwehrmann, Ingenieur) einen höheren sozialen Status zu als stereotyp weiblichen Berufen (z. B. Erzieherin, Sekretärin) (Liben, Bigler, & Krogh, 2001; Teig & Susskind, 2008). Jungen profitieren demnach von traditionellen Geschlechterrollen, während Mädchen von egalitären Geschlechterrollen profitieren. Auch dies könnte eine Erklärung für den Befund aus Beitrag 2 sein, dass egalitäre Einstellungen besonders mit weiblichen Interessensprofilen und traditionelle Einstellungen mit männlichen Interessensprofilen in Verbindung stehen.

Weiterhin stehen egalitäre Geschlechterrollen mit höherer Bildung in Verbindung (z. B. Boehnke, 2011; Dicke et al., 2019). Dies kann auch als Erklärung dafür gesehen werden, dass in Beitrag 1 und Beitrag 2 egalitäre Einstellungen bei Schülerinnen und Schülern mit höheren Kompetenzzuwächsen in Mathematik und Lesen und höheren Interessen verbunden waren. Egalitäre Kinder beziehungsweise Jugendliche scheinen Bildung einen höheren Stellenwert beizumessen, als traditionelle Kinder. Um diese Annahme weiterführend zu testen wäre eine Längsschnittstudie interessant, die untersucht ob sich diese Ergebnisse aus einem noch jungen Altersbereich auch auf spätere Bildungsaspirationen und –entscheidungen übertragen lassen.

Ein weiterer Grund für den Befund, dass Mädchen in ihrer Kompetenzentwicklung in mehreren Domänen profitieren und egalitäre Einstellungen mit weiblichen Interessen korrelieren, kann auch mit der Art und Weise der Messung der Geschlechterrolleneinstellungen zusammenhängen. Im NEPS wurden Geschlechterrolleneinstellungen mit vier Items erfasst, welche sich größtenteils auf die Gleichstellung von Mädchen gegenüber Jungen bei Berufen und Technik beziehen. Die umgekehrte Richtung, zum Beispiel die soziale Seite von Jungen, wurde nicht erfasst. Dies kann damit zusammenhängen, dass eine egalitäre Einstellung zum einen eher bei Mädchen gefunden wurde und diese auch eher mit weiblichen als mit männlichen Interessen in Verbindung stand. Interessant wäre aus diesem Grund sicherlich eine breitere Erfassung von Geschlechterrollen, auch wenn dies in einer Large Scale Studie kaum realisierbar ist. Zur Frage der Messung gehört auch die Frage, ob man präskriptive oder deskriptive Stereotype und Geschlechterrolleneinstellungen erfasst. Während präskriptive Aussagen verdeutlichen, wie ein Verhalten zu sein hat, zeigen Deskriptionen den Zustand zum Beispiel von Geschlechterunterschieden auf (Burgess & Borgida, 1999; Koenig, 2018; Rudman & Glick, 2008). Die Reaktion auf das Verletzen von deskriptiven Stereotypen wird mit Überraschung und einer Neubewertung der Informationen beschrieben, kostet für andere Personen also kognitive Ressourcen, die Verletzung von präskriptiven Stereotypen kann allerdings zur Bestrafung der Person führen (Gill, 2004; Rudman & Glick, 2008). Durch die

Messung dieser verschiedenen Facetten von Stereotypen könnten somit verschiedene Effekte erwartet werden. Wie erwähnt ist die ausführliche Messung einzelner Konstrukte in einem Large Scale Assessment nicht immer durchführbar, hierfür wären kleinere Studien hilfreich.

Effekte der Lehrerstereotype auf die Kompetenzen von Schülerinnen und Schülern wurden in Beitrag 3 im Querschnitt nicht gefunden. Hiermit kann jedoch noch nicht abschließend beantwortet werden, ob dieser Zusammenhang bei der Betrachtung im Längsschnitt über mehrere Jahre ebenfalls nicht auftritt. Zum einen scheint es möglich, dass Kinder den Stereotypen von Lehrkräften über einen längeren Zeitraum ausgesetzt sein müssen, um negative Auswirkungen zu spüren, zum anderen liegt keine Untersuchung vor, ob mit Stereotypen behaftete Lehrkräfte ihre Überzeugungen auch durch ihr Verhalten zeigen. In diesem Bereich sind vor allem weitere Studien nötig, um dieser wichtigen Frage weiter auf den Grund zu gehen. In der vorliegenden Studie spielte allerdings tatsächlich der Klassenkontext keine Rolle in der Erklärung von Geschlechterunterschieden. Gründe für Geschlechterunterschiede in den Mathematik- und Lesekompetenzen sind also entweder auf höherer Ebene zu finden, das heißt zum Beispiel auf Unterschieden zwischen den Schulen oder Städten oder auf der interindividuellen Ebene, wie den eigenen Stereotypen oder Einstellungen von Kindern, deren Interessen, Selbstkonzepten oder Motivation.

Ein positives Ergebnis der vorgestellten Studien ist sicherlich, dass egalitäre Einstellungen der Kinder aber auch nichtstereotype Einstellungen der Lehrpersonen keinen negativen Effekt auf Kompetenzen oder Interessen hatten, sondern, wie beschrieben, im besten Fall zu höheren Kompetenzen und Interessen führten. Vor allem zeigen die vorgestellten Studien, dass die Untersuchung von Geschlechterrolleneinstellungen der Schülerinnen und Schüler in Verbindung mit Interessen und Kompetenzen als förderlich gesehen werden kann, um Geschlechterunterschiede zu verstehen.

6.3 LIMITATIONEN DER ARBEIT

Diese Arbeit beinhaltet neben ihren Stärken, wie der Untersuchung einer großen Stichprobe oder aufwendig entwickelten Kompetenztests, mehrere Limitationen, die im Folgenden betrachtet werden sollen. Während der Vorteil eines Large Scale Assessments die große Menge an Teilnehmenden darstellt, ist ein Nachteil sicherlich, dass aufgrund der Fülle an abgefragten Daten und Konstrukten wenig Zeit für einzelne Skalen bleibt. Somit wurden die Geschlechterrolleneinstellungen nur mit vier Items abgefragt, während vergleichbare Skalen (z. B. Athenstaedt, 2000) sehr viel mehr Items verwenden um das Konstrukt valide zu erfassen. Das gleiche Problem wird auch bei den Interessenskalen deutlich, die mit vier beziehungsweise nur drei Items pro Interessensbereich erhoben wurden. So können sicherlich nicht alle Facetten des Konstrukts abgebildet werden.

Aufgrund der eingeschränkt zu Verfügung stehenden Konstrukte war es in dieser Arbeit leider nicht möglich die Wirkmechanismen der untersuchten Einstellungen zu betrachten. Mutmaßlich wirken sich die eigenen Einstellungen gegenüber Geschlechterrollen auf das Selbstkonzept oder die Anstrengungsbereitschaft in bestimmten Domänen aus wie im Erwartungs-Wert-Modell beschrieben wird (Eccles & Wigfield, 2002). Hier sind weiterführende Studien nötig, um die Verbindung zwischen Einstellungen und schulischen Outcomes zu ergründen.

Ähnlich verhält es sich bei der Wirkung von Lehrkraftstereotypen, auch hier konnte nicht untersucht werden, welche Mechanismen hinter einem möglichen Einfluss liegen. Denkbar wäre unterschiedliches Verhalten gegenüber Jungen und Mädchen in der jeweils stereotyp behafteten Domäne. Da jedoch kein Zusammenhang der Lehrkraftstereotype und der Kompetenzen der Schülerinnen und Schüler gefunden wurde, könnte es auch möglich sein, dass Lehrkräfte durch professionelles Handeln im Unterricht ihre Stereotype nicht zeigen. Dies könnte nur durch konkretes Erfassen von Unterrichtsverhalten untersucht werden. Hierfür

wären entweder Beobachtungsstudien vonnöten oder Fragebogenstudien bei Lehrkräften und Schülerinnen und Schülern, die dieses Verhalten erfassen.

Nicht möglich war es durch die zu Grunde liegen Daten zu betrachten, ob Stereotype von Lehrerinnen und Lehrern möglicherweise erst über einen längeren Zeitraum hinweg wirken. Eine längsschnittliche Studie wäre für diese Fragestellung nötig. Weiterhin könnten sich Stereotype von Lehrkräften stärker auf unterrichtsnahe Outcomes auswirken, anstatt auf Kompetenzen. Hier wären Noten oder auch das Selbstkonzept oder emotionale Outcomes wie Angst interessante Möglichkeiten.

6.4 PRAKTISCHE IMPLIKATIONEN DER ERGEBNISSE

Zum Ende dieser Arbeit stellt sich auch die Frage, welche Schlüsse für die Praxis aus den Ergebnissen der vorgestellten Studien gezogen werden können. Es zeigte sich, dass vor allem die eigenen Einstellungen der Schülerinnen und Schüler relevant für ihre Kompetenzen und Interessen sind. Es ist sinnvoll dies zum Anlass zu nehmen, um Lehrkräfte aber auch Eltern zu sensibilisieren, sich mit der Relevanz der Einstellungen von Kindern auseinandersetzen. Egalitäre Einstellungen sollten bei Jungen und Mädchen gefördert werden und das im frühen Alter, da in den vorgestellten Studien deutlich wird, dass Einstellungen der Kinder schon in der sechsten Klasse mit Interessen und Kompetenzen zusammenhängen können. Hilfreich dabei egalitäre Einstellungen zu fördern könnte zum Beispiel sein, Stereotype und Vorurteile anzusprechen und aufzubrechen und Gemeinsamkeiten der Geschlechter hervorzuheben, anstatt Unterschiede. Pahlke, Bigler und Martin (2014) zeigten, dass auch in der Grundschule Interventionen schon möglich sind, um zumindest das Bewusstsein für Sexismus zu erhöhen.

Zum einen ist jede einzelne Lehrerin und jeder einzelne Lehrer in ihrem und seinem Handeln gefragt, zum anderen kann auch über das Curriculum das Handeln gesteuert werden, um so allen Schülerinnen und Schülern die gleiche Chance zu geben unabhängig von ihrer

außerschulischen Erziehung über Sexismus, Geschlechterrollen oder Diskriminierung Erfahrungen zu sammeln.

Die Ergebnisse in Bezug auf die Lehrkräfte zeigen, dass hier teilweise Handlungsbedarf besteht. Lehrkräfte sollten nicht auf Grund des Geschlechtes auf bestimmte Fähigkeiten von Kindern schließen, was die Untersuchungen bei einer Vielzahl von Lehrerinnen und Lehrern in der Domäne Lesen ergeben hat. Hier kann man sicherlich schon in der Lehrerbildung ansetzen, um Geschlechtergerechtigkeit und Stereotype anzusprechen und Vorurteile abzufangen. Fortbildungen können außerdem zum Thema Geschlechtergerechtigkeit beitragen. Letztendlich sind die Eigeninitiative und der Wille der Lehrerinnen und Lehrer gefragt, sich zu informieren und die eigenen Überzeugungen in Frage zu stellen.

6.5 FAZIT

Das Thema dieser Arbeit war Zusammenhänge zwischen den eigenen Geschlechterrolleneinstellungen von Schülerinnen und Schülern sowie den Geschlechterstereotypen von Lehrkräften mit den Kompetenzen und Interessen von Schülerinnen und Schülern aufzudecken. In den vorgestellten Beiträgen wurden vor allem Beziehungen zwischen der eigenen Geschlechterrolleneinstellungen und den Kompetenzen und Interessen von Schülerinnen und Schülern gefunden. Es zeigte sich hierbei, dass eine egalitäre Einstellung in einem positiven Bezug zur Kompetenzentwicklung und Interessensausprägung steht, für den schulischen Erfolg also durchaus relevant ist.

Dass Geschlechterrollen über das Thema dieser Arbeit hinaus eine gesamtgesellschaftliche Bedeutung haben, zeigt weiterführende Forschung. Jungen weisen bis zum Eintritt ins Studium einen geringeren Bildungserfolg auf als Mädchen (Hannover & Kessels, 2011), Frauen arbeiten weniger oft als Männer in MINT-Berufen (Bechmann et al., 2013; Hausmann & Kleinert, 2014), dafür öfter in sozialen Berufen, haben weniger Führungspositionen inne als Männer und

werden in diesen anders wahrgenommen als Männer (Eagly & Karau, 2002; Statistisches Bundesamt, 2020) und sind außerdem weniger oft auf wissenschaftlichen Positionen vertreten, obwohl bei den Hochschulabsolventen das Geschlechterverhältnis ausgeglichen ist (Statistisches Bundesamt, 2019). Frauen verdienen im Durchschnitt weniger als Männer (Adriaans, Sauer, & Wrohlich, 2020; Schrenker & Zucco, 2020) und sind auch heute noch mehrheitlich für die Kinderbetreuung und den Haushalt zuständig (Katz-Wise, Priess, & Hyde, 2010; Samtleben, 2019). In allen diesen Befunden spielen Geschlechterrollen und Stereotype sicherlich eine Rolle.

Die Ergebnisse dieser Dissertationsarbeit zeigen deutlich, dass egalitäre Einstellungen für Mädchen wie auch für Jungen positive Auswirkungen auf ihren schulischen Erfolg haben können. Dies deutet darauf hin, dass die Überwindung geschlechtstypischer Normen in der Zukunft dazu beitragen kann, Jungen und Mädchen zu helfen ihr volles individuelles Potenzial zu entfalten.

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8   ANHANG – VOLLSTÄNDIGE BEITRÄGE

Beitrag 1

Ehrtmann, L., & Wolter, I. (2018). The impact of students' gender-role orientation on competence development in mathematics and reading in secondary school. *Learning and Individual Differences*, *61*, 256–264. doi:10.1016/j.lindif.2018.01.004

Beitrag 2

Ehrtmann, L., Wolter, I., & Hannover, B. (2019). The interrelatedness of gender-stereotypical interest profiles and students' gender-role orientation, gender, and reasoning abilities. *Frontiers in Psychology*, *10*, 1402. doi:10.3389/fpsyg.2019.01402

Beitrag 3

Ehrtmann, L., Wolter, I. (Manuskript eingereicht). Teachers' stereotypes about gender: Are they relevant to students' competencies in mathematics and reading in elementary school?

Beitrag 1

Ehrtmann, L., & Wolter, I. (2018). The impact of students' gender-role orientation on

competence development in mathematics and reading in secondary school. *Learning and*

Individual Differences, *61*, 256–264. doi:10.1016/j.lindif.2018.01.004[1]

The impact of students' gender-role orientation on competence development in mathematics and reading in secondary school

Abstract

Gender differences in mathematical and reading competences have been widely reported for years. In an attempt to explain these differences, the effect of socialization outcomes (in this case, students' gender-role orientation) on gender-specific competence growth is explored. The study was conducted using data from the German National Educational Panel Study. The participants were 3,374 students (48.5% female), whose reading and mathematical competences were assessed in grades five and seven. Students' gender-role orientations were assessed in grade six, as well as their interest in mathematics and German. The results confirmed expected gender differences in both domains in grades five and seven, with girls being better in reading and boys being better in mathematics. As an important point of this study, the results revealed that girls who endorsed an egalitarian orientation towards gender roles displayed higher competence development between grades five and seven in both domains than did girls who held a traditional gender-role orientation. Boys holding an egalitarian gender-role orientation displayed higher competence development than boys holding a traditional gender-role orientation in reading but not in mathematics. This text discusses the results and presents ideas for further research in the area of gender roles.

Keywords: Reading competence, mathematical competence, gender differences, gender-role orientation

Introduction

Even though educational policies have an agenda of equal opportunities for everyone, a gap between boys and girls has been reported for years in competence levels in mathematics and – even more prevalently – in reading. These findings should raise the question of whether every student is supported in reaching their full potential. International large-scale assessments like PISA, TIMSS, and PIRLS have consistently shown gender differences in mathematics (e.g., Hammer et al., 2016; Mullis, Martin, Foy, & Hopper, 2016; OECD, 2016; Reiss, Sälzer, Schiepe-Tiska, Klieme, & Köller, 2016) as well as in reading (e.g., Mullis, Martin, Foy, & Drucker, 2012; OECD 2016; Reiss et al., 2016; Weis et al., 2016). Although these gender differences are relatively small in their effect sizes (for a review see Else-Quest, Hyde, & Linn, 2010), they have been consistently found as early as at the beginning of school in various studies (e.g., Niklas & Schneider, 2012).

In addition to the extent of research showing gender differences in competences, there is an increasing number of research findings that explain the origins of these interindividual differences. Studies have focused on affective-motivational factors, such as domain-specific anxiety (OECD, 2015; Hill et al., 2016), domain-specific interest as a part of intrinsic motivation (Schiefele & Csikszentmihalyi, 1995; Wigfield & Cambria, 2010), and domain-specific self-concept (Marsh, 1989; OECD, 2015; Stankov & Lee, 2014), as determinants of competences and factors in the formation of gender differences in competences. According to these studies, girls display greater anxiety (Bieg, Götz, Wolter, & Hall, 2015; Götz, Bieg, Lüdtke, Pekrun, & Hall, 2013), lower interest (Preckel, Götz, Pekrun, & Kleine, 2008), and lower self-concept in mathematics (Marsh & Yeung, 1998; Skaalvik & Skaalvik, 2004) than boys, whereas boys report lower intrinsic motivation and interest (Retelsdorf, Köller, & Möller, 2011; Stanat & Kunter, 2002; Wolter, Braun, & Hannover, 2015) as well as lower self-concept

in reading and languages compared with girls (Marsh & Yeung, 1998; Skaalvik & Skaalvik, 2004).

The expectancy-value theory (e.g., Eccles & Wigfield, 2002) describes a theoretical model of the mechanisms at play in the development of interindividual differences in academic choices. The model reveals multifaceted determinants of gender-specific academic choices, which might later be transferred into gender-specific competences.

According to the expectancy-value theory (Wigfield & Eccles, 2002), in addition to previous performance, children's perceptions of gender roles play a critical role in the development of academic expectations and task values, which are assumed to be important determinants for motivation and achievement. Based on this theory, children's perceptions of gender roles are influenced by their socializers' beliefs and gender stereotypes. Children's perceptions, on the other hand, have an impact on their expectancies and task values, mediated by their interpretations of their experiences, achievement-related goals, and self-concepts. Eccles and colleagues (e.g., Eccles, Barber, Updegraff, & O'Brien, 1998; Frome & Eccles, 1998; Jacobs & Eccles, 1992) provided an array of research revealing the importance of socializers' and individuals' expectations and the value that is placed on the respective domain.

Against the background of research showing that competence domains are perceived as being gender stereotyped (e.g., Steffens & Jelenec, 2011), in this study, we presume that boys and girls expect different learning outcomes and place different values on domains if these domains are perceived as being associated with their own gender group. We argue that students who endorse traditional gender roles (cf., Athenstaedt, 2000) also incorporate gender stereotypes with respect to subject domains. Therefore, students with egalitarian gender-role orientations should be less influenced by the expected traditional gender roles and be more inclined to not only put effort into the stereotypical domain but also to engage in the domain that is not associated with their own gender group (Heyder & Kessels, 2013; Kessels, Heyder, Latsch, &

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Hannover, 2014). We thereby focus on the impact of students' egalitarian or traditional gender-role orientation on their mathematical and reading competence growth between grades five and seven.

The relationship of gender-role orientation and gender stereotypes

A person's gender-role orientation describes their beliefs about normative gendered behaviors (such as the division of labor) and rules of social interaction or gendered clothing (e.g., Athenstaedt, 2000; Athenstaedt & Alfermann, 2011; Eagly, Wood, & Diekman, 2000). A person with a traditional gender-role orientation, for example, would endorse the idea that women should remain at home with the children or assume home-keeping and care-taking tasks, whereas men should be the "breadwinner" of the family. In contrast, an egalitarian-oriented person would endorse an equal task division as well as equal occupation opportunities for women and men and would also associate the same abilities with women and men.

A person's gender-role orientation depends on social factors, such as gender, age, and education (Athenstaedt, 2000). According to Athenstaedt (2000), on average, men display more traditional gender-role orientations than women. Furthermore, older people are more traditionally orientated towards gender roles than younger people, and people with a higher education as well as their children have a more egalitarian gender-role orientation than people with a relatively lower education.

Gender-role orientation also develops differently in boys and girls during adolescence. Galambos, Almeida, and Petersen (1990) found an increasing gender difference in the endorsement of gender-role attitudes during the sixth and eighth grade. Female students expressed increasingly egalitarian attitudes in higher grades, whereas male students, who already endorsed more traditional attitudes on average, further intensified their traditional attitudes over the years.

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As much as gender-role orientations consist of men's and women's behaviors, there are also gender stereotypes regarding specific subject domains. According to Tobin and colleagues' gender self-socialization model (Tobin et al., 2010), gender stereotypes are defined as the association of certain attributes with the gender groups. Previous research suggests that boys and girls hold the explicit stereotypes that languages are a female domain and mathematics are a male domain (e.g., Cvencek, Meltzoff, & Greenwald, 2011; Steffens & Jelenec, 2011; Steffens, Jelenec, & Noack, 2010). Children as young as two and a half years old identify specific behaviors and characteristics as being associated to women and men (for an overview, see Ruble, Martin, & Berenbaum, 2006), and by the end of elementary school, children apply the concept of gender stereotypes to more abstract constructs, such as academic domains (for a review see Signorella, Bigler, & Liben, 1993).

As a result of learning about gender stereotypes, children might incorporate stereotypical expectations into their self-concepts and adapt their academic engagement according to stereotypes. Despite previous findings on the effect of gender stereotypes on students' domain-specific self-concepts and competences (e.g., Schmader, Johns, & Barquissau, 2004; Steffens & Jelenec, 2011), research on the impact of students' gender-role orientation remains relatively scarce. Nonetheless, previous findings indicate that the relationship regarding the impact of gender-role orientation should be similar to that regarding gender stereotypes. In this study, we thereby aim to investigate the impact of students' gender-role orientation on their competence development in mathematics and reading.

The impact of gender-role orientation and gender stereotypes on domain-specific competences

Previous findings point to a relationship of gender stereotypes and gender-role orientation with competences in school contexts. Hadjar, Grünewald-Huber, Gysin, Lupatsch, and Braun (2012) showed that the traditional gender-role orientation in a group of eighth-grade students was related to lower school achievement in general (i.e., to grades) for boys and girls. Steffens and

Jelenec (2011) revealed that girls had a lower self-concept and lower competences in mathematics when they also showed strong stereotypes with respect to mathematics being a male domain in implicit association tests. Boys, on the other hand, had higher mathematics self-concepts and competences when they also had higher mathematics-related stereotypes. However, the impact of implicit gender stereotypes was not found for languages domains (Steffens & Jelenec, 2011). Furthermore, Plante, La Sablonnière, Aronson, and Théorêt (2013) found that sixth- and eighth-grade students' endorsement of stereotypes in mathematics and reading predicted their grades in the corresponding domain. In line with the expectancy-value theory (Eccles & Wigfield, 2002), this relationship was mediated by their competence beliefs and task values. Beyond this finding, Schmader, Johns, and Barquissau (2004) showed through a questionnaire study that female undergraduate college students who believed that status differences between genders were legitimate also endorsed the stereotypical belief about women's lower mathematical abilities and had a lower self-perception of their own mathematical competence.

Hence, previous studies have revealed that a) gender stereotypes about mathematics and reading have an impact on school achievement and that b) gender stereotypes are related to traditional gender-role orientations. Nevertheless, elaborate research on the impact of students' gender-role orientations on their competence development in gender-typed domains is missing. As mentioned above, based on research on subject-related gender stereotypes (e.g., Cvencek et al., 2011; Steffens & Jelenec, 2011), we presume that students should benefit from an egalitarian gender-role orientation in their competence development (e.g., Hadjar et al., 2012), most notably in the subject domain that is not associated with their own gender group.

Hypotheses

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(H1) In line with findings of PISA, TIMSS, and PIRLS, there are gender differences in domain-specific competence. Boys outperform girls in mathematical competence, whereas girls perform better than boys in reading competence.

Against the background of previous research that has confirmed a relationship of gender stereotypes and gender-role orientations with academic competence, (H2) students' gender-role orientation should influence their competence development in mathematics and reading: A more egalitarian gender-role orientation should be beneficial to students' competence development in mathematics and reading. However, this effect should be affected by students' gender and the gender connotation of the subject domain. In particular, we expect to find a higher impact of students' gender-role orientation for boys and girls in the subject domain that is not associated with their own gender group.

(H2a) In mathematics, girls benefit from a more egalitarian gender-role orientation compared to girls with a more traditional gender-role orientation. Since mathematics is stereotypically perceived to be a male domain, we expect that boys are not affected at all or even benefit in their mathematical competence development from a more traditional gender-role orientation in comparison to boys with a more egalitarian gender-role orientation. As a consequence, the gender difference in mathematical competence should decrease with students' increasingly egalitarian gender-role orientation. This should appear in a significant interaction between gender and gender-role orientation, with girls profiting in their competence development in mathematics more from an egalitarian gender-role orientation than boys.

(H2b) In reading, boys benefit from a more egalitarian gender-role orientation compared to boys with a more traditional gender-role orientation. Since reading is stereotypically perceived to be a female domain, we expect that girls from a more traditional gender-role orientation are not affected at all or even benefit in their reading competence development compared with girls with a more egalitarian gender-role orientation. As a consequence, the gender difference in

reading competence should decrease with students' increasing egalitarian gender-role orientation. This should appear in a significant interaction between gender and gender-role orientation, with boys profiting in their competence development in reading more from an egalitarian gender-role orientation than girls.

As aforementioned, interest as a part of intrinsic motivation has been found to have effects on competences; therefore, domain-specific interest will be controlled for to ensure that the incremental impact of gender-role orientation on competence development in reading and mathematics between the fifth and seventh grade is found.

Methods

The study was conducted with data from the German National Educational Panel Study (NEPS), a longitudinal study on educational trajectories in Germany following a multi-cohort sequence design (Blossfeld, Roßbach, & von Maurice, 2011). This study used data from the NEPS starting cohort three, which began with fifth-grade students in 2010. The NEPS provides Scientific Use Files (SUF) for registered users that include separate data files for competences and cohort information as well as student, teacher, and parent questionnaires. All procedures and instruments are carefully checked by the NEPS data protection team and follow professional guidelines. Moreover, a formal approval was given by the 16 Federal States involved.

Representatives from participating schools provided information about age, gender, class membership, and school type. Students from special-education schools were excluded from this study, as were students with no gender indication or missing competence test data in grades five or seven. The following analyses were conducted with data from measurement points in grades five and seven for students' domain-specific competence and grade six for their gender-role orientation and domain-specific interests.

Sample

The final sample used in this study consisted of 3,375 students (48.4% female). The mean age for this sample in grade seven was $M = 12.88$ years ($SD = 0.49$). In the sample 22.7 % of students had a migration background, meaning that either they or a parent had been born abroad.

School type was categorized into general secondary school, intermediate secondary school, and advanced secondary school. Students from comprehensive schools with specific tracks were grouped into the corresponding school-type category. School types with no clear ability track were excluded from the following analyses since there was no theoretical assumption as to how students rank in their competence levels compared with the other school types.

School type was coded from one to three, with one representing general secondary school and three representing advanced secondary school. The distribution of boys and girls in different school types was significantly different (χ^2 (2, 3374) = 8.61, p = .014). More boys than girls attended general secondary schools (boys: 200; girls: 139) and intermediate secondary schools (boys: 504; girls: 478). The distribution in advanced secondary schools was considered equal (boys: 1035; girls: 1018).

Research Instruments

Domain-specific competence tests

The following analyses were conducted with competence assessments in the domains of mathematics as well as reading and were scaled in an IRT-Model (for more information on scaling in the NEPS, see Pohl & Carstensen, 2012). The indicators of domain-specific competence provided by the NEPS were weighted maximum likelihood estimates (WLE), which are estimates of a person's most likely competence score (see also Pohl & Carstensen, 2013). Competences in mathematics and reading were measured in grades five and seven. For

competence in grade seven, WLEs that were uncorrected for differences in test position but linked to the first measurement point were provided in the dataset and used in the following analyses to enable longitudinal comparisons (Fischer, Rohm, Gnambs, & Carstensen, 2016).

Mathematical competence

The assessment of mathematical competence was developed to be relevant to realistic situations and consisted of four content areas: quantity, change and relationship, shape and space, and data and chance. Six different cognitive components were assessed within these four areas (Neumann et al., 2013). Mathematical competence was measured in grades five and seven.

The test had good reliability in grade five (WLE reliability = 0.778 (Duchhardt & Gerdes, 2012)) and grade seven (WLE reliability = 0.721 (Schnittjer & Gerken, 2017)). The mean of mathematical competence in grade five for this sample was $M = 0.21$ ($SD = 1.13$); this value varies from zero due to sample selection procedures for these analyses. In grade seven, the mean for this sample was $M = 0.93$ ($SD = 1.23$).

Reading competence

The assessment of reading competence in the NEPS was based on functional understanding of texts (Gehrer, Zimmermann, Artelt, & Weinert, 2013). Texts used within the competence assessment of the NEPS were meant to represent everyday reading material. The test therefore consisted of informational texts, commentaries and argumentative texts, literary texts, instructional texts, and advertising texts. The cognitive requirements for these different text types were categorized into finding information in the text, drawing text-related conclusions, as well as reflecting and assessing.

The test had good reliability in grade five (WLE reliability = 0.767 (Pohl, Haberkorn, Hardt, & Wiegand, 2012)) and grade seven (WLE reliability = 0.791 (Krannich et al., 2017)). The mean of the reading competence test in grade five of this sample was $M = 0.18$ ($SD = 1.21$); this score

varies from zero due to the sample selection for these analyses. In grade seven, this sample had

a mean of $M = 0.83$ ($SD = 1.36$).

Gender-role orientation

The gender-role orientation of students in the NEPS was measured by four items ("Boys and

girls should have the same chores at home."; "Girls can handle technical devices just as well as

boys."; "Girls should be able to learn the same professions as boys."; "Men are better suited for

some professions than women."), with answers ranging from *completely agree* to *completely*

disagree on a four-point Likert scale. Gender-role orientation was measured in grade six. A

higher score on the scale indicates a more egalitarian orientation towards gender roles, whereas

lower scores indicate a more traditional gender-role orientation. Cronbach's alpha for this scale

was $\alpha = .72$. On average, students displayed more egalitarian gender-role orientations, with M

$= 2.80$ ($SD = 0.78$).

In a first step, we tested the measurement invariance between boys and girls: The unrestricted

baseline model showed good fit ($\chi^2 = 13.54$; df $= 4$; $p = .009$; CFI $= .99$; RMSEA $= .039$, 90%

CI [.017, .062]), indicating configural measurement invariance. As recommended by Cheung

and Rensvold (2002), we compared goodness-of-fit indices for large sample sizes when

comparing the different measurement models instead of interpreting the χ^2-difference-test.

Partial metric measurement invariance was assured when two factor loadings were unrestricted

($\chi^2 = 20.80$; df $= 6$; $p = .002$; CFI $= .99$; RMSEA $= .039$, [.022, .058]). This model displayed a

good fit (the χ^2- difference to the baseline model was significant, $\Delta\chi^2 = 7.25$, df $= 2$; $p = .025$),

but there was no difference in the CFI. Scalar measurement invariance was also given with a

good model fit ($\chi^2 = 29.37$; df $= 8$; $p < .001$; CFI $= .98$; RMSEA $= .041$, [.026, .057]). The

difference to the metric measurement model in χ^2 was significant when unrestricting one

parameter ($\Delta\chi^2 = 8.58$, df $= 2$; $p = .01$), but the difference in CFI was ΔCFI $= .01$, indicating

partial scalar measurement invariance.

Subject-related interest in mathematics

Students' subject-related interest in mathematics was measured through the NEPS by four items (e.g., "I enjoy puzzling over a mathematical problem."), with answers ranging from *does not apply at all* to *applies completely* on a four-point Likert scale. Subject-related interest in mathematics was measured in grade six. Cronbach's alpha for this scale was $\alpha = .76$, and the mean in this sample was $M = 2.20$ ($SD = 0.77$).

Subject-related interest in German

Students' subject-related interest in German was measured through the NEPS by four items (e.g., "I really enjoy learning more about myself and the world through reading books."), with answers ranging from *does not apply at all* to *applies completely* on a four-point Likert scale. Subject-related interest in German was measured in grade six. Cronbach's alpha for this scale was $\alpha = .73$, and the mean in this sample was $M = 2.30$ ($SD = 0.71$).

Data analysis

Regression analyses were conducted with Mplus Version 7 (Muthén & Muthén, 1998-2015). Stepwise multiple regressions were conducted to demonstrate the changing effects due to the inclusion of predictor and control variables. To allow for the interpretation of effects in the sense of actual competence growth between grades five and seven, competence in grade five was included as a control variable and competence in grade seven was used as the dependent variable. We were thus able to model interindividual development of competence over two years as a change of the student group rather than as an intraindividual change. We estimated three sequential models and entered variables based on theoretical assumptions.

Since students were nested within classes, they were not considered independent of each other within these classes. As we did not have hypotheses at the class level and we did not analyze variables from different levels, there was no need for a multilevel analysis (e.g., Hox, 2002). However, in order to take the nested data structure into account, the standard errors in our analyses were corrected (i.e., type = complex) by the respective class ID. Missing data were handled via full information maximum likelihood (187 cases). Missing data on the clustering variable class IDs were excluded from the analyses (75 cases).

Results

Descriptive analyses

The bivariate correlations between the variables that were included in the regression analyses are displayed in Table 1. Students' gender-role orientation significantly correlated with all variables except subject-related interest in mathematics.

- Insert Table 1 about here -

Significant gender differences were found in all continuous predictor and dependent variables. Table 2 displays descriptive statistics for competences of boys and girls in grades five and seven, their subject-related interests, and their gender-role orientation. Independent sample t-tests were conducted to analyze the significance of gender differences.

Boys outperformed girls in mathematical competences in grade five ($t(3360) = 7.57$, $d = 0.26$, 95% CI [0.19, 0.32]) as well as in grade seven ($t(3370) = 8.25$, $d = 0.28$, [0.22, 0.35]). Boys also showed more subject-related interest in mathematics than girls ($t(3198) = 8.35$, $d = 0.30$, [0.23, 0.37]). The expected reverse pattern was present in reading competence: Girls

outperformed boys in reading competence in grade five (t(3371) = -3.37, d = -0.12, [-0.18, -0.05]) and grade seven (t(3373) = -6.72, d = -0.23, [-0.30, -0.16]). As expected, girls also showed more subject-related interest in German (t(3146) = -9.83, d = -0.32, [-0.41, -0.27]) than boys.

Additionally, t-tests for paired, dependent samples revealed significant competence differences between grades five and seven in both mathematics and reading for boys as well as girls. The effect sizes of the difference in mathematical competence between grades five and seven were comparable for girls (t(1632) = -33.58, d = 0.85, 95% CI [0.77, 0.92]) and boys (t(1741) = -34.10, d = 0.88, [0.82, 0.95]). The effect sizes of the difference in reading competence between grades five and grade seven, on the other hand, were generally smaller and were also higher for girls (t(1632) = -27.32, d = 0.71, [0.64, 0.78]) than for boys (t(1741) = -27.32, d = 0.52, [0.46, 0.59]).

Finally, boys had lower scores on the gender-role orientation scale than girls (t(3105) = -29.67, d = -1.04, 95% CI [-1.12, -0.98]), meaning that they endorsed a more traditional view of gender roles than girls.

- Insert Table 2 about here -

Regression analyses

In the following section, the results for the development of mathematical and reading competences are presented. We conducted separate regression analyses for both domains. Since we expected gender differences in competence growth, students' gender was added as a

predictor variable in the initial models. The subsequent models also included the predictor variable of gender-role orientation as well as the interaction of students' gender and their gender-role orientation, which represented our main hypotheses. In the third models, we tested whether our findings were robust when controlling for school type, subject-related interest, and students' migration background.[1]

Mathematical competence

Gender had a significant effect on the development of mathematical competence in all three models. Competence growth was higher for boys than for girls between grades five and seven (see Table 3). Beginning with a significant effect (b = -.119, *SE* = .029, $p < .05$) and an effect size of d = -0.14, 95% CI [-0.21, -0.08] in the first model, the gender difference in competence growth increased further in Model 2 after entering students' gender-role orientation and the interaction of students' gender and their gender-role orientation (b = -.232, *SE* = .033, $p < .05$, d = -0.24, [-0.31, -0.17]). Subsequently, the gender difference remained stable in the final model, even after controlling for students' domain-specific interest, school type, and migration background (b = -.241, *SE* = .032, $p < .05$, d = -0.26, [-0.33, -0.20]). Moreover, school type (b = .414, *SE* = .028, $p < .05$, d = 0.51, [0.45, 0.58]) and subject-related interest in mathematics (b = .141, *SE* = .020, $p < .05$, d = 0.25, [0.18, 0.32]) also had significant effects on competence growth in mathematics. The effect of migration background was not significant (b = -.057, *SE* = .035, $p > .05$, d = -0.06, [-0.13, 0.01]).

- Insert Table 3 about here -

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1 Since the analyses were controlled for prior competences in mathematics and reading, an incremental impact of socio-economic status was not expected. Consequently, controlling for the socio-economic status of parents did not substantially change the results and was thus not included as a part of the final analysis.

As hypothesized, the interaction of students' gender and their gender-role orientation was significant for competence development in mathematics ($b = .103$, $SE = .043$, $p < .05$, $d = 0.08$, 95% CI [0.01, 0.15]), even when controlling for school type, subject-related interest, and migration background. The interaction effect is pictured in Figure 1.

Fig. 1 Development of mathematical competences in relation to gender-role orientation, shown for boys and girls
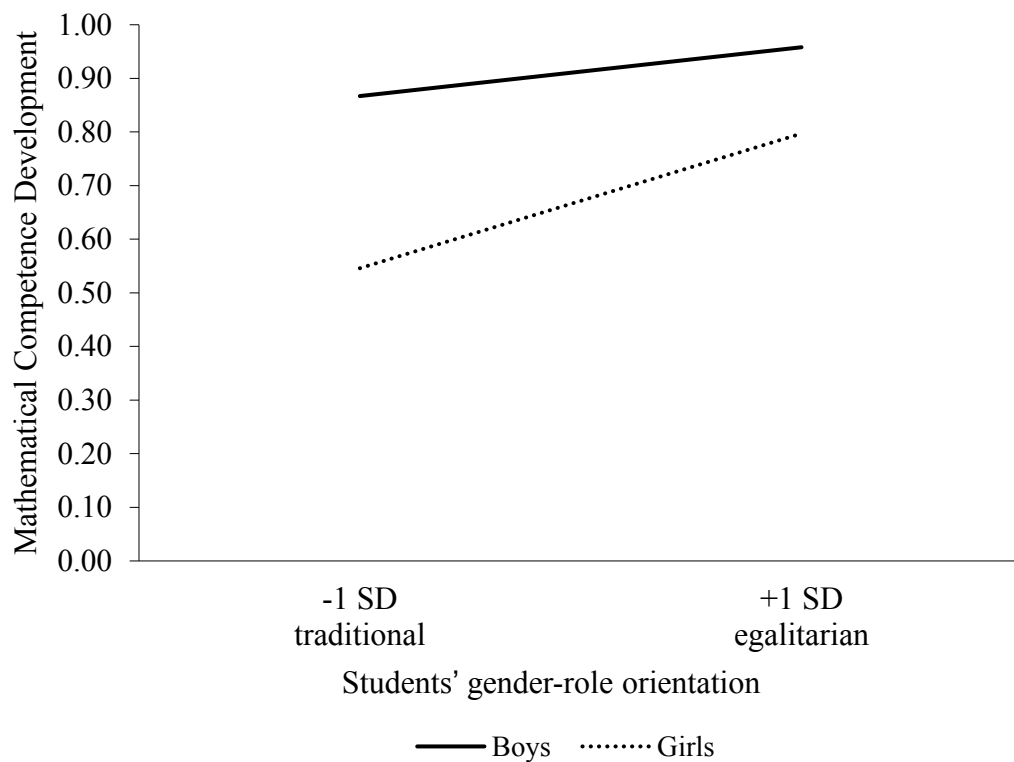
The post-hoc probing of the interaction effect (Aiken & West, 1991) revealed a significant simple slope for girls ($b = .251$, $SE = .05$, $p < .05$), with an effect size of $d = 0.18$, 95% CI [0.11, 0.25]. The simple slope for boys was not significant ($b = .091$, $SE = .05$, $p > .05$, $d = 0.06$, [0, 0.13]). As expected, the more that girls incorporated an egalitarian gender-role orientation rather than a traditional gender-role orientation, the higher was their competence development

in mathematics. For boys, having an egalitarian gender-role orientation was not beneficial to their competence growth.

The tested simple differences were also significant and were both in favor of boys: Boys with a more traditional gender-role orientation (one standard deviation below the mean (b = -.321, SE = .05, p < .05)) as well as boys with a more egalitarian gender-role orientation (one standard deviation above the mean (b = -.161, SE = .05, p < .05)) had a greater increase in their mathematical competence over the course of the two years from fifth to seventh grade than did girls. However, the gender difference in mathematical competence development was slightly diminished within the group of students with a more egalitarian gender-role orientation (d = -0.12, 95% CI [-0.19, -0.05]) compared with the group of students with a more traditional gender-role orientation (d = -0.24, [-0.31, -0.17]).

Reading competence

There was a gender effect on students' reading competence development, which was evident in the initial model (b = .215, SE = .038, p < .05), in the direction of girls showing higher competence growth than boys (see Table 4). Interestingly, the gender difference in competence growth became smaller and insignificant when entering students' gender-role orientation in the second model (b = .081, SE = .042, p > .05), where the effect size decreased from d = 0.20, 95% CI [0.13, 0.27] to d = 0.07, [0, 0.14]. When the control variables of school type, subject-related interest, and migration background were included in the third model, the gender difference remained insignificant (b = .07, SE = .041, p > .05, d = 0.06, [-0.01, 0.13]).

The expected interaction effect of students' gender and their gender-role orientation was significant in Model 2 (b = .126, SE = .057, p < .05, d = 0.08, 95% CI [0.01, 0.15]) but became insignificant when including the control variables in Model 3 (b = .094, SE = .058, p > .05, d = 0.06, [-0.01, 0.13]). There was still a main effect of students' gender-role orientation on reading

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competence growth between grades five and seven when including the control variables in

Model 3 (b = .131, SE = .026, p < .05, d = 0.18, [0.11, 0.24]): Egalitarian students showed

higher competence growth than traditional students. School type (b = .435, SE = .035, p < .05,

d = 0.43, [0.36, 0.50]) and subject-related interest in German (b = -.192, SE = .027, p < .05, d

= 0.25, [0.18, 0.32]) also had significant effects on reading competence growth. Migration

background, however, did not have a significant effect (b = -.064, SE = .043, p > .05, d = -0.05,

[-0.12, -0.02]).

- Insert Table 4 about here -

Contrary to our hypotheses, the interaction of students' gender and their gender-role orientation

was not significant for their reading competence development. The main effect of students'

gender-role orientation on competence development in reading, which continues to be

significant, is pictured in Figure 2. For the sake of completeness, Figure 2 also displays the

differentiating trends for boys and girls.

Fig. 2 The development of reading competences in relation to gender-role orientation, shown

for boys and girls
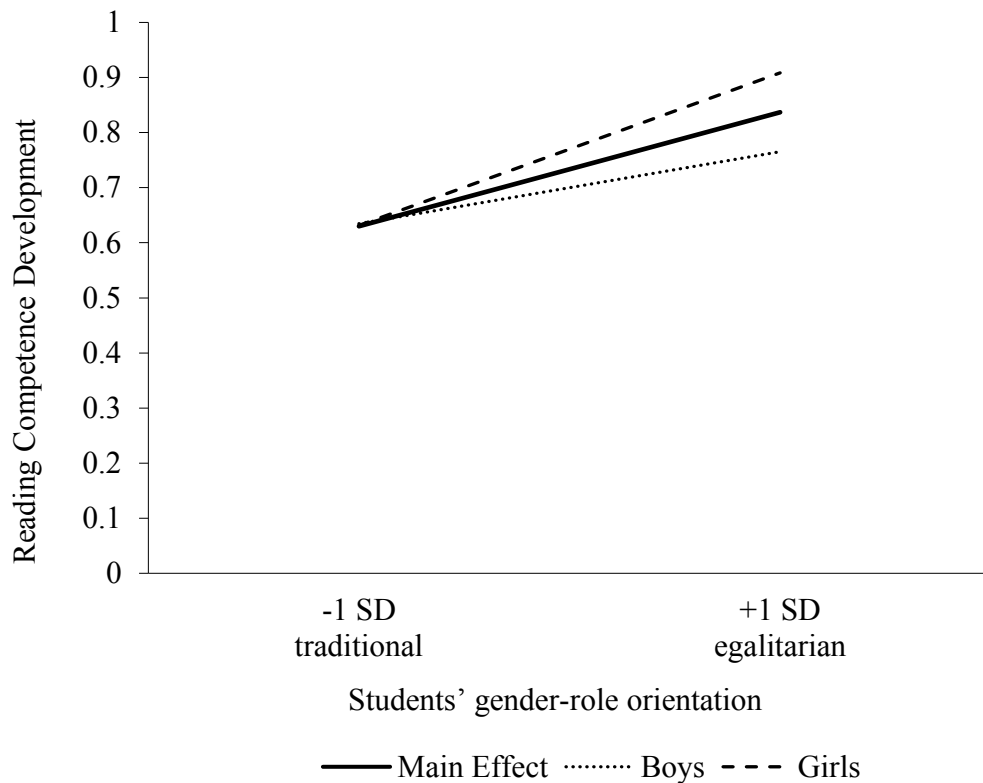
Students with egalitarian gender-role orientations displayed a greater development in their

reading competences than did children with traditional gender-role orientations. While the trend

was not interpretable, there was a small gender difference in favor of girls when students were

highly egalitarian in their gender-role orientation (i.e., one standard deviation above the mean

($b = .143$, $SE = .06$, $p < .05$, $d = 0.08$, 95% CI [0.01, 0.15])) but not between traditionally

oriented boys and girls (i.e., one standard deviation below the mean ($d = 0.00$, [-0.07, 0.07])).

Discussion

The main goal of this study was to determine if students' gender-role orientation impacts their

competence growth in mathematics and reading in early adolescence and whether this effect

emerges differently for girls and boys. In extension to previous research on the impact of

gender-role orientation on competence development, in this study competence was measured

via standardized competence tests within an elaborate framework of measuring competencies

in the National Educational Panel Study (Gehrer et al., 2013; Neumann et al., 2013). With

respect to mathematical competence, there was a significant gender difference in grades five

and seven in favor of the boys. In reading competence, the expected difference between girls

and boys in grades five and seven was also found as girls had higher reading competence than

boys (H1). These results confirm our hypotheses and are comparable with findings from other

large-scale assessments (Hammer et al., 2016; Mullis et al., 2012; Mullis et al., 2016; OECD,

2016; Weis et al., 2016).

As expected, the results further confirm that students' gender-role orientation was related to

competence growth between grades five and seven in both domains (H2). The more egalitarian

students' gender-role orientations were, the higher was their competence development in

mathematics and reading. This effect was found even when controlling for students' school

type, migration background and subject-related interest as a motivational component.

In mathematics (H2a) – but not in the domain of reading – our findings confirm the expected

interaction of students' gender and gender-role orientation on competence development. Girls

benefited from an egalitarian gender-role orientation in mathematics; consequently, as there

was a large gender difference for students with a traditional gender-role orientation, girls with

an increasingly egalitarian gender-role orientation almost closed the gap on boys in

mathematical competence development.

In reading, however, contrary to our assumptions, there was no gender-differentiated effect of

students' gender-role orientation (H2b): The positive effect of having an egalitarian gender-role

orientation was not moderated by students' gender. The results reveal that both girls and boys

benefited from an egalitarian gender-role orientation in their reading competence development.

By trend, girls might profit even more from an egalitarian gender-role orientation than boys,

which would cause the gender gap in the development of reading competence to become more pronounced in favor of girls in students with an egalitarian gender-role orientation as compared with traditionally orientated students.

Contrary to our hypotheses and against the empirical background of domain-related gender stereotypes (Cvencek et al., 2011; Steffen & Jelenec, 2011), the results of our study suggest that the effects of gender-role orientation are domain-specific for boys, but not for girls. While boys benefited from egalitarian gender-role orientations only in the domain that was not associated with their own gender group, girls generally benefited from an egalitarian gender-role orientation and displayed less competence growth if they had a traditional gender-role orientation. In other words, there was a substantial gender difference in mathematics between boys and girls with traditional gender-role orientations, whereas boys with traditional gender-role orientations displayed comparable reading competence development with that of girls with traditional gender-role orientations.

We assume that because gender-role orientation represents a broader concept than domain-specific gender stereotypes, girls with a traditional gender-role orientation, in particular, may generally be negatively affected by their attitudes in regard to competence development in school. This would reflect a more general constraint to girls in regards to their academic success and might also be in line with findings showing that girls are more challenged by traditional gender roles (e.g., Fortin, 2005; Vella, 1994). Since the traditional gender role of women emphasizes their role as care-takers (Athenstaedt, 2000; Eagly et al., 2000), girls with traditional gender-role orientations might be less engaged in academic achievement because they do not aspire to positions that require higher education. Traditionally oriented girls may therefore not only endorse domain-specific stereotypes but also conform to general traditional gender roles (Athenstaedt, 2000; Eagly et al., 2000) and adopt more general stereotypes and beliefs with respect to women's being less likely and less able to be successful leaders (Eagly

& Karau, 2002) and their more common representation in low-paying care-taking jobs (Hausmann, Kleinert, & Leuze, 2015). Girls who have an egalitarian gender-role orientation, on the other hand, hold the expectation that girls should have equal opportunities and academic success to boys, and their aspirations might therefore not differ from those of boys. Correspondingly, research has found that traditionally orientated girls – more so than traditionally orientated boys – are less likely to finish high school than girls with an egalitarian gender-role orientation (Vella, 1994). Furthermore, Fortin (2005) showed that employment status as well as part-time work was more associated with traditional gender roles in women than in men.

As expected, the beneficial effect of an egalitarian gender-role orientation on competence growth for boys was only found in the domain of reading. Contrary to the results for girls, having a traditional gender-role orientation, compared to having an egalitarian gender-role orientation, is only detrimental to boys in the domain not associated with their own gender group and in which they are confronted with a negative competence-related stereotype. Since boys are not held back academically by traditional gender roles (Vella, 1994), they may not be affected in the same way as girls by a traditional gender-role orientation or by endorsing gender stereotypes. However, having an egalitarian orientation and therefore not endorsing gender differences may still be beneficial for boys in domains in which they face a negative performance-related stereotype.

Interestingly, the gender difference in mathematical competence growth as compared with that in reading competence growth seemed to be different. In mathematics, the effect of students' gender on competence growth increased with the inclusion of their gender-role orientation and the interaction of gender and gender-role orientation. In fact, gender remained an important predictor for mathematical competence development even when controlling for important determinants. After controlling for school type, subject-specific interest, and migration

background, the gender difference in mathematical competence growth was even more pronounced. We therefore assume that gender differences in mathematical competence growth might be explained by additional variables which were not measured in our study but should be carried out in future research. For example, one possible reason for gender differences in mathematics could also lie in mathematics anxiety, which affects academic achievement and is more pronounced in girls (Hill et al., 2016).

For reading, the opposite result was observed. While there was an initial gender difference in reading competence development, this difference diminished after entering students' gender-role orientation, school type, subject-related interest, and migration background. The gender difference in competence growth in reading became insignificant, especially when including gender-role orientation. In reading, gender was therefore not an important predictor of competence development incremental to students' gender-role orientation.

Limitations, further research, and practical implications

While the NEPS provides large samples and an opportunity to use many constructs and therefore also to explore a wide range of research questions, using data from a large-scale assessment has its limitations, such as drop-out over time and a restriction to the scales and measurement points of the large-scale study. Nonetheless, for our purposes, the provided data were more than sufficient. To elaborate on the mechanisms in more detail, additional data would be necessary.

Although several effects and the interaction of gender and gender-role orientation in mathematics were significant, it is important to keep in mind that effect sizes remained rather small.

With respect to students' gender-role orientation, this study relied on self-reported data, which means that the questions were very explicit and might have been challenged by social desirability effects. Since implicit attitude measures can have other outcomes than explicit measures (Nosek, Banaji, & Greenwald, 2002; Steffens et al., 2010), it would be interesting to use implicit or behavioral measures to assess students' gender-role orientations and to explore how they relate to competence development.

It is important to note that this measure of gender-role orientation included both prescriptive and descriptive components of traditional gender roles – that is, attitudes about how boys and girls should and do behave (Burgess & Borgida, 1999). As Burgess and Borgida (1999) described in their paper, both forms can lead to discrimination for different reasons. Descriptive gender stereotypes can lead to a perceived misfit between the requirement of a situation and the person by an employer or – in our context – the person themself. Prescriptive stereotypes, on the other hand, would punish individuals who do not conform to the stereotype. An interesting future approach could be to disentangle the effects of prescriptive and descriptive components of students' gender-role orientations from their academic achievements.

Furthermore, there are multiple additional factors that should be discussed with respect to the development and effects of students' gender-role orientation, but these factors lie beyond the scope of our study. Previous studies (e.g., Hess, Ittel, & Kuhl, 2006; Tenenbaum & Leaper, 2002) and the expectancy-value theory (e.g., Eccles & Wigfield, 2002) have highlighted the importance of socialization agents, such as parents and peers, whose impact on students' gender-role orientation could be examined in future research. Against the background of research showing gender stereotypes in domains other than mathematics and reading (e.g., in physics (Kessels, 2005)), the generalizability of our results might prove to be an interesting line of additional research and should therefore be examined.

To identify further conditions under which students' gender-role orientation influences domain-specific competence, potentially moderating variables other than gender (e.g., socio-economic status and theories of intelligence) could be investigated. Furthermore, although additional external influences (e.g., parental support, teachers' competences, beliefs and teaching methods, and characteristics of schools and classes) are important factors in competence development, including these factors would have lain beyond the scope of this study.

In summary, this study aimed at assessing the impact of girls' and boys' gender-role orientation on their competence growth in mathematics and reading. As was evident in the results, having an egalitarian gender-role orientation rather than a traditional gender-role orientation is not only a matter of ideology but is de facto positively related to higher competence gains in the domains of mathematics and reading. Girls, in particular, profited from having a more egalitarian gender-role orientation in both domains. However, endorsing gender equality could help both genders and is certainly not detrimental to boys. From our point of view, this is an important finding since it demonstrates that students can be hindered in their competence development by their own gender-role orientations and the incorporation of gender stereotypes. Our study also revealed that in contrast to the effects of students' domain-specific gender stereotypes, at least girls' gender-role orientations seem to impact both mathematical and reading competences in the same way. This effect of gender-role orientation as an important part of educational development in adolescents should be addressed openly within schools, politics, educational programs, and teacher education. Making educators aware of the importance of fostering an egalitarian gender-role orientation could prove helpful to children of both genders in reaching their full potential.

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Table 1. *Correlations between all variables of the final regression model.*

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Mathematics grade 5	-									
2. Mathematics grade 7	.73*	-								
3. Reading grade 5	.62*	.56*	-							
4. Reading grade 7	.54*	.59*	.61*	-						
5. Mathematical interest	.12*	.17*	-.03	.02	-					
6. Reading interest	.03	.06*	.14*	.21*	.27*	-				
7. School type	.56*	.55*	.48*	.47*	0	.11*	-			
8. Migration background	-.21*	-.17*	-.18*	-.13*	.04*	.05*	-.10*	-		
9. Gender	-.13*	-.14*	.06*	.11*	-.15*	.17*	.04*	.04*	-	
10. Gender-role orientation	.11*	.12*	.23*	.25*	.01	.23*	.16*	-.08*	.46*	-

Notes. * $p < .05$. Gender coding: male = -0.5, female = 0.5; coding for school type: 1 = general secondary school, 2 = intermediate secondary school, 3 = advanced secondary school; coding for migration background: -0.5 = no migration background, 0.5 = migration background.

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Table 2. *Descriptive statistics for competences, gender-role orientation and control variables for boys and girls separately.*

	M_{boys} (*SD*)	M_{girls} (*SD*)	*t*	Effect size *d* [CI]
Mathematics grade 5	0.35 (1.12)	0.06 (1.11)	7.53*	0.26 [0.19,0.32]
Mathematics grade 7	1.10 (1.27)	0.75 (1.16)	8.25*	0.28 [0.22,0.35]
Reading grade 5	0.11 (1.24)	0.25 (1.19)	-3.35*	-0.12 [-0.18,-0.05]
Reading grade 7	0.68 (1.39)	0.99 (1.31)	-6.72*	-0.23 [-0.30,-0.16]
Gender-role orientation	2.45 (0.76)	3.17 (0.61)	-29.62*	-1.05 [-1.12,-0.98]
Mathematical interest	2.31 (0.79)	2.08 (0.74)	8.47*	0.30 [0.23,0.37]
German interest	2.19 (0.69)	2.41 (0.70)	-9.63*	-0.34 [-0.41,-0.27]

Notes. * $p < .05$.

Table 3. *Results for stepwise multiple regression of mathematical competence in grade seven on gender role orientation and the interaction of gender and gender-role orientation, controlling for competence in grade five, migration background, school type and subject-related mathematical interest.*

	Model 1				Model 2				Model 3			
	b	SE	β	d [CI]	b	SE	β	d [CI]	b	SE	β	d [CI]
Intercept	.771	.021	.627*	1.30 [1.22,1.37]	.755	.022	.614*	1.22 [1.14,1.29]	.792	.019	.645*	1.45 [1.38,1.53]
Competence grade 5	.785	.016	.720*	1.72 [1.64,1.80]	.767	.016	.703*	1.68 [1.60,1.76]	.614	.017	.564*	1.22 [1.15,1.30]
Gender	-.119	.029	-.049*	-0.14 [-0.21,-0.08]	-.232	.033	-.095*	-0.24 [-0.31,-0.17]	-.241	.032	-.098*	-0.26 [-0.33,-0.20]
Gender-role orientation					.146	.023	.092*	0.22 [0.15,0.29]	.110	.023	.070*	0.17 [0.10,0.24]
GenderXGRO					.116	.045	.032*	0.09 [0.02,0.16]	.103	.043	.029*	0.08 [0.01,0.15]
Mathematical interest									.141	.020	.089*	0.25 [0.18,0.32]
School type									.414	.028	.227*	0.51 [0.45,0.58]
Migration background									-.057	.035	-.019	-0.06 [-0.13,0.01]
R^2		.53				.54				.58		

Notes. * $p < .05$. GenderXGRO = interaction between gender and gender-role orientation. CI = confidence interval [lower bound, upper bound]. Gender coding: male = -0.5, female = 0.5; coding for school type: 1 = general secondary school, 2 = intermediate secondary school, 3 = advanced secondary school; coding for migration background: -0.5 = no migration background, 0.5 = migration background.

Table 4. *Results for stepwise multiple regression of reading competence in grade seven on gender role orientation and the interaction of gender and gender-role orientation, controlling for competence in grade five, migration background, school type and subject-related German interest.*

	Model 1				Model 2				Model 3			
	b	*SE*	β	*d* [CI]	*b*	*SE*	β	*d* [CI]	*b*	*SE*	β	*d* [CI]
Intercept	.722	.027	.533*	0.93 [0.86,1.00]	.705	.029	.521*	0.85 [0.78,0.92]	.735	.026	.543*	0.97 [0.90,1.05]
Competence grade 5	.678	.018	.607*	1.28 [1.20,1.35]	.653	.018	.584*	1.23 [1.16,1.31]	.524	.019	.469*	0.98 [0.90,1.05]
Gender	.215	.038	.079*	0.20 [0.13,0.27]	.081	.042	.030	0.07 [0,0.14]	.070	.041	.026	0.06 [-0.01,0.13]
Gender-role orientation					.186	.026	.107*	0.25 [0.18,0.32]	.131	.026	.076*	0.18 [0.11,0.24]
GenderXGRO					.126	.057	.032*	0.08 [0.01,0.15]	.094	.058	.024	0.06 [-0.01,0.13]
German interest									.192	.027	.100*	0.25 [0.18,0.32]
School type									.435	.035	.216*	0.43 [0.36,0.50]
Migration background									-.064	.043	-.012	-0.05 [-0.12,-0.02]
R²			.38				.39				.43	

Notes. * *p* < .05. GenderXGRO = interaction between gender and gender-role orientation. CI = confidence interval [lower bound, upper bound]. Gender coding: male = -0.5, female = 0.5; coding for school type: 1 = general secondary school, 2 = intermediate secondary school, 3 = advanced secondary school; coding for migration background: -0.5 = no migration background, 0.5 = migration background.

Beitrag 2

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The Interrelatedness of Gender-Stereotypical Interest Profiles and Students' Gender-Role Orientation, Gender, and Reasoning Abilities

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This study investigates early secondary school students' gender-stereotypical interest profiles and how they relate to students' gender-role orientation, i.e., their traditional or egalitarian attitudes toward gender roles. Gender-stereotypical interest profiles are described by relatively high interests in either female- or male-stereotypical domains and low interests in domains that are not associated to the own gender group. In a study conducted with 4,457 students (49.2% female, sixth graders) with data from the German National Educational Panel Study[1], four interest profiles were derived from the combined latent profile analysis of two academic interest domains (mathematics and German) and six vocational interest domains (realistic, investigative, artistic, social, enterprising, and conventional). Aside from two gender-stereotypical interest profiles, two gender-undifferentiated interest profiles were found. One undifferentiated interest profile was marked by generally high interests in all domains, the other by generally low interests in all domains. Students in the male-stereotypical interest profile had high values in the mathematics, realistic, investigative, and enterprising domains and low interest in the German, artistic, social, and conventional domains. The female-stereotypical interest profile was marked by the opposite pattern. The results further showed that students more likely belonged to the high or female interest profiles when they expressed egalitarian gender-role orientations. Also, boys were more likely members of the female interest profile than were girls of the male interest profile. Students with low reasoning skills were generally more likely members of the low interest profile group. Results are discussed with respect to the question whether interest profiles are more predictive of students' academic development than single domain-specific measures of interest.

Keywords: vocational interest, academic interest, gender-role orientation, interest profiles, gender differences, secondary school

INTRODUCTION

Interests are important for academic as well as vocational decisions and an important motivational component of learning and school success (Wigfield and Cambria, 2010). Academic and vocational decisions have repeatedly been found to be highly dependent on young people's gender (Statistisches Bundesamt [German Federal Statistical Office], 2017). This becomes a problem when considering differences in income and prestige of male- and female-dominated occupations and the uneven distribution of men and women in high-status positions (e.g., Oh and Lewis, 2011). Therefore, when investigating interests as a precursor of vocational decisions, gender differences have to be taken into account. In this study, we aim at finding gendered interest profiles in a sample of sixth grade students and investigated how students' attitudes toward gender roles as well as their reasoning abilities were related to their probability to belong in different profiles. Going beyond previous studies which, in a variable-centered approach, investigated gender differences in particular school subject areas, we compare interest profiles that are gender congruent, gender incongruent, or are gender neutral but differ with regard to interest levels being generally low or high. We argue that employing such a person-centered perspective to examine intraindividual profiles of interests and corresponding gender differences can help to improve our understanding of gendered educational aspirations and vocational career paths (cf., Seidel, 2006; Viljaranta et al., 2009; Chow et al., 2012; Jurik et al., 2013, 2014).

Schiefele (1991) described interest as a motivational component which is content-specific and defined by an intrinsic feeling- and value-related valence toward the content. Eccles and Wigfield (2002) define interests as enduring affective orientations toward an object or class of objects resulting from the interaction between an individual and these objects. Objects of interests can be academic ideas, vocational or leisure time activities. Most of these objects carry a gender connotation or are part of gender stereotypes (e.g., Nosek et al., 2002; Ruble et al., 2006; Lagaert et al., 2017). The two areas of interest that this study will focus on are academic interests, i.e., in regard to school subjects, in particular German and mathematics, which have particularly gender-stereotyped connotations (Hannover and Kessels, 2004; Steffens and Jelenec, 2011; Makarova and Herzog, 2015), and vocational interests, i.e., in regard to occupational tasks and responsibilities. As a novel way to regard interests during early secondary school years, we integrate both academic and vocational interests into interest profiles. With the identification of profiles, we extent previous research. For example, by using this approach we can identify congruent and incongruent patterns of interests in multiple interest domains. German and mathematics as well as most vocations have gendered connotations (e.g., Garrett et al., 1977; Steffens and Jelenec, 2011). Accordingly, we expected gendered interest profiles and boys and girls – at the end of middle childhood – to differ in their interest profiles. Furthermore, we wanted to identify what predicts highly gender-stereotypical interests versus interests that are inconsistent with gender stereotypes. The student characteristics

we focus on are children's cognitive abilities, gender, and gender-role orientations. The goal of this study is to find interest profiles and investigate their connection to students' individual characteristics in a representative large-scale assessment study. Thus, the research questions are explored with a sample of the German National Educational Panel Study (NEPS; Blossfeld et al., 2011).

THEORETICAL BACKGROUND

Gender Differences in Academic and Vocational Interest

Academic and vocational interests have been found to predict educational and occupational attainments, aspirations, and decisions and to be even more important predictors than gender or grades (Lent et al., 1994, 2010; Volodina and Nagy, 2016).

For academic interests, Korhonen et al. (2016) found, for example, that interest in mathematics and reading was related to achievement in both genders. Further, the relationship between achievement and academic aspirations was mediated by interest in reading for girls and boys and by interest in mathematics for girls. Other studies of high school students found interest in mathematics to be a predictor of mathematics grades and chosen course level (Schiefele and Csikszentmihalyi, 1995; Köller et al., 2001).

According to Holland's popular theory (1997), vocational interests can be categorized into six types or domains of interest. These six domains are realistic, investigative, artistic, social, enterprising, and conventional interests. Accordingly, this model is named the RIASEC model. Holland (1997) describes people holding realistic interests as preferring activities where they can manipulate objects, i.e., manual activities, and avoid academic activities. People with investigative interest prefer activities focusing on the "investigation of physical, biological, and cultural phenomena" (Holland, 1997, p. 22) as well as scientific and scholarly activities. Artistic interest is characterized by a preference for creation of different art forms and self-expression, while avoiding ordered activities. People holding social interests prefer activities that focus on other people rather than things. People with enterprising interest are characterized by their preference for activities from which they can attain economic gain, focusing on leadership and persuasive competencies. Lastly, people with conventional interests favor activities involving a clear structure while avoiding ambiguous tasks. These types of interest vary in strength in different people, while not being mutually exclusive to one another. Similar to academic interests, vocational interests have an impact on academic achievement (Warwas et al., 2009). Warwas et al. (2009) found in a sample of 11th grade students a relationship between students' high realistic interest and higher mathematical literacy as well as a relationship between high artistic and social interests and lower mathematical literacy.

Stereotypes about school subjects being either feminine or masculine are still prevalent in children today. Mathematics is, for example, stereotyped as male whereas languages are stereotyped as female (Hannover and Kessels, 2004; Steffens and Jelenec, 2011;

Makarova and Herzog, 2015). This gender stereotyping of children and adults has also been found for occupations (Garrett et al., 1977; White and White, 2006). Being an engineer has, for example, been found to be perceived as stereotypically male, while being an elementary school teacher is perceived as a stereotypically female occupation (White and White, 2006). This stereotyping of domains is mirrored in children's interests. Regarding academic interest, several studies have shown that gender differences exist in reading and mathematics interests in the direction of girls having higher reading and lower mathematics interests and boys having higher mathematics and lower reading interests (Evans et al., 2002; Su et al., 2009; Chow and Salmela-Aro, 2011). Gender differences have also been found in empirical studies on the six types of vocational interest (Su et al., 2009; von Maurice and Bäumer, 2015). According to a meta-analysis by Su et al. (2009), men have generally higher realistic, investigative, and enterprising interests, whereas women have generally higher social, artistic, and conventional interests. The highest effect sizes for gender differences were found in realistic and social interests, the lowest effect sizes were found in enterprising interest, although findings have been inconsistent (Proyer and Häusler, 2007). Thus we have concluded from this empirical evidence that gender-stereotyped interests should also be present in our study.

Gender-Stereotypical Interest Profiles

In this study, we aim at extending previous findings on gender differences in various interest domains by focusing on gender-stereotypical interest profiles. We assume that the genders not only differ in the strength of their interest in various subject domains but that we can identify clusters of interests, with the probability of belonging to one of the clusters varying systematically according to the student's gender. Such a person-orientated investigation of profiles adds to existing variable-centered research because the approach allows to identify gender congruent and gender incongruent patterns, as well as patterns indicating strong or weak interest across subject domains, irrespective of the subjects' gender connotation, thus disentangling the impact of gender stereotypes and of overall strength of interest.

We expect to find interest profiles in sixth grade students of combined academic and vocational interests. These interest profiles should either be differentiated by the level of interests, i.e., high and low interests, or by gender-stereotypical content, i.e., male- or female-stereotypical interests. To this end, instead of just comparing average scale scores, students will be clustered into latent interest profiles which show the relative level of each interest domain to each other. Profiles of interest should be investigated during students' compulsory school years, since during high school, a broad range of skills in different subjects needs to be acquired, compared to a later specialization of skills during university studies or at work.

Interest profiles with gendered connotations have been found in both academic and vocational interests, meaning differentiated interests in male and female interest domains. In a sample of students in 11th grade, Warwas et al. (2009) examined vocational interest profiles and compared them to students' self-reports on single interest scales. Both methods produced comparable results in regard to predicting students' mathematical literacy. However, once covariates were included in the model, only interest profiles still added to the prediction of mathematical literacy. The authors concluded that interest profiles were a more reliable predictor of mathematical literacy than just interest scale scores. Warwas et al. (2009) did not, however, explore interest profiles in relation to students' gender. Chow and Salmela-Aro (2011) found in a study with a sample of ninth grade students gender-specific task-value profiles of a "high-math-and-science" profile which was dominated by boys, and a "low-math-and-science" profile which was dominated by girls. Additionally, Viljaranta et al. (2009) reported in a sample of predominantly 16-year-old students six profiles of task values differentiated by overall level and gender-stereotypical content, including a high profile, a low profile, and gender-stereotypical profiles. Girls were overrepresented in the "multi-motivated" profile and "practical skills and language-motivated" profile, whereas boys where overrepresented in the "low-motivated," "math and science-motivated," and "practical skills-motivated" profiles. These profiles predicted students' academic and vocational attainment expectations.

Interest profiles found in previous studies (Viljaranta et al., 2009; Warwas et al., 2009; Chow and Salmela-Aro, 2011) show gender-stereotypical patterns, i.e., profiles in which interests are high in both mathematics and sciences and low in languages and, *vice versa*, profiles with low interest in mathematics or high interest in languages. Most studies investigating interest profiles have focused on older adolescents or adults, probably because they are already actively involved in making vocational decisions. There has been little research thus far on vocational or pre-vocational interest profiles in children. Furthermore, previous research in children has focused rather on interest scores than profiles. According to the circumscription and compromise theory by Gottfredson (e.g., Gottfredson and Lapan, 1997; Gottfredson, 2002), children start valuing the sextype or gender stereotype of occupations in elementary school and eliminate occupations as options accordingly. Focusing on the development of vocational interests in younger age groups, von Maurice and Bäumer (2015) found that gender differences in vocational interest domains are already present in 9-year-old children or third graders and become even stronger between grades three and five. We therefore expected gendered vocational tasks would also be reflected in young adolescent students' interest profiles.

In summary, in this study, two interest areas, academic and vocational, will be investigated. Both have been found to predict important educational and vocational outcomes, such as achievement and choices (Warwas et al., 2009; Korhonen et al., 2016). Empirical studies about these interests have also found gender difference in the respective sub-domains (Su et al., 2009; Chow and Salmela-Aro, 2011). Interest profiles have been shown to be a valid alternative to absolute scale scores in predicting vocational and academic outcomes (Warwas et al., 2009) and interest profiles of adolescent students have been found to be generally either gender-stereotyped or high or low in all interests (Viljaranta et al., 2009; Chow and Salmela-Aro, 2011).

In the current study, we want to investigate whether gendered interest profiles can already be found in approximately 12-year-old sixth grade children. We expected to find high, low as well as gender-stereotypical interest profiles.

The Impact of Students' Gender-Role Orientation and Gender on Gender-Stereotypical Interest Profiles

As gender-specific interest profiles are based on gender stereotypes, we expected that students' interest profiles would be interrelated with their attitudes toward gender roles, i.e., their gender-role orientation. An individual's gender-role orientation describes internalized societal norms and expectations regarding traditional gendered behaviors. Labor therefore is divided between the genders – men are traditionally characterized as the breadwinners while women are designated to take care of the household and children – and people also perceive other behaviors as more or less appropriate or desirable depending on the actor's biological sex. People holding a *traditional gender-role orientation* differentiate between the appropriateness of traits, attitudes, and behaviors for either men or women and, therefore, also endorse gendered division and distribution of labor (e.g., Athenstaedt, 2000). People holding an *egalitarian gender-role orientation*, however, advocate for equal occupational and behavioral opportunities and rights for both genders and reject differences between the genders as described by gender stereotypes (e.g., Athenstaedt, 2000).

Students' gender-role orientation should be related to their level of interest, i.e., low interest or high interest profiles. In particular, we expected that students with traditional attitudes toward gender roles would more likely be represented in low interest profiles because they can be expected to be less inclined to strive for academic success. In a study by Ehrtmann and Wolter (2018), girls were restricted in their competence development between grades five and seven in the domains of reading and mathematics only when they showed traditional attitudes. Hadjar et al. (2012), however, found a relationship between traditional gender role attitudes and lower grades for boys and girls in eighth grade. We assume these findings are due to lower academic aspirations of students with a traditional gender-role orientation.

A traditional gender-role orientation has been found to be related to academic achievement and vocational interests (Tokar and Jome, 1998; Steffens and Jelenec, 2011; Hadjar et al., 2012; Plante et al., 2013). In particular, Tokar and Jome (1998) found that men who endorse male gender roles report more traditional vocational interests and career choices. Ehrtmann and Wolter (2018) showed that especially traditional girls are restricted in their competence development in mathematics and reading between grades five and seven compared to boys and egalitarian girls. Egalitarian girls therefore had an advantage over traditional girls in their competence development in both mathematics and reading, while egalitarian boys had an advantage over traditional boys only in reading. Traditional girls therefore displayed lower competences than egalitarian girls in a traditional male domain, mathematics, as well as a traditional female

domain, reading; boys were however only affected by a traditional orientation in the traditional female domain, reading. Concerning occupational aspirations, women with traditional attitudes toward gender roles also show more traditional aspirations; the same relationship could, however, not be found for men, who were therefore not more likely to have aspirations to work in occupations with more women even when they showed egalitarian attitudes (Baird, 2012). For our study, we assume that girls with an egalitarian gender-role orientation would therefore more likely show male-stereotypical interests than girls with a traditional orientation, whereas boys would not have a higher probability of showing a counter-stereotypical (i.e., female-stereotyped) interest profile with neither traditional nor egalitarian gender-role orientation.

Since a traditional gender-role orientation was associated with lower achievement (e.g., Hadjar et al., 2012; Ehrtmann and Wolter, 2018), we expected that children's gender-role orientations should also be related to overall interest levels. Traditional gender roles for girls are less consistent with a successful academic or professional career than for boys, in particular with respect to a career in male-connoted subjects or domains. We therefore expected girls to profit particularly strongly from an egalitarian orientation and that a traditional gender-role orientation should strengthen girls' (but not boys') relative preference for gender-stereotypical domains over counter-stereotypical ones (e.g., Baird, 2012; Ehrtmann and Wolter, 2018).

In addition to children's gender-role orientations, their gender should play a role in their stereotypical interests. We expected gender to be a main factor explaining students' interest profiles (e.g., Viljaranta et al., 2009).

It is especially notable that children and adults experience sanctions or stigmatization when they do not act in accordance with traditional gender roles or stereotypes (Blakemore, 2003; Heilman et al., 2004; Rudman and Mescher, 2013). According to Social Role Theory (e.g., Eagly et al., 2000), gender stereotypes develop from the division of labor between men and women. Men more often act in high-status positions and are therefore associated with agency while women more often act in nurturant roles and are therefore associated with communion. According to social-cognitive theory (Bussey and Bandura, 1999), children acquire these gender stereotypes and gender roles through social modeling, enactive experience, and direct instruction. Especially modeling is a strong mechanism through peers, parents, or media (Eccles et al., 1990; Witt, 1997, 2000; Collins, 2011). Accordingly, children also show greater interests in occupations that are associated with their own gender (Liben et al., 2001; Weisgram et al., 2010). This is also evident in an ongoing gender-segregated labor market (e.g., Hausmann and Kleinert, 2014).

Reasons for this gender segregation of interests and occupations might lie in the social sanctioning of counter-stereotypical behavior. Studies have shown that even though both boys and girls suffer from sanctions, the mechanisms behind these sanctions may differ. According to Blakemore (2003), boys are socially sanctioned for looking feminine and for feminine activities, girls, however, are only sanctioned for masculine activities. Even though both genders are

sanctioned for counter-stereotypical activities, boys have the additional disadvantage of also being sanctioned for their looks. In a study of adults, Heilman and Wallen (2010) found that men in gender-atypical jobs are perceived as more ineffectual and are less respected, whereas women in gender-atypical jobs are more disliked and derogated. Likewise, men who endorse gender-egalitarian attitudes are also seen as feminine, weak, and likely to be gay (Rudman et al., 2012), which is due to their association with a low-status group, i.e., women. Moreover, it seems that men are underrepresented in female-dominated occupations compared to women in male-dominated occupations (Croft et al., 2015). Croft et al. (2015) argue that this underrepresentation is a consequence of the perceived lower status of communal roles and female occupations. Children already perceive male-connoted occupations as higher in status than female occupations (Liben et al., 2001). In addition to women's occupations being perceived as lower in status, children find it more difficult to process information about men in counter-stereotypical occupations than about women in counter-stereotypical occupations (Wilbourn and Kee, 2010). Following this argumentation, boys should be less prominently represented in the female-stereotypical interest profile than girls in the male-stereotypical interest profile due to sanctions against their counter-stereotypical behavior.

The Interrelatedness of Cognitive Skills and Interests

Lastly, we assume that students' cognitive skills play a role in their level of interests. Low reasoning ability should be connected to a low interest profile while high reasoning ability should be connected to a high interest profile.

The relationship between cognitive skills and interests can be explained by the social cognitive theory of career development (Lent et al., 1994), which presumes motivational factors, like self-efficacy or expectations of outcomes, play a role in the development of academic and vocational interests together with social factors. Interests then have a relationship with performance attainments, which in turn affect interests, making the relationship between interests and performance attainments reciprocal.

Following this line of reasoning, different studies have found links between domain-specific achievement and interest. Achievement is certainly not just a cognitive factor but heavily influenced by cognitive abilities (e.g., Rohde and Thompson, 2007). Korhonen et al. (2016) found that achievement in mathematics and reading was related to interest in the according domain. Another study (Marsh et al., 2005) reported small reciprocal links between students' mathematics interest and achievement as well as self-concept. Denissen et al. (2007) showed that students felt more competent and interested in domains in which they also showed high achievement and felt their personal strength.

Päßler et al. (2015) investigated the relationship between cognitive skills and vocational interests in students and adults in a meta-analysis. The results showed that a general factor of intelligence correlated positively, in both boys and girls, with realistic, investigative, and conventional interests, negatively

with artistic and social interests, and not at all with enterprising interest. Furthermore, in a study by Schoon and Polek (2011), general cognitive ability was found to be a predictor of general higher occupational aspirations.

Overall, there seems to be a connection between cognitive factors, such as achievement and cognitive abilities, and interests, even though the effects are not consistent. Since our aim is to investigate characteristics of students in certain combined interest profiles rather than single, domain-specific interests, we expect cognitive abilities to be related to students' interest profiles in the direction of high cognitive abilities being associated with a high interest profile.

RESEARCH AIMS AND HYPOTHESES

We expected to find gender-stereotypical interest profiles in girls and boys in middle childhood. These interest profiles should incorporate both academic and vocational domains and reflect gender-stereotypical patterns. We further expected that students' gender and gender-role orientation should be related to their interest profiles. Boys should be less likely to display female-stereotypical interest profiles than girls display male-stereotypical interest profiles since boys should expect greater sanctions than girls when interested in non-gender-stereotypical domains. Gender-role orientation of students should be related to whether students express low interests in all domains or not. It should further be of relevance for girls who should only express interests in male-stereotyped domains when they also express egalitarian gender role views.

Interest Profiles

We expect to find four interest profiles of combined academic and vocational interests. A "low interest profile" is characterized by only weak interest in all domains. A "high interest profile" is characterized by strong interests in all domains.

Furthermore, we expected to find two gender-stereotypical interest profiles. The "female-stereotypical interest profile" should be characterized by higher interest in female-stereotypical interest domains than in male-stereotypical interest domains. Students in this profile are expected to show high interest in German, artistic, social, and conventional domains, and low interest in mathematical, realistic, investigative, and enterprising domains. The "male-stereotypical interest profile" should be characterized by higher interest in male-stereotypical interest domains than in female-stereotypical interest domains. Students in this profile are expected to show higher interest in mathematical, realistic, investigative, and enterprising domains and low interest in German, artistic, social, and conventional domains.

Profile-Specific Hypotheses

Cognitive skills in the form of reasoning ability, students' gender, and students' gender-role orientation are expected to be associated to the probability of students belonging to a certain interest profile compared to other interest profiles as specified below:

Low Interest Profile

Students, regardless of gender, with more traditional gender-role orientations (H1a) or low reasoning abilities (H1b) have a higher probability of belonging to the low interest profile compared to other interest profiles.

High Interest Profile

Students, regardless of gender, with more egalitarian gender-role orientations (H2a) or high reasoning abilities (H2b) have a higher probability of belonging to the high interest profile compared to other interest profiles.

Female-Stereotypical Interest Profile

Girls have a higher probability than boys of belonging to the female-stereotypical interest profiles (H3a); boys are rarely represented in this profile since they would face greater obstacles than girls to express gender-atypical interests (H3b).

Regardless of gender, students with high reasoning abilities are more likely to belong to the female-stereotypical interest profile than to the low interest profile (H3c).

Male-Stereotypical Interest Profile

Boys have a higher probability than girls to belong to the male-stereotypical interest profile (H4a). For girls, the probability of belonging to this profile depends on their gender-role orientation (H4b). Girls are more likely to belong to this profile than to other profiles only when they are also egalitarian. Girls are therefore represented in the male-stereotypical interest profile in higher proportions than boys in the female-stereotypical interest profile. Boys, however, are more likely to belong to this profile than to other profiles regardless of their gender-role orientation.

Regardless of gender, students with high reasoning abilities are more likely to belong to the male-stereotypical interest profile than to the low interest profile (H4c).

MATERIALS AND METHODS

Data

This study was conducted with data from the German National Educational Panel Study (NEPS). The NEPS is a longitudinal panel study on educational trajectories in Germany following a multi-cohort sequence design (Blossfeld et al., 2011). In particular, this study used data from the NEPS starting cohort three, which started assessments with fifth grade students in 2010.

For registered researchers, the NEPS provides Scientific Use Files, which include data on competence tests of students and student, parent and teacher questionnaires as well as cohort information. The study was conducted as an educational survey. A large number of other measures was administered during the whole survey, ranging from socio-demographics to motivational measures. More information and all scales can also be found on the NEPS website: https://www.neps-data.de/en-us/home.aspx. Written informed consent was given

by the students and their parents. Participants were told that they could stop the survey at any time without any disadvantage.

Sample

The sample consisted of 4,457 students (49.2% female), with a mean age of $M = 11.88$ years (SD = 0.50) in grade six; 24.7% of the students had a migration background (i.e., either they or a parent were born abroad). Germany applies achievement tracking in their secondary education system. Depending on the state, after 4 or 6 years of primary school, students are placed into different school types which, after graduation, either provide the option of pursuing vocational training or of attending higher education at the university level. Our sample consists of an oversampling of students in the highest educational track ("Gymnasium") with 46% of students belonging to this track versus 34% of students according to the German Federal Statistical Office (2012).

Research Instruments

Measurement points of academic interests, vocational interests, and gender-role orientations were all located in sixth grade, whereas only students' reasoning ability was assessed in grade five. Reasoning ability is assumed to be a fairly stable construct (Strand, 2004); for this reason, reasoning ability being measured a year prior to the other constructs should not pose a problem. All measures were developed by an interdisciplinary team of item developers working for the NEPS and were extensively pretested (Blossfeld et al., 2011).

Academic Interest in German

Academic interest in the school subject German, which includes German language and literature, was measured by four items (e.g., "I really enjoy learning more about myself and the world through reading books."), with answers ranging from *does not apply at all* to *applies completely* on a 4-point Likert scale, ranging from 1 to 4. The scale showed good reliability, $\alpha = 0.74$, and the mean for the sample was $M = 2.21$ (SD = 0.77). This scale was adapted from Baumert et al. (2003).

Academic Interest in Mathematics

Academic interest in mathematics was measured with four items (e.g., "I enjoy puzzling over a mathematical problem."), with answers ranging from *does not apply at all* to *applies completely* on a 4-point Likert scale, ranging from one to four. The scale showed good reliability, $\alpha = 0.76$, and the mean for the sample was $M = 2.32$ (SD = 0.71). This scale was adapted from Baumert et al. (2003).

Vocational Interests

Vocational interests were measured by the Interest Inventory Life Span (IILS-I), a scale developed for the NEPS, assessing all six of Holland's interest domains (Wohlkinger et al., 2011). Each domain was assessed by three items with the question "How much are you interested in the following things?" and answers ranged from *I have little interest in that; I do not*

like doing that to *I am very interested in that; I like doing that* on a 5-point Likert scale, ranging from 1 to 5. Realistic interest ("building or assembling things," "watching someone repair an electrical device," and "working with metal or wood/creating things from metal or wood") showed a reliability of $\alpha = 0.68$, and a mean of $M = 2.99$ (SD = 1.08). Investigative interest ("watching a science show," "conducting experiments in a test laboratory," and "viewing things through a microscope") showed a reliability of $\alpha = 0.64$, and a mean of $M = 3.10$ (SD = 1.01). Artistic interest ("drawing pictures," "designing something artistically," and "playing with clay or play dough") showed a reliability of $\alpha = 0.65$, and a mean of $M = 3.14$ (SD = 1.03). Social interest ("helping others feel comfortable," "help sick people," and "caring for children or adults in need") showed a reliability of $\alpha = 0.76$, and a mean of $M = 3.40$ (SD = 0.91). Enterprising interest ("negotiating with other people," "being a leader of a group," and "telling other people what they should do") showed a reliability of $\alpha = 0.62$, and a mean of $M = 2.64$ (SD = 0.96). Conventional interest ("keeping lists or records of things," "counting and sorting things," and "tidying up a closet") showed a reliability of $\alpha = 0.53$, and a mean of $M = 2.34$ (SD = 0.87)[2].

Gender-Role Orientation

Students' gender-role orientation was measured by four items ("Boys and girls should have the same chores at home."; "Girls can handle technical devices just as well as boys."; "Girls should be able to learn the same professions as boys."; "Men are better suited for some professions than women.") Answers for this scale ranged from *completely agree* to *completely disagree* on a 4-point Likert scale, ranging from 1 to 4. Higher scores on the scale signify more egalitarian gender-role orientations, whereas lower scores signify more traditional gender-role orientations. The scale had good reliability, $\alpha = 0.72$, and a mean of $M = 2.79$ (SD = 0.78).

Reasoning Ability

Reasoning as one aspect of basic cognitive skills was assessed in grade five using a matrices test (NEPS-MAT) which was developed for the NEPS (Haberkorn and Pohl, 2013; Brunner et al., 2014). The test consisted of 12 items which are described by Haberkorn and Pohl (2013, p. 2) as "horizontally and vertically arranged fields in which different geometrical elements are shown – with only one field remaining free. The logical rules on which the pattern of the geometrical elements is based have to be deduced in order to be able to select the right complement for the free field from the offered solutions." The mean of the provided sum scores for this sample was $M = 7$ (SD = 2.61).

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[2]An exploratory factor analysis showed a five-factor model. Realistic and investigative interests combined accounted for one factor while all remaining factors represented one interest type each, as is expected according to the factors as proposed by Holland (1997). Also, the factor analysis did not suggest merging the subscale of conventional interests, which had the lowest reliability ($\alpha = 0.53$), with another subscale.

Analysis

In order to test the presented hypotheses, a latent profile analysis was conducted using Mplus Version 8 (Muthén and Muthén, 2017). Mathematical, German, and vocational interests were standardized because they were measured on different scales. Latent profile solutions from one to six profiles were compared. The aim of our study was to find clusters that are described by combinations of interests with regard to multiple academic (German, mathematics) and vocational (RIASEC model) interest domains. To our knowledge, a latent profile analysis is an appropriate way to include the joint interests of a person by allocating latent interest profiles and calculating an individual's probability of membership or using the most likely group as outcome. The decision for using latent profiles is therefore based on a joint consideration of academic and vocational interests for an individual. We still use continuous information of each variable which is then used to allocate the latent profiles. The advantage of this approach is that we did not need to aggregate the academic and vocational interest in a joint variable, but rather look at them from a more holistic perspective to consider the probable profile membership of each person.

To test the profile-specific hypotheses, the automatic three-step method implemented by Mplus through the R3STEP command was used (Asparouhov and Muthén, 2014). In this procedure, three steps were conducted. In a first step, we computed a latent profile analysis using the latent profile indicators, in this case the interest domains. In a second step, the most likely profile membership was established for each observation, in this case for each student, using the latent class posterior distribution obtained during the first step. In the third step, auxiliary variables (i.e., the predictor variables) were included; the profile memberships were fixed according to the previous step and used in a multinomial logistic regression as dependent variables. As independent variables, students' reasoning ability, gender, gender-role orientation, and the interaction of students' gender and gender-role orientation were included in the model[3]. Germany has a highly tracked secondary school system. However, we decided not to include school tracks as a control variable since tracking should be closely related to reasoning ability. Furthermore, school tracks are assumed to be related to mean level differences in interest domains, but are not expected to be relevant for the clustering of interest profiles. Reasoning ability and gender-role orientation were grand-mean centered beforehand. The Mplus syntax and model output for the four profile solutions of the latent profile analysis are available under: https://osf.io/wv2at/?view_only=9dcfea10b3144c0fb49 f359f7aac17d9

Cases with missing values on either dependent or independent variables were excluded from the analyses to ensure that the sample was identical for the latent profile analysis and the following multinomial logistic regression analyses.

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[3]An earlier model included parents' socioeconomic status as a control variable. Since this variable showed a large number of missing values and excluding it did not change the results, it was excluded.

RESULTS

Descriptive Results

Means and standard deviations for all variables used in the latent profile analysis, separated by gender, as well as effect sizes (Cohen's d) of gender differences are displayed in **Table 1**. According to independent sample t-tests, gender differences (gender was effect-coded in all analyses: boys = −0.5, girls = 0.5) were significant in all interest domains, in students' gender-role orientations, and in their reasoning abilities.

Boys' interest was higher in realistic [$t(4403)$ = 29.66, $d = 0.89$], investigative [$t(4410)$ = 9.51, $d = 0.29$], enterprising [$t(4332)$ = 17.13, $d = 0.52$], and mathematics [$t(4386)$ = 9.95, $d = 0.30$] interest domains. Girls had higher interests in artistic [$t(4346)$ = −29.25, $d = −0.89$], social [$t(4346)$ = −19.85, $d = −0.60$], conventional [$t(4327)$ = −9.51, $d = −0.29$], and German [$t(4350)$ = −10.66, $d = −0.32$] domains. Regarding predictor variables, girls had higher scores in gender-role orientation [$t(4341)$ = −34.27, $d = −1.04$], i.e., a more egalitarian orientation than boys. Boys had higher cognitive basic skills (i.e., reasoning) than girls [$t(4455)$ = 2.50, $d = 0.07$].

The bivariate correlations between all latent class indicators in the subsequent latent class analysis, i.e., all interest domains, and the predictor variables gender-role orientation, and reasoning ability can be found in **Table 2**. Notably, an egalitarian gender-role orientation correlated positively with the female-connoted interest domains of artistic, social, conventional, and German interests, whereas it correlated negatively or not all with the male-connoted interest domains of realistic, investigative, enterprising, and mathematics interests. Reasoning ability was positively but weakly correlated with realistic, investigative, artistic, and mathematics interests.

Results of Latent Profile Analysis

Before using the previously described three-step method to test the profile-specific hypotheses, simple latent profile analyses

TABLE 1 | Means and standard deviations for interest domains, i.e., the latent class indicators, and predictor variables for boys and girls separately.

	Overall	Boys	Girls	Effect size
	M (SD)	**M (SD)**	**M (SD)**	**d**
Realistic	2.99 (1.08)	3.42 (1.02)	2.54 (0.95)	0.89*
Investigative	3.10 (1.01)	3.24 (1.03)	2.95 (0.97)	0.29*
Artistic	3.14 (1.03)	2.73 (0.98)	3.56 (0.90)	−0.89*
Social	3.40 (0.91)	3.15 (0.90)	3.67 (0.84)	−0.60*
Enterprising	2.84 (0.96)	3.08 (0.96)	2.59 (0.89)	0.52*
Conventional	2.34 (0.87)	2.22 (0.83)	2.47 (0.89)	−0.29*
German	2.32 (0.71)	2.21 (0.70)	2.43 (0.71)	−0.32*
Mathematics	2.21 (0.77)	2.32 (0.78)	2.09 (0.75)	0.30*
Gender-role orientation	2.79 (0.78)	2.44 (0.76)	3.15 (0.62)	−1.04*
Reasoning ability	7.00 (2.61)	7.10 (2.65)	6.90 (2.57)	0.07*

Effect sizes for gender differences.$p < 0.05$.*
Higher scores for gender-role orientation = more egalitarian attitudes.

with profiles differing from one to six were conducted to determine if the presumed four class solution was acceptable. The Vuong-Lo-Mendell-Rubin likelihood ratio test (Vuong, 1989; Lo et al., 2001) showed that a four-profile model had a better fit compared to a three-profile model (adjusted value = 990.95, $p < 0.01$), the fit of the four-profile model was however worse compared to a five-profile model (adjusted value = 237.15, $p = 0.03$). **Figure 1** shows the Bayesian information criterion (BIC) and the Akaike's information criterion (AIC) of each latent profile analysis. The BIC and the AIC were used to compare the different models (e.g., Nylund et al., 2007). As can be seen, there were two bends in the slopes, one at a two-profile solution and one at a four-profile solution. Since the AIC and the BIC did not decrease considerably after the four-profile solution (four profiles: BIC = 93,999; AIC = 93,724; five profiles: BIC = 93,816; AIC = 93,483), and the profile solutions with a larger number of profiles did not contribute any more theoretical value, but merely level differences in the profiles, the four-profile solution was used in further analyses[4]. Through this procedure, each student was given a classification probability for each profile.

Figure 2 displays the results of the four-profile latent profile model. For the analyses, all interest variables were z-standardized to account for the difference in scales. As was proposed in the hypotheses, two undifferentiated interest profiles and two gender-stereotypical interest profiles were confirmed. The undifferentiated interest profiles included one profile with high interests ("high interest profile") in all domains and one profile with low interests in all domains ("low interest profile"). The gender-stereotypical interest profiles included one "male-stereotypical interest profile" with relatively high interests in the mathematics, realistic, investigative, and enterprising domains. This profile is further characterized by relatively low interests in the German, artistic, social, and conventional domains.

The second gender-stereotypical interest profile can be described as the "female-stereotypical interest profile." This profile was identified by relatively high interests in the German, artistic, social, and conventional domains and relatively low interest in the mathematics, realistic, investigative, and enterprising domains.

Table 3 shows the distribution of the four profiles for the whole sample as well as for boys and girls. The low interest profile covered the smallest proportion of 17.2% of all students, the female-stereotypical interest profile was the largest profile with a proportion of 36.8% of all students. For boys, the largest profile was the male-stereotypical interest profile, with a proportion of 41.7% of all boys belonging to it. For girls, the female-stereotypical interest profile was the largest profile, with a proportion of 57.2% of all girls belonging to it. Interestingly, still 17% (386 cases) of the boys belonged to the female-stereotypical interest profile, whereas only 6.4% (141 cases) of the girls belonged to the male-stereotypical interest profile. This difference between boys and girls being categorized in the profile opposite of gender stereotypes was significant,

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[4]The Mplus model outputs for the five- and six-class solutions can be found here: https://osf.io/wv2at/?view_only=9dcfea10b3144c0fb49f359f7aac17d9

TABLE 2 | Correlations between all latent class indicators and predictor variables.

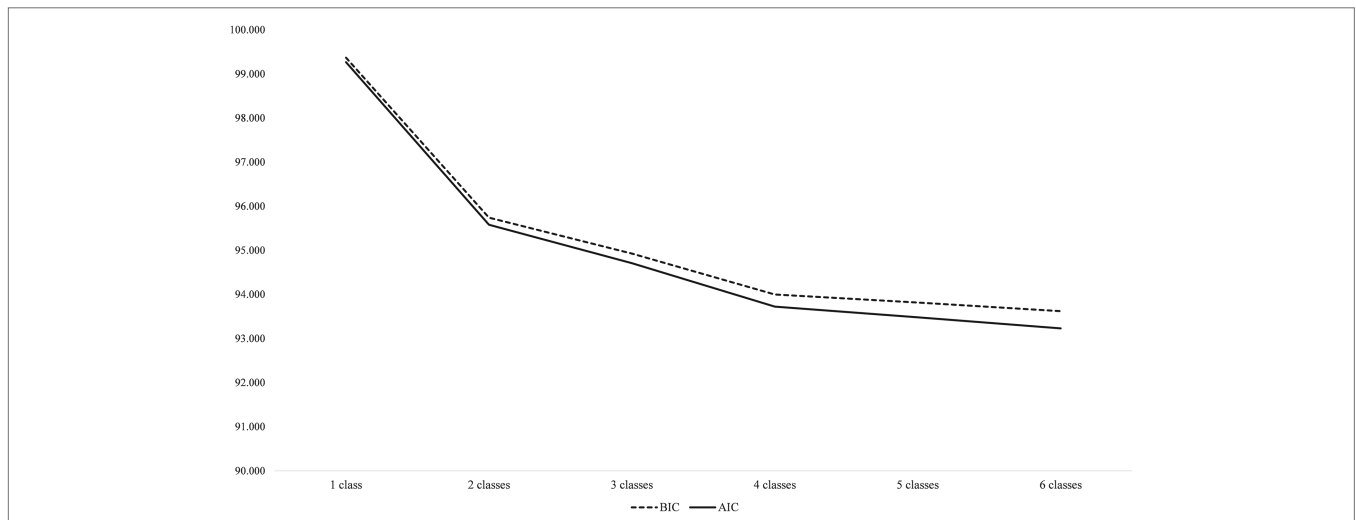|	1	2	3	4	5	6	7	8	9
Realistic	-								
Investigative	0.51*	-							
Artistic	0.13*	0.27*	-						
Social	0.09*	0.25*	0.34*	-					
Enterprising	0.24*	0.13*	0.02	0.02	-				
Conventional	0.21*	0.25*	0.33*	0.32*	0.15*	-			
German	0.34*	0.35*	0.12*	0.18*	0.10*	0.35*	-		
Mathematics	0.15*	0.34*	0.36*	0.40*	0.03	0.39*	0.31*	-	
Gender-role orientation	−0.12*	0.07*	0.29*	0.29*	−0.16*	0.13*	−0.00	0.21*	-
Reasoning ability	0.07*	0.11*	0.03*	−0.00	0.01	−0.02	0.06*	0.01	0.11*

*$p < 0.05$.

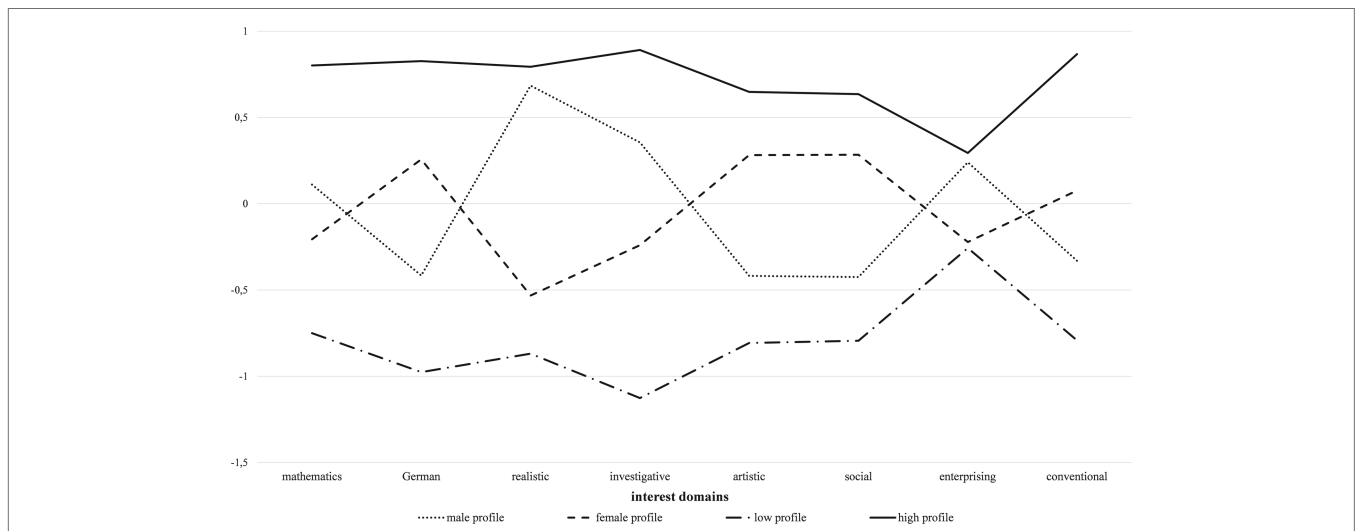**FIGURE 1 |** AIC and BIC values of one- to six-class solutions.

FIGURE 2 | Graphical display of the results of the four-profile latent profile model.

$t(3909) = 11.20$, $d = 0.36$. Boys were therefore significantly more often categorized into the female-stereotypical interest profiles than girls into the male-stereotypical interest profile. This finding goes against our hypothesis **H3b**, which states that boys should rarely be presented in the female-stereotypical profile.

Independent sample t-tests showed significant gender differences in the classification probabilities between boys and girls in the high [$t(4455) = 2.36$, $d = 0.07$], female [$t(3927) = -35.08$, $d = -1.12$], and male [$t(3427) = 34.65$, $d = 1.18$] interest profiles. Girls had a higher probability than boys to be categorized in the female interest profile, boys had a higher probability than girls to be categorized in the male

and high interest profiles. The gender difference in the classification probability in the low interest profile was not significant [$t(4448) = 1.94$].

Results of Logistic Regressions

In the next step, the three-step method described above was implemented to test the profile-specific hypotheses. The results of the derived logistic regressions are shown in **Table 4**. All significant results are reported, but only the results relevant to the hypotheses were examined in more detail.

Hypotheses H1a and H1b

The probability of being categorized into the low interest profile over the high interest profile ($b = -0.84$, SE = 0.10) or the female-stereotypical interest profile ($b = 0.76$, SE = 0.12) was higher with an increasing traditional gender-role orientation. The probability of being categorized into the low interest profile over the male-stereotypical interest profile, however, did not depend on students' gender-role orientation ($b = -0.98$, SE = 0.87). Hypothesis **H1a**, that students with a traditional orientation are more likely represented in the low interest profile compared to other profiles, could therefore not be confirmed.

TABLE 3 | Frequencies for the four interest profiles for the whole sample and separate for boys and girls.

	Overall (%)	Boys (%)	Girls (%)
Low profile	17.2	18.2	16.1
High profile	21.7	23.1	20.2
Female profile	36.8	17.0	57.2
Male profile	24.3	41.7	6.4

TABLE 4 | Results of multinomial logistic regression analyses.

Ref. class			b	SE	OR	CI
High						
	Low	Intercept	−0.315	0.071*	0.73	0.63/0.84
		Reasoning	−0.053	0.022*	0.95	0.90/0.99
		Gender	0.519	0.142*	1.68	1.27/2.22
		GRO	−0.839	0.097*	0.43	0.36/0.52
		IA	0.292	0.192	1.34	0.92/1.95
	Female	Intercept	0.127	0.087	1.14	0.96/1.35
		Reasoning	0.013	0.023	1.01	0.97/1.06
		Gender	2.298	0.175*	9.95	7.06/14.03
		GRO	−0.076	0.115	0.93	0.74/1.16
		IA	−0.519	0.231*	0.60	0.38/0.94
	Male	Intercept	−2.775	1.822	0.06	0.00/2.22
		Reasoning	0.100	0.025*	1.11	1.05/1.16
		Gender	−6.631	3.648	0.00	0.00/1.68
		GRO	−1.821	0.868*	0.16	0.03/0.89
		IA	−2.364	1.737	0.09	0.00/2.83
Low						
	Female	Intercept	0.441	0.091*	1.55	1.30/1.86
		Reasoning	0.067	0.024*	1.07	1.02/1.12
		Gender	1.779	0.184*	5.92	4.13/8.50
		GRO	0.762	0.119*	2.14	1.70/2.71
		IA	−0.810	0.238*	0.44	0.28/0.71
	Male	Intercept	−2.460	1.820	0.09	0.00/3.03
		Reasoning	0.153	0.025*	1.17	1.11/1.22
		Gender	−7.150	3.641	0.00	0.00/0.99
		GRO	−0.982	0.869	0.37	0.07/2.06
		IA	−2.656	1.739	0.07	0.00/2.12
Female						
	Male	Intercept	−2.902	1.820	0.05	0.00/1.94
		Reasoning	0.086	0.030*	1.09	1.03/1.16
		Gender	−8.929	3.648*	0.00	0.00/0.17
		GRO	−1.744	0.868*	0.17	0.03/0.96
		IA	−1.845	1.738	0.16	0.01/4.77

*$p < 0.05$.
GRO, gender-role orientation; IA, interaction between gender and GRO.

As for **H1b**, the probability of being categorized into the low interest profile over all other profiles was higher with a decreasing reasoning ability, confirming the hypothesis (compared to high: $b = -0.05$, SE = 0.02; female: $b = 0.07$, SE = 0.02; male: $b = 0.15$, SE = 0.03).

Hypotheses H2a and H2b

There was a higher probability of being categorized into the high interest profile than into the low ($b = 0.84$, SE = 0.10) and male-stereotypical interest profiles ($b = 1.82$, SE = 0.87) with an increasingly egalitarian gender-role orientation. However, there was no equivalent result for the probability compared to the female-stereotypical interest profile ($b = 0.08$, SE = 0.12). Hypothesis **H2a**, that students with an egalitarian orientation are more likely represented in the high interest profile compared to other profiles, was therefore not confirmed.

For reasoning ability (**H2b**), the pattern was different: there was a higher probability of being categorized into the high interest profile than into the low interest profile ($b = 0-05$, SE = 0.02) with higher reasoning ability. The probability of belonging to the high interest profile compared to the male-stereotypical interest profile ($b = -0.1$, SE = 0.03), however, decreased with higher reasoning abilities. There was no effect of reasoning abilities on the probability of belonging to the high interest profile compared to the female-stereotypical interest profile ($b = -0.01$, SE = 0.02). The hypothesis (H2b), that students with a high reasoning ability more likely belong to the high interest profiles compared to other profiles, could not be confirmed.

Hypotheses H3a, H3b, and H3c

Hypothesis **H3a**, that girls most likely belong to the female-stereotypical profile, was confirmed. There was a higher probability for girls to be categorized into the female-stereotypical interest profile than into all other profiles (compared to high: $b = 2.30$, SE = 0.18; low: $b = 1.78$, SE = 0.18; male: $b = 8.93$, SE = 3.65).

However, as the previous analysis showed girls were less represented in the male-stereotypical profile than boys in the female-stereotypical profile, contradicting hypothesis **H3b** that almost no boys should be in the female-stereotypical profile. Therefore, hypothesis H3b was not confirmed.

Hypothesis **H3c** was confirmed, in that there was a higher probability to be categorized into the female-stereotypical interest profile than into the low interest profile ($b = 0.07$, SE = 0.02) with higher reasoning ability.

Hypotheses H4a, H4b, and H4c

Finally, there was a higher probability for boys to be categorized into the male interest profile than into the female interest profile ($b = -8.93$, SE = 3.65). The effect of gender, however, was insignificant at the 95% level when comparing the probability of students to belong to the low interest profile over the male interest profile ($b = -7.15$, SE = 3.64) and the probability to belong to the high interest profile over the male interest profile ($b = -6.63$, SE = 3.65). Therefore, hypothesis **H4a** that boys

most likely belong to the male-stereotypical profile over all other profiles was not confirmed.

Hypothesis **H4b** had to be rejected, because there was no significant interaction effect of gender and gender-role orientation when comparing the male interest profile to any other profile (compared to high: $b = -2.36$, SE = 1.74; low: $b = -2.66$, SE = 1.74; female: $b = -1.85$, SE = 1.74). Girls who had an egalitarian gender-role orientation had no higher probability to belong to the male interest profile compared to any other profile.

Lastly, hypothesis **H4c** was confirmed; there was a higher probability to be categorized into the male interest profile than into the low interest profile ($b = 0.15$, SE = 0.03) with higher reasoning abilities.

DISCUSSION

This study investigated gender-stereotypical interest profiles of combined academic and vocational interests and their relationship to students' gender-role orientation, gender, and reasoning ability in a large representative sample of sixth grade students from Germany.

The first goal was to identify different interest profiles: two undifferentiated and two gender-stereotypical profiles. Results confirmed one generally high interest profile, one generally low interest profile, one male-stereotypical interest profile, and one female-stereotypical interest profile into which students could be categorized. Gender-stereotypical interest profiles were identified by strong interest in gender-stereotypical domains and weak interest in non-stereotypical domains. The largest profile was the female-stereotypical interest profile, followed by the male-stereotypical interest profile, the high interest profile, and the low interest profile. Still 17% of all students were categorized into the low interest profile. This means that they did not show particular interest in any domain.

We had expected that more girls would be categorized into the male-stereotypical interest profile than boys into the female-stereotypical interest profile since boys face greater sanctions for associating with the lower status group (Liben et al., 2001; Rudman et al., 2012; Croft et al., 2015) and girls and women were shown to aspire to more agentic domains and leadership positions over the past decades (Eagly and Carli, 2003). This expectation was not confirmed by the current findings. In fact, the distribution was reversed: more boys were found in the female-stereotypical interest profile than girls in the male-stereotypical interest profile. Therefore, it seems that the female-stereotypical interest profile is the most desirable and more boys divert their interests to non-stereotypical domains than girls. One explanation of this unexpected finding is a positive connotation of communal tasks and domains: children of our age group consider prosocial behaviors as highly moral (e.g., Eisenberg, 2018). This might explain, why it is less threatening for boys to engage in the female-stereotyped interest domains because the tasks and behavioral descriptions are considered as prosocial behaviors (e.g., helping others to feel comfortable) and age appropriate.

In a next step, profile- and predictor-specific hypotheses were tested. The analyses revealed that, in line with previous research on the relationship between gender-role orientation and academic competence (e.g., Ehrtmann and Wolter, 2018), the probability of being categorized into the low interest profile rather than the female-stereotypical or high interest profiles increased with a traditional gender-role orientation. However, students' gender-role orientation did not differentiate between the likelihood of being categorized into the low versus male-stereotypical interest profiles. Having an egalitarian gender-role orientation increased the probability of being categorized into the high interest profile compared to the low and male-stereotypical interest profiles, but not compared to the female-stereotypical interest profile. These results of students' gender-role orientation suggest that increasingly egalitarian students are more likely to have high or female-stereotypical interest profiles rather than low or male-stereotypical interest profiles. Possibly, egalitarian attitudes toward gender roles indicate more liberal attitudes in general. Research on stereotypes associated with different subject domains has shown that female-connoted domains – such as languages, arts, or social activities – are more strongly associated with liberal values such as autonomy and freedom of expression, compared to mathematics, sciences, or domains dominated by manual activities (e.g., Hannover and Kessels, 2004; Makarova and Herzog, 2015). Conversely, increasingly traditional students are more likely to have either a low or male-stereotypical interest profile rather than a high or female-stereotypical interest profile.

Reasoning ability was also relevant to the probability of students' membership in specific profiles. Students with higher reasoning ability were also more likely to have a high, female-, or male-stereotypical interest profile rather than a low interest profile. Surprisingly, high reasoning ability was also connected to a male-stereotypical interest profile compared to a high interest profile. Reasoning did not, however, differentiate between the probability of having a high or a female-stereotypical interest profile. This shows that reasoning ability differentially predicts low interests versus other profiles. It also shows that reasoning ability may be connected especially to male-stereotypical interests, i.e., mathematics, realistic, investigative, and enterprising interests. Similar results were found by Päßler et al. (2015), who reported a connection between a general intelligence factor and realistic, investigative, and conventional interests.

As expected, gender was also related to the probability of belonging to a profile. Girls more likely belonged to the female-stereotypical interest profile than to other profiles. Boys more likely belonged to the male-stereotypical interest profile than to the female-stereotypical interest profiles. Yet, the gender effect for the probability of displaying the male-stereotypical compared to the low and high interest profiles was not significant. Students' gender did not seem to be relevant to the probability of memberships when they expressed either low or high compared to male-stereotypical interests.

Overall, these results showed that students' interests were already rather differentiated regarding gender stereotypes in early secondary school years. This is in line with previous studies investigating gender differences in academic interests (Wigfield and Cambria, 2010) and vocational interests (von Maurice and Bäumer, 2015). Yet, unexpectedly, more girls expressed gender-stereotypical interests than boys and a considerable number of boys expressed female-stereotypical interests. Reasons may lie in the nature of the assessed interest domains: vocational female-stereotypical interests may – especially for 12-year-old children – not be associated with certain, more concrete occupations, but are rather considered as general activities that are performed and encouraged regardless of vocational aspirations or special interests, such as helping others, being neat, or drawing a picture. Male-stereotypical interests, such as working with metal or using a microscope, must be especially sought out and warrant a special interest in the activity. In addition, gender stereotypes intensify during adolescence, especially in girls, which may result in more engagement in female activities (for an overview, see Ruble et al., 2006). Evidence for the sanctioning of boys following female-stereotypical interests could, however, not be found in the current study.

Furthermore, considering students' gender-role orientation, the results revealed that traditional students more likely expressed low interests or male-stereotypical interests rather than high interests or female-stereotypical interests. This held true for boys and girls. A possible explanation for this connection of students' gender-role orientation and their interest profiles could lie in the broader meaning of having egalitarian or traditional attitudes toward gender roles. Endorsing egalitarian attitudes toward gender roles indicates a more liberal world view in general with more need for autonomy and the freedom to express oneself, such as in languages, arts, or social activities than endorsing traditional attitudes, which may be associated with a preference for stricter rules and highly structured environments as reflected in more clearly defined activities like mathematics, sciences, or manual activities.

Limitations and Outlook

When considering the results, it is important to note that most variables were assessed in grade six, and therefore primarily cross-sectional data were presented in this study. For this reason, the relationships were only correlational in nature and no causal inferences should be drawn.

Reasoning ability was used in order to measure cognitive abilities. This is, of course, only one indicator of fluid cognitive abilities and might be more strongly connected to interests in mathematical skills or science than to interests in more female-connoted domains such as reading or arts. Other indicators of cognitive abilities that might tap more into other areas, such as language processing, could be investigated in further studies.

It has to be kept in mind that academic and vocational interests were assessed with different scales; therefore, the assessed concepts could also differ slightly from each other. Especially some of the subscales of the vocational interests scale showed low internal consistencies, specifically conventional interest. This might be due to the small number of items used for each interest domain (Cortina, 1993).

Furthermore, it is important to mention that correlations and odds ratios of the logistic regression analyses are mostly rather small to medium. In a large sample, such as was used in this study, even small effects become significant; this needs to be kept in mind when interpreting the results and thinking about implications.

Social desirability might have challenged the explicit assessment of students' gender-role orientation, as this study relied on self-reported data.

In a next possible step, the change over time of these interest profiles of both academic and vocational interests and their predictive value for academic outcomes and choices in later years should be examined. It is plausible to assume that gender-stereotypical interests become less important in favor of even more differentiated interests in only specific domains. Another interesting aspect in future studies of latent interest profiles could be the inclusion of context factors, such as class or teacher stereotypes, which might influence students' interests and choices.

Also, our analysis was clearly focused on individuals and is mute with respect to the question where girls' and boys' interests come from. Future studies need to broaden the perspective to include cultural explanations relating to masculinity and femininity and how the changes that have occurred over the last decades in how boys and girls are perceived impact the development of academic and vocational interests in boys and girls.

Conclusions

Students in sixth grade already seem to have rather gender-stereotyped interests in both academic and vocational domains, which is shown by gender differences in all interest scales and the finding of two gender-stereotypical interest profiles, even though stereotypicality varied for individuals and, in some cases, was even reversed This effect is more pronounced in girls than in boys in middle childhood, which might be due to girls' more advanced general development and an intensifying of gender stereotypes (Hill and Lynch, 1983; Ruble et al., 2006).

Furthermore, it seems that boys at this age are not as stereotyped as girls. Quite a few boys even have gender-atypical interests. The question remains why these interests are not transferred into later occupational choices, as evidenced by the low number of men in female-dominated occupations (e.g., Hausmann and Kleinert, 2014; Croft et al., 2015). It is concerning that only a very small percentage of girls was interested in male-connoted areas. This finding is repeatedly reflected in

statistical data which confirm the underrepresentation of women in STEM study subjects and occupational fields (Statistisches Bundesamt [German Federal Statistical Office], 2017). Promoting girls' interest in mathematical, practical, scientific, and entrepreneurial areas seems to be a challenge even in children as young as about 12 years old. Additionally, fostering gender-egalitarian attitudes in all children could promote higher interests in a broad range of areas.

Finally, it is alarming that 17% of students did not have any particular interests within the academic and vocational areas explored in this study. A goal in future education should certainly be to foster students' interests at a young age in order to help them build skills and aspirations.

ETHICS STATEMENT

The Federal Ministries of Education in Germany approved the study. Ethical standards were approved by the National Educational Panel Study. Written informed consent was given by the students and their parents in accordance with the Declaration of Helsinki. Moreover, informed consent was also given by the educational institutions to take part in the study. The consent procedure was approved by a special data protection and security officer of the National Educational Panel Study. Students (as well as all other parties) could abort their participation at any time in the study. Further approval by an ethics committee was not required according to the local and national guidelines.

AUTHOR CONTRIBUTIONS

All three authors contributed to the conception of the article. LE conducted the statistical analyses and drafted the article with advice from IW. IW and BH critically reviewed the article and substantially contributed to the Theoretical Background and Discussion sections.

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Beitrag 3

Ehrtmann, L., Wolter, I. (Manuskript eingereicht). Teachers' stereotypes about gender: Are they relevant to students' competencies in mathematics and reading in elementary school?

Teachers' stereotypes about gender: Are they relevant to students' competencies in mathematics and reading in elementary school?

Previous research shows gender differences in mathematical and reading competencies as early as elementary school. The aim of the present study was to investigate the relevance of teachers' endorsement of gender stereotypes on children's competencies in fourth grade. Previous research shows inconsistent effects of teachers' stereotypes and teachers' ratings of abilities in the domains of reading and mathematics. We focus on the relationship of teachers' stereotypes regarding differential abilities of boys and girls in mathematics and reading and children's competencies in mathematics and reading in elementary school. Using cross-sectional data from 3,669 students in Grade 4 and their teachers ($N = 591$) of the German National Educational Panel Study we found that teachers express gender stereotypes in reading but not in mathematics. Furthermore, multilevel analyses did not corroborate an effect between teachers' stereotypes and gender differences in competencies in mathematics or reading.

Introduction

Gender differences in academic competencies are detrimental when the goal is to provide equal educational opportunities and participation for boys and girls (UNESCO, 2020). However, depending on the study, a gender gap in two main competence domains, mathematics and reading, can still be found, and maybe even more importantly, males and females are believed to possess different abilities depending on the domain (Kollmayer, Schober, & Spiel, 2016). Gender stereotypes are prevalent throughout children's lives in media, school or their families and influence children's self-concepts, motivation, educational decisions and achievement (e.g., Collins, 2011; Haines, Deaux, & Lofaro, 2016; Muntoni & Retelsdorf, 2019; Muntoni, Wagner, & Retelsdorf, 2020; Witt, 1997). This study explores competence differences between boys and girls on the basis of their teachers' stereotypes about children's abilities in mathematics and reading.

Reading is a basic competence which has influence on the comprehension of material in all other domains and high reading competencies are therefore relevant to be able to participate in an active life (Artelt et al., 2007). Low mathematics competencies, however, are among other factors like self-concept accountable for lower aspirations and decisions to study and work in STEM (science, technology, engineering, mathematics) fields (Wang & Degol, 2013; Wang, Degol, & Ye, 2015). The continuous assessment of reading and mathematical competencies throughout the life course is one of the aims of the German National Educational Panel Study[1] (Blossfeld, Roßbach, & von Maurice, 2011) which provides the data base of this study. The

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[1] This paper uses data from the National Educational Panel Study (NEPS): Starting Cohort Kindergarten, doi:10.5157/NEPS:SC2:8.0.1 . From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

paper will focus on the group of fourth grade students as well as their teachers. Fourth grade, the last year of elementary school in the majority of federal states in Germany, represents a critical time for students as decisions about secondary school tracking are made. Also, by this time children possess a good understanding about gender stereotypes and gender differences in different domains have developed (Banse, Gawronski, Rebetez, Gutt, & Morton, 2010; Robinson & Lubienski, 2011; Signorella, Bigler, & Liben, 1993). In this context, the aim of this study is to identify if there is a relationship between teachers' gender stereotypes about the domains mathematics and reading and their students' competencies in those domains.

Gender differences in mathematics and reading competencies

Differences in competencies between boys and girls in the domains of reading and mathematics have been well researched and documented in previous research. The gender gap in reading has been found consistently in favor of girls in large scale assessments for different age groups internationally and in Germany (Mullis, Martin, Foy, & Hopper, 2017; OECD, 2019). The results on gender differences in mathematics have been inconsistent in recent years and indicate a reduction of the gender gap. The latest TIMS-Study (Trends in International Mathematics and Science Study), which assessed fourth grade students, did not find higher mathematical competencies in boys (Mullis, Martin, Foy, & Hooper, 2016), while the latest PISA (Programme for International Student Assessment) study did find a very small gender difference in favor of boys in 15-year-olds (OECD, 2019).

From a developmental viewpoint, studies have found differing results about the time when gender differences in mathematics and reading emerge. While Robinson and Lubienski (2011) found that differences between boys and girls can be already observed before the beginning of school in precursor skills of reading, Niklas and Schneider (2012) found no differences until children entered first grade of elementary school. For mathematics, results are more consistent in showing no differences before school and an emergence of gender differences during the first

years of elementary school (Niklas & Schneider, 2012; Robinson & Lubienski, 2011). In reading, early performance differences are especially apparent in children with low competencies, while in mathematics gender differences appear first in students with higher levels of competencies and then later spread throughout the competence levels during elementary school (Cimpian, Lubienski, Timmer, Makowski, & Miller, 2016; Robinson & Lubienski, 2011). These results show that if differences in competencies between boys and girls exist, they should be well established by the end of elementary school. While gender differences in the domains of reading and mathematics are found in many studies, it is also important to note that effect sizes of gender differences, including in large scale assessments, are generally small and negligible (Hyde, 2014).

Even though the research is not always consistent, gender differences at the end of elementary school in mathematics and reading have been documented during the last decade (Mullis et al., 2017; Mullis, Martin, Foy, & Drucker, 2012; Robinson & Lubienski, 2011).

Especially in elementary school it has been discussed if the superior number of female teachers compared to male teachers explains gender differences, especially in reading. While this has been largely refuted (Hannover & Kessels, 2011), in this study we want to explore one other condition that can be explanatory in the emergence of these differences, which are gender stereotypes within the educational environment.

Gender stereotypes

In accordance to gender differences in competencies, gender stereotypes about reading and mathematics exist. Gender stereotypes are beliefs about attributes that characterize different gender groups (Tobin et al., 2010) and knowledge about which academic domains are gender stereotyped consolidate during middle childhood in elementary school years (Banse et al., 2010; Kollmayer et al., 2016; Ruble, Martin, & Berenbaum, 2006; Signorella et al., 1993). Common stereotypes in the academic domains, that children believe, are girls having low abilities in

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mathematics and mathematics being a boys' domain, while boys are supposed to have low abilities in reading and language domains, which are perceived to be girls' domains (Cvencek, Meltzoff, & Greenwald, 2011; Steffens & Jelenec, 2011).

Stereotypes about groups include both elements of descriptive as well as prescriptive nature (Burgess & Borgida, 1999; Gill, 2004; Koenig, 2018; Rudman & Glick, 2008). While, according to Rudman and Glick (2008), all stereotypes are descriptive (e.g., "Boys are taller than girls"), some are also prescriptive (e.g., "Boys are good at sports"). When a person violates descriptive stereotypes, people usually react with surprise and the information needs to be newly processed. However, violating prescriptive stereotypes can lead to bias and punishment towards the person violating the stereotype since prescriptive stereotypes can act as a way of system justification (Gill, 2004; Rudman & Glick, 2008). While children's endorsement of gender stereotypes has been found to be related to their performance in mathematics and reading (Plante, La Sablonnière, Aronson, & Théorêt, 2013; Steffens & Jelenec, 2011), in this study the focus will be on teachers' endorsement of gender stereotypes in mathematics and reading and the relationship to their students' competencies in those domains.

Gender stereotypes of teachers

Different studies have shown that gender stereotypes and gender-role attitudes of teachers affect how children perceive their competencies and how they perform in different domains (Alan, Ertac, & Mumcu, 2018; Muntoni & Retelsdorf, 2018; Retelsdorf, Schwartz, & Asbrock, 2015; Upadyaya & Eccles, 2015; Wolter, Braun, & Hannover, 2015).

The expectancy-value theory (e.g., Eccles & Wigfield, 2002) serves as a theoretical model to explain the mechanisms at play in the development of interindividual differences in academic achievements and choices. Accordingly, socializers' beliefs and gender stereotypes influence children's perceptions of gender roles which in turn have an impact on their achievement expectancies and values of a specific task, mediated through achievement-related goals,

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experiences, and self-concepts. In this study the relation between teachers' stereotypes and students' achievements, i.e., competencies, will be examined.

The literature regarding teachers' gender stereotypes about mathematics is much larger than teachers' gender stereotypes about reading (for reviews about mathematics see Gunderson, Ramirez, Levine, & Beilock, 2012; Li, 1999). Tiedemann (2000) showed that teachers rated boys and girls differently in their mathematical competence, logic skills and failure attributions. A later study (Tiedemann, 2002) revealed that teachers' stereotypic perceptions of students were in correspondence to gender stereotypes teachers held about boys and girls in mathematics but only for low and average achievers. Carlana (2019) found that implicit gender stereotypes of mathematics teachers lead to higher gender differences in standardized mathematics tests and for girls to follow in less demanding school tracks. This effect, however, was not found for literature teachers and boys' performance in standardized language tests. Another recent study by Heyder, Steinmayr, and Kessels (2019) did not confirm gender differences in mathematical tests in fourth grade students but a gender difference in their mathematical self-concept which was partly accounted for by teachers' stereotypic beliefs about girls' and boys' mathematical abilities. A different study (Lorenz, Gentrup, Kristen, Stanat, & Kogan, 2016) found that teachers of first grade students had stereotypic expectancies in both mathematics and reading. While teachers' higher expectancies of boys in mathematics did hold true, higher expectancies for girls in reading did not. Studies concentrating on reading have found that teachers' stereotypes negatively impacted boys' self-concept in reading in grade six (Retelsdorf et al., 2015) and that preschool teachers' traditional gender-role attitudes negatively impacted boys' reading motivation (Wolter et al., 2015).

To identify the mechanism of transmitting gender stereotypes in school, it is necessary to find out what teachers who hold gender stereotypes do differently in class. This research question is best addressed by observational studies. One study by Becker (1981) showed that teachers had

more contact with boys than girls in secondary school mathematics classes, they offered more help to boys than girls and encouraged boys more than girls to pursue mathematics classes. A meta-analysis by Jones and Dindia (2004) showed that teachers' interactions between boys and girls differ, not accounting for the school subject. Although gender stereotypes were not investigated in these studies, they can give an idea about the way teachers could interact differently with boys and girls. An experimental study by Hilliard and Liben (2010) indicates that factors such as the classroom organization, physical separation of girls and boys or gender-specific language use impact the salience of gender in classrooms and thereby promote gender stereotypes. Furthermore, with respect to a potential mechanism of transmitting gender stereotypes to children, Muntoni and Retelsdorf (2018) found for the domain of reading that teachers' gender stereotypes moderated their expectations for their students. When teachers exhibited stronger gender stereotypes regarding reading, they also had higher expectations for girls' achievement, which in turn mediated the relationship between students' gender and achievement in reading.

The reviewed body of literature showed different ways to capture teachers' stereotypes, either by assessing teachers' ability perception or beliefs of students (Lorenz et al., 2016; Tiedemann, 2000, 2002), measuring implicit stereotypes (Carlana, 2019), explicit stereotypes (Retelsdorf et al., 2015; Tiedemann, 2002), or gender-role attitudes (Alan et al., 2018; Wolter et al., 2015). Just like the assessments of stereotypes differ greatly, the results in relation to students' achievement related outcomes are also not consistent.

As there is a lack of studies examining explicit stereotypes of teachers in relation to competencies, the aim of our current study is to find out, with data from a large scale assessment, if there is a relationship between teachers' explicit stereotypes regarding boys' and girls' performance in reading and mathematics and their students' competencies assessed by standardized tests, regardless of an average gender difference in those domains.

Hypotheses

Firstly, we assume to find descriptive differences in competencies and teachers' stereotypes. We expect to find gender differences in mathematics and reading competencies in grade four (H1). Boys have higher competencies in mathematics than girls (H1a), and girls have higher competencies in reading than boys (H1b).

Further, fourth grade teachers hold gender stereotypes regarding boys' and girls' performance in mathematics and reading (H2). Teachers endorse gender stereotypes in that boys are rated higher in their competence in mathematics than girls (H2a), while girls are rated higher in their competence in reading than boys (H2b).

In a next step the following interaction hypothesis will be tested: Gender differences in competencies are moderated by their teachers' endorsement of gender stereotypes (H3). The performance of boys in reading should be lower the more their teachers endorse gender stereotypes in reading (H3a). The performance of girls in mathematics should be lower the more their teachers endorse gender stereotypes in mathematics (H3b).

Methods

This study was conducted using data from the German National Educational Panel Study (NEPS, Blossfeld et al., 2011). The NEPS is a multi-cohort longitudinal large scale study on educational trajectories in Germany. In particular, data from the NEPS starting cohort two, which started assessments with four-year-old preschool children in 2010, was used. We utilized the data from wave six of the starting cohort two for our study, which was conducted between November and February during the school year 2015/2016. The NEPS provides information about the study, scales and how to access the data on their website: https://www.neps-data.de/en-us/home.aspx. Written informed consent was given by the parents of the participants. Parents and participants were told that they could stop the survey at any time

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without any disadvantage. All procedures and instruments are carefully checked by the NEPS data protection team and follow professional guidelines. Moreover, a formal approval was given by the 16 German Federal States involved.

Sample

Out of the available data, only cases were selected where students participated in the competence testing and those whose teachers had also participated in the study. Notably, students whose teachers did not fill out the survey also had lower competencies, than students whose teachers participated in the study. The interpretation of the results can therefore not be generalized.

The final analysis sample consisted of 3,669 fourth grade students (51.9 % female; 9.75 years old) and their 591 teachers. Overall 1749 cases of students out of the sample of students that were assessed in the class context were excluded because teacher information was not available. Students' whose teachers did not fill out the teacher questionnaire had significantly lower competencies in both reading (t(5824) = -3.70, $p < .001$, $d = -0.10$) and mathematics (t(5576) = -5.45, $p < .001$, $d = -0.15$).

On average about six students of one class took part in the study. Of all students, 20.3 % had a migration background, which means they or a parent were not born in Germany. Teachers were predominantly female (88.0 %) and fairly evenly distributed within different age groups, with 22.5 % between 55 and 65 years, 23 % between 45 and 55 years, 26.6 % between 35 and 45 years and 22.7 % younger than 35 years old.

Research Instruments

All measures were assessed in fourth grade of elementary school in a class setting. The instruments were developed by an interdisciplinary team of researchers and were extensively pretested (Blossfeld et al., 2011).

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Competence tests

Competencies in mathematics and reading were assessed in Grade 4. The competence tests in the NEPS are scaled in an IRT-model and weighted maximum likelihood estimates (WLE) of a person's most likely competence score are provided as competence indicators (Pohl & Carstensen, 2013). Competence tests in the NEPS are not curriculum or school based, but follow the concept of functional literacy and everyday relevance (Artelt, Weinert, & Carstensen, 2013). The NEPS provides WLEs, which are corrected for the test position and recommended for use in cross-sectional analyses (Fischer, Rohm, Gnambs, & Carstensen, 2016; Pohl & Carstensen, 2013).

Mathematical competence

In line with the general framework, the development of the assessment of mathematical competence was focused on being relevant to realistic everyday situations. The test consisted of four content areas: quantity, change and relationship, shape and space, and data and chance. Six different cognitive components were assessed within these four areas (Neumann et al., 2013). The test in Grade 4 was administered in a paper-pencil mode and consisted of 24 items for which students had 28 minutes to solve.

The test had good reliability in Grade 4 (EAP/PV reliability = 0.749) (Schnittjer, Gerken, & Petersen, 2020). The mean of mathematical competence in Grade 4 for this sample was $M = 0.06$ ($SD = 1.07$); this score varies slightly from zero due to the sample selection for these analyses.

Reading competence

The NEPS framework of reading (Gehrer, Zimmermann, Artelt, & Weinert, 2013) is based on functionality of reading and the understanding of texts in everyday situations. The test therefore consisted of five different functions of texts: Texts that are imparting information, commentaries and argumentative texts, literary texts, instructional texts, and advertising texts.

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The five texts were carefully chosen to minimize the effect of prior knowledge of the text contents on reading competence. The cognitive requirements for these different text types were categorized into finding information in the text, drawing text-related conclusions, as well as reflecting and assessing. The reading test in Grade 4 was administered in a paper-pencil mode and consisted of 33 items for which students had 28 minutes to solve.

The test had good reliability in Grade 4 (EAP/PV reliability = 0.824) (Rohm, Krohmer, & Gnambs, 2017). The mean of the reading competence test in Grade 4 of this sample was $M =$ -0.54 (SD = 1.27). The competence test in reading in Grade 4 of starting cohort two was linked to the competence test in Grade 5 of starting cohort three of the NEPS (Rohm, Krohmer, & Gnambs, 2017), so these cohorts could be compared with each other. Because the mean in Grade 5 of starting cohort three was scaled to zero, the mean WLE of Grade 4 of starting cohort two turns out to be lower, due to the lower reading competence of fourth graders.

Gender stereotypes of teachers

Gender stereotypes of teachers were assessed within the class teacher survey in Grade 4. Teachers were asked to rate boys and girls in regards to their ability in the domains of mathematics and reading ("*What results do you think fourth grade students from the following groups (boys/girls) achieve overall in the competence field 'Mathematics' / 'Reading' compared to fourth grade students in Germany?*"). Answers were made on an 11 point scale (0-10) ranging from *far below average* to *far above average*. The scale was developed by a NEPS team and pretested (Wenz, Olczyk, & Lorenz, 2016).

As an indicator for teachers' endorsement of gender stereotypes regarding mathematics and reading the difference between teachers' ratings for boys and girls was calculated for mathematics and reading respectively. The possible range therefore was -10 to 10. Positive values indicate a high endorsement of stereotypes of teachers. In reading, positive values indicate teachers rated girls as having higher competence compared to boys. The mean for

reading was *M* = 1.39 (*SD* = 1.47). In mathematics, positive values indicate teachers rated boys as having higher competence compared to girls. The mean for mathematics was *M* = 0.06 (*SD* = 1.56).

Control Variables

For the multilevel analyses the models controlled for teachers' age and teachers' gender. On the student level, models were controlled for students' migration background and books at homes, which was interpreted as an indicator for socioeconomic background (Watermann & Baumert, 2006).

Data Analysis

Data preparation was done using IBM SPSS Statistics, version 25. Further analyses, including multilevel regression analyses, were done using Mplus version 8 (Muthén & Muthén, 2017). In order to investigate our hypotheses we conducted multilevel analyses in a stepwise approach for mathematical and reading competence separately. First, in a basic model the intraclass correlation was inspected, to decide if the part of variance on the context level sufficiently explained parts of the total variance. Then, we inspected the fixed effects on the individual (i.e., students' gender) and context level (i.e, teachers' endorsement of stereotypes), and in a third model we also added the random slope of students' gender. Finally we examined the cross-level interaction effect between students' gender and teachers' gender stereotypes on competencies.

Gender was effect coded and teachers' gender stereotypes were grand mean centered. Missing data in the multilevel analyses were estimated using full information maximum likelihood. All models were furthermore controlled for teacher's gender and age and migration background of students as well as number of books at home as an indicator for socioeconomic status.

Results

Descriptive analyses

Means for the variables used in the multilevel regression analyses are depicted in table 1.

- Insert Table 1 -

When looking at children's actual competencies, paired samples t-tests show significant differences between boys and girls in both reading as well as mathematics. Girls had higher reading competencies in Grade 4, $t(3667) = -5.22$, $p < .001$, while boys had higher mathematical competencies, $t(3667) = 2.90$, $p = .004$. The effect sizes for the gender differences in mathematical and reading competencies were both small, with $d < 0.2$. Hypothesis **H1** can be confirmed. Both in the domains of mathematics (**H1a**) and reading (**H1b**) gender differences exist.

For teachers' endorsement of stereotypes independent samples t-tests showed a significant difference for teachers' stereotypes regarding reading competencies, $t(544) = 22.05$, $p < .001$, in the direction that teachers rated girls more competent in reading than boys. However, teachers did not endorse gender stereotypes in mathematics since they rated boys and girls equally in their mathematical competencies, $t(545) = -0.84$, $p = .399$. The effect size for the different ratings of boys and girls in reading was large, Cohen's $d = 1.89$. This means, **H2a** cannot be confirmed since teachers in our sample did not express gender stereotypes in mathematics, while **H2b** can be confirmed, because teachers did show gender stereotypes regarding reading.

To further investigate if male and female teachers hold different gender stereotypes, mean differences between stereotypes of female and male teachers were analyzed in an explorative manner. For gender stereotypes regarding mathematical competencies independent samples t-tests revealed differences between female and male teachers, $t(529) = -3.62$, $p < .001$. Male teachers rated girls higher than boys on average ($M = -0.63$, $SD = 1.57$), while female teachers

rated boys slightly higher than girls ($M = 0.17$, $SD = 1.53$). In reading, there were no differences between male and female teachers' gender stereotypes, $t(528) = 0.77$, $p > .484$.

- Insert Table 2 -

Table 2 shows bivariate correlations between stereotypes of teachers and students' competencies. The correlations in this sample are generally very small. The correlation between mathematics and reading stereotypes is negative ($r = -.098$, $p < .001$). The correlation between mathematical competence and mathematics stereotype is significant, $r = .040$, $p = .019$, while the correlation between reading competence and reading stereotype is not significant r = -.016, p = .362.

Multilevel analyses for reading competence

The null model showed an intra-class correlation (ICC) of 0.119, which means about 12 % of the variation in reading competence can be explained by the class level context. Results for the analyses in reading can be found in table 3.

- Insert Table 3 -

The first *random intercept and fixed slope model* showed a significant effect of students' gender on their reading competencies, $b = 0.217$, $p < .001$. Girls had significantly higher reading

competencies than boys, also when controlling for students' migration background and socioeconomic background, teachers' stereotypes about reading as well as teachers' age and gender. The level two effect of teachers' endorsement of gender stereotypes in reading on students' reading competencies was not significant, $b = -0.019$, $p = .347$, which was expected. This means, teachers' endorsement of gender stereotypes in reading did not have an effect on the reading competencies of all students regardless their gender.

In the next model, the *random intercept and random slope model*, we added the random slope of students' gender, i.e., we assumed that gender differences in reading competencies of students would not be the same in all classes. The variance of the slope was not significant, $b = 0.027$, $p = .650$, as well as the covariance between the random slope of students' gender and the random intercept of their reading competencies, $b = 0.028$, $p = .195$. This means, the extent of gender differences in reading competence did not significantly vary across classes.

When examining the *cross-level interaction model*, the interaction between students' gender and teachers' endorsement of stereotypes was also not significant, $b = 0.001$, $p = .968$. Hypothesis **H3a** could not be confirmed. There was no relationship between boys' reading competence and their teachers' endorsement of gender stereotypes about reading.

As can be seen in table 3, the model fit indicated by the BIC and AIC (Hox, 2010) did slightly increase with every model, indicating a worse model fit when the random slope of gender and the cross-level interaction were included into the model.

Multilevel analyses for mathematical competence

Results of the multilevel analyses for mathematical competence can be found in table 4. The null model showed an ICC of 0.115, which means 11.5 % of the variation in mathematical competencies can be explained by the class level context.

The first *random intercept and fixed slope model* showed a significant effect of students' gender on mathematical competence, $b = -0.102$, $p < .001$, meaning that boys had significantly higher

mathematical competencies than girls, when controlling for migration background of students and their socioeconomic background, teachers' endorsement of gender stereotypes about mathematics, teachers' age and gender. The level two effect of teachers' endorsement of gender stereotypes on students' mathematical competence was not significant, $b = 0.025$, $p = .117$, which was expected. This means that there was no effect of teachers' endorsement of gender stereotypes in mathematics on mathematical competencies of all students regardless their gender.

- Insert Table 4 -

In the next model, the *random intercept and random slope model*, we added the random slope of students' gender, i.e., we assumed that the extent of gender differences in mathematical competencies would not be the same in all classes. The variance of the slope was not significant, $b = 0.020$, $p = .558$, as well as the covariance between the random slope of students' gender and the random intercept of their mathematical competencies, $b = -0.024$, $p = .125$. This means the extent of gender differences in mathematical competence was comparable between classes.

When examining the *cross-level interaction model*, the interaction between students' gender and teachers' endorsement of gender stereotypes in mathematics was also not significant, $b = -0.025$, $p = .265$. Hypothesis **H3b** could also not be confirmed. Girls' mathematical competencies did not depend on their teachers' endorsement of gender stereotypes in mathematics.

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In the same way as for the analyses in reading competence, the model fit indicated by the BIC and AIC (Hox, 2010) increased slightly with every model, indicating a worse model fit when adding the random slope of students' gender and the cross-level interaction to the model.

Discussion

In this paper we investigated if elementary school teachers' endorsement of gender stereotypes regarding mathematics and reading were associated with their students' competencies in fourth grade. To this purpose we analyzed data from the German National Educational Panel Study (Blossfeld et al., 2011).

While we hypothesized to find teacher stereotypes regarding boys' and girls' mathematical and reading competencies, results showed that overall fourth grade teachers in our sample did not hold gender stereotypes regarding mathematical competencies, i.e., they rated boys and girls at the end of elementary school to have the same competencies in mathematics on average. In reading, however, teachers held strong stereotypes regarding boys' compared to girls' competence. They rated girls as having much higher competencies in reading than boys at the end of elementary school. Actual competencies of boys and girls in our sample did not reflect teachers' gender stereotypes. In line with previous research, gender differences were present in both reading (Mullis et al., 2017; OECD, 2019) and mathematical (Mullis et al., 2016; OECD, 2019) competencies in the expected directions. Boys had higher competencies in mathematics than girls, whereas girls had higher competencies in reading than boys. While the effect was small in both domains, the gender difference was slightly higher in reading than in mathematics. Therefore, there seems to be a discrepancy between the teachers' endorsement of gender stereotypes and children's actual competencies. Teachers, regardless of their own gender, overestimate the gender difference in reading, yet in mathematics, they show a rather unbiased view on children's competencies. In fact, male teachers even rated girls higher in mathematics than did female teachers, while there was no difference in how male and female teachers rated

children in reading. In line with the proportion of female preschool teachers of 90.1% in Germany according to the Federal Statistical Office (Statistisches Bundesamt [German Federal Statistical Office], 2020), this sample suffers from very few male teachers compared to female teachers. However, the findings of a strong teacher stereotype regarding reading but not regarding mathematics seems not to be explained by the predominance of female teachers in German elementary schools (Hannover & Kessels, 2011).

While one argument for the findings could be that teachers draw from their own experience when rating children's competencies, the study asked teachers not to rate their own students but rather all German fourth grade students. Therefore, their ratings should not have been affected primarily by their own students' competencies, but rather teachers' actual stereotypes about boys' and girls' competencies were assessed.

One explanation for teachers endorsing stereotypes in reading but not in mathematics could be in relation to mathematics related stereotypes being discussed in research as well as in media and educational politics for much longer than reading related gender stereotypes.

Mathematical competence has been found to be important among motivational factors to aspire and pursue a career in a STEM field (Ing, 2014; Wang et al., 2015). Teachers might therefore actively work against the stereotype of girls' lesser mathematical competence because it is known that mathemtical competence is important for later education and careers and that gender differences in mathematical competence persist into adulthood (Ing, 2014; Wang et al., 2015), whereas the potential long term effects of gender difference in reading competence are not as pronounced yet in public and scientific discussions and it remains unclear, how exactly they impact other areas and domains. Furthermore, research indicates that the gender gap closes in adulthood (Hyde & Linn, 1988). There have been many programs to help girls' pursue careers within STEM fields, one example in Germany being "Girls' Day", which helps girls to get a glimpse into jobs within the STEM field for one day each year since 2001 (www.girls-day.de).

The equivalent "Boys' Day" on the other hand, for boys to get an insight into jobs in the social and service field, was initiated ten years later in 2011 (www.boys-day.de). Fostering girls has therefore probably been more central in teachers' minds for many years than fostering boys. In contrast to a relatively high awareness of stereotypes regarding mathematics, teachers therefore might not be as aware of gender stereotypes regarding reading and put their relevance on the same level as gender stereotypes regarding mathematics.

Furthermore, the findings also indicate that there is no moderation effect of teachers' endorsement of gender stereotypes for gender differences in their students' competencies. This means our hypothesis that gender stereotypes of teachers would relate to lower competencies for students in the gender group that is confronted with a negative performance-related stereotype in the according domain was not confirmed for either domain. In fact, the extent of gender differences in competencies in both domains did not substantially vary across classes, which means that the class context does not play a substantial role in explaining gender differences in competencies in this study. Therefore presumably, gender differences in competencies, at least in this sample, stem from interindividual differences between students rather than context differences between different school classes. As has been shown in previous research, students own gender stereotypes are related to their achievement in mathematics and languages (e.g., Ehrtmann & Wolter, 2018; Plante, La Sablonnière, Aronson, & Théorêt, 2013).

While there are both studies which found effects of teachers' stereotypes in a cross-sectional design (Heyder et al., 2019) as well as in longitudinal designs (Lorenz et al., 2016; Retelsdorf et al., 2015), it is possible that the effect of teachers' gender stereotypes on students' competencies was not found because of the cross-sectional design of our analysis, and that the effects of teacher' stereotypes and class differences could become relevant at a later point in the educational paths of students. Since previous research showed an effect of teachers' stereotypes on teachers' expectations of boys and girls (e.g., Muntoni and Retelsdorf. 2018) or

affective-motivational characteristics of students (Heyder et al., 2019; Retelsdorf et al., 2015; Wolter et al., 2015), the effect on cognitive competencies might only become visible in a longitudinal perspective (Carlana, 2019).

It is also possible that stereotypes of teachers could also only affect certain sub groups of students that are especially at risk, such as socioeconomically disadvantaged students, students with a migration background or students with a learning disability. This would be in line with the findings of Tiedemann (2002), who only found a relation between teachers' stereotypic perception of students and teachers' stereotypes for low performing students.

Limitations and Outlook

An obvious limitation of this analysis is its cross-sectional design since competence assessments and assessments of teachers' gender stereotypes were conducted at the same measurement point in fourth grade. While the NEPS follows a longitudinal approach regarding competence assessments, this has not yet been implemented on the context level. Therefore no causal inferences can be drawn from this study. We were also presented with the limitation of not knowing how long teachers had been teaching a particular class or student, since teacher IDs are not linked longitudinally in starting cohort two of the NEPS and teachers often, but not always, change during the course of elementary school in Germany. Teachers who have only shortly taught their class might not have the same influence as teachers who have taught the same children for several years. This argument however stands against the fact that in general, students in fourth grade in this study did not differ in their gender differences between classes.

Unfortunately, not all teachers participated in the study. Students of teachers who refused to fill in the questionnaire performed worse in the competence tests, than students whose teachers did participate in the study. Our sample is therefore positively skewed regarding students' competencies. This should be kept in mind when interpreting the results.

Furthermore, teachers' stereotypes were assessed explicitly and could be affected by social desirability bias (Nederhof, 1985). We can, however, only assume that teachers were not affected by social desirability when stereotypes were assessed since teachers were not asked directly about their stereotypes but a less obvious approach was conducted. Furthermore, the findings confirmed that they did endorse gender stereotypes in one domain at least. More so than answering in a social desirable way, teachers may answer according to their best knowledge, which might have changed over the last decades, especially regarding mathematics, as was discussed above.

To further investigate the transmission mechanism, i.e. how teachers' gender stereotypes could have an impact on students, a more detailed assessment of teaching behaviors in classrooms would be needed. In a very limited setting, this could be done through observational studies, but also through survey assessments of teaching behaviors in a larger scale.

Conclusions

Overall, this study served to get a glimpse into the shape and effect of gender stereotypes of elementary school teachers in Germany within an innovative measure in a large-scale assessment. Even though this study did not find any relationship between the endorsement of gender stereotypes of teachers and domain-specific competencies of their students in mathematics and reading, further studies are needed to delve deeper into possible effects of teachers' gender stereotypes on their students' educational outcomes in different domains. Especially long-term effects and detailed information on potential mechanisms such as teaching behavior should be the focus of future studies. Furthermore, the study showed that gender differences in competencies did not vary between school classes, hinting at explanations for gender differences that are not on the institutional level, but rather lie within interindividual differences in attitudes, motivation, or self-concepts.

It has to be noted as a positive finding, that teachers overall in our study did not express stereotypes regarding girls' lower competencies in mathematics compared to boys at the end of elementary school. This finding might reflect the more recent developments regarding teacher education programs and further initiatives to increase the participation of girls and women in STEM fields. Yet, teachers still strongly hold stereotypes regarding boys' lower competencies in reading compared to girls which is unsettling against the background of reported research showing the impact on boys' self-concept and motivation. Generally, children should not be categorized as possessing certain abilities in any subject based on their gender, especially not by their teachers. Teachers need to identify individual strengths and weaknesses and foster children accordingly. Stereotypes need to be a topic among teachers, during teacher education, and in schools.

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Table 1

Means, standard deviations, and effect sizes for gender differences

		Overall Mean (*SD*)	Boys Mean (*SD*)	Girls Mean (*SD*)	Effect size *d*
Level 1 Students	Math Competence	0.06 (1.07)	0.11 (1.09)	0.01 (1.06)	**0.10**
	Reading Competence	-0.54 (1.27)	-0.66 (1.28)	-0.44 (1.26)	**0.17**
Level 2 Teachers	Teacher Stereotype Reading	1.39 (1.47)	5.17 (1.27)	6.56 (1.30)	**1.89**
	Teacher Stereotype Math	0.06 (1.56)	5.69 (1.27)	5.62 (1.34)	0.01

Note. Bold effect sizes are significant on a 95% level.

Table 2

Correlations for teachers' stereotypes and students' competencies in mathematics and reading

	1.	**2.**	**3.**
1. Mathematics stereotype	-		
2. Reading stereotype	-.098*	-	
3. Mathematical competence	.040*	-.008	-
4. Reading competence	.030	-.016	.636*

Note. *p < .05.

Table 3

Multilevel analyses for reading

		Model		
	Null	Random Intercept and Fixed Slope b (*SE*)	Random Intercept and Random Slope b (*SE*)	Cross-level Interaction b (*SE*)
Level 1				
Intercept		-1.752 (.223)*	-1.746 (.223)*	-1.746 (.223)*
Gender		0.217 (.039)*	0.219 (.039)*	0.219 (.039)*
Level 2				
Teacher stereotype		-0.019 (.020)	-0.020 (.020)	-0.020 (.020)
Teacher*Gender				0.001 (.028)
Variance Components				
Residual		1.342 (.036)*	1.335 (.037)*	1.335 (.037)*
Intercept (L2)		0.135 (.022)*	0.137 (.022)*	0.137 (.022)*
Slope			0.027 (.060)	0.027 (.060)
Covariance			-0.028 (.022)	-0.028 (.022)
ICC	0.119			
BIC/AIC		30021/ 29903	30036/ 29906	30044/ 29908

Note. *$p < .05$. Gender effect coded as boys = -0.5, girls = 0.5. Model controlled for teacher gender, teacher age, student migration background, and books at home. Teacher gender and age had no significant effect in any model, student migration background and books at home had significant effects in all models.

Table 4

Multilevel analyses for mathematics

	Null	**Model**		
		Random Intercept	Random Intercept and Random Slope	Cross-level Interaction
		b (*SE*)	*b* (*SE*)	*b* (*SE*)
Level 1				
Intercept		-0.679 (.167)*	-0.697 (.166)*	-0.697 (.167)*
Gender		-0.102 (.034)*	-0.100 (.034)*	-0.101 (.034)*
Level 2				
Teacher stereotype		0.025 (.016)	0.023 (.016)	0.024 (.016)
Teacher*Gender				-0.025 (.022)
Variance Components				
Residual (L1)		0.965 (.027)*	0.960 (.028)*	0.960 (.028)*
Intercept (L2)		0.100 (.016)*	0.101 (.016)*	0.101 (.016)*
Slope			0.020 (.034)	0.017 (.033)
Covariance			-0.024 (.015)	-0.023 (.015)
ICC	0.115			
BIC/AIC		28885/ 28768	28899/ 28769	28906/ 28770

Note. *p < .05. Gender effect coded as boys = -0.5, girls = 0.5. Model controlled for teacher gender, teacher age, student migration background, and books at home. Teacher gender and age had no significant effect in any model, student migration background and books at home had significant effects in all models.